# Barriers to Adherence Among Adolescents with Inflammatory Bowel Disease

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**Background:** The purpose of this study was to describe barriers to adherence among adolescents with inflammatory bowel disease (IBD) and to examine demographic, disease-related, and treatment regimen-related correlates of adherence barriers using a multimethod reporting strategy. A final goal was to examine relationships between the frequencies of barriers and levels of nonadherence.

**Methods:** In all, 64 adolescents (ages 11–18) participated, along with 61 mothers and 25 fathers. Barriers to adherence and ratings of medication adherence were assessed via patient and parent reports. Disease activity ratings were provided by pediatric gastroenterologists.

**Results:** Lack of time and medication side effects were commonly reported barriers across adolescent, mother, and father reports. Other adolescent-reported barriers included missing medication due to feeling well or discontinuing medication based on the belief that the medication was not working. The prevalence of adherence barriers was not consistently associated with adolescent age, sex, time since diagnosis, or disease activity. Adolescents whose regimen involved more than 1 daily medication administration had more adherence barriers based on adolescent and maternal report than did those whose regimen involved 1 or less than 1 daily medication administration. Finally, adherence barriers were significantly higher among families reporting imperfect adherence as compared to those reporting perfect adherence.

**Conclusions:** Barriers to medication adherence do exist among adolescents with IBD and may have negative implications for medication adherence. Systematic assessment of barriers during routine medical appointments may help to identify and modify these barriers and ultimately improve adherence.

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Inflammatory bowel disease (IBD) is a chronic relapsing condition of the gastrointestinal tract comprised of Crohn's disease (CD) and ulcerative colitis (UC). IBD results in significant morbidity including rectal bleeding, anemia, weight loss, school absences, and frequent hospital and clinic visits. Prevalence rates of IBD are estimated at 13 per 100,000 by the age of 10, with an average age of diagnosis of 12.5 years.[1] Successful management of IBD necessitates adherence to a treatment regimen that may involve multiple medications or supplements delivered via various modalities (e.g., oral, topical, rectal, or intravenously), as well as dietary modifications, and in some cases surgical intervention.

Promoting medication adherence is challenging among adolescents with IBD in part because IBD is often diagnosed during adolescence, a time in which adherence to condition management regimen is known to be poor among adolescents with other chronic medical conditions.[2] The typical developmental changes of adolescence include a greater desire for autonomy, more time spent outside of the home, and an increased desire to "fit in" with peers.[3] These normative developmental changes are complicated by the need to set aside time to carry out condition management tasks and the need to incorporate management and symptoms of a chronic illness into one's identity and social routine. Moreover, since medications must be taken continually to maintain remission (i.e., even when no symptoms are present), and because even when medications are taken as prescribed the chance of relapse is high, the benefits of taking medication may not be immediately observable to all adolescents, thereby posing an additional challenge to adherence. Finally, side effects associated with certain medications, as well as the socially embarrassing nature of the condition, may pose additional barriers to adherence.[4]

Despite the challenges to medication adherence among adolescents with IBD, little research has focused on this area. A number of studies have documented rates of medication nonadherence in pediatric IBD ranging from 38%–66%,[5–9] depending on the reporter, medication type, and method of assessment (e.g., objective methods versus subjective self-report methods). Little, however, is known about families' perceptions of what the barriers to adherence are among adolescents with IBD. Some studies have

identified correlates of nonadherence including less optimal adolescent coping strategies,[7] lower adolescent physical health-related quality of life,[5] greater family dysfunction,[7] and less disease activity.[8] However, no studies to date have explicitly asked families of youth with IBD about their perceptions of barriers to adherence. Understanding barriers to treatment adherence among adolescent populations may help to identify subgroups at risk for nonadherence and allow for the development of interventions to address these barriers before nonadherence adversely impacts medical and psychosocial outcomes.

The goals of the current study were to summarize the frequency with which different barriers to adherence were reported by adolescents and their parents, and to compare whether the frequency of barriers endorsed varied by participant demographic characteristics (i.e., age and sex), disease characteristics (i.e., time since diagnosis, disease activity), or medication regimen characteristics (i.e., number of daily medications, frequency of medication administration, and type of medication). Finally, we sought to examine relationships between the number of barriers reported and medication adherence.

## MATERIALS AND METHODS

### Participants

Participant eligibility criteria included: 1) patient age 11–18 years old, 2) confirmed diagnosis of IBD, 3) at least 1 legal guardian willing to participate, and 4) English fluency of adolescent and parent(s). Exclusion criteria included: 1) presence of another chronic medical condition requiring daily medication or 2) history of cognitive or developmental delay. Of the 86 families invited to participate, 64 (74%) completed the study. Ten families declined participation and an additional 12 families consented to participate but did not return study questionnaires. No differences with respect to adolescent age ($t$ (84) = 0.03, $P$ = 0.98) or sex ($\chi;^2$ = 0.96, $P$ = 0.33) existed between those who completed the study ($n$ = 64) and those who did not complete the study or declined participation ($n$ = 22).

### Procedure

Following study approval by the local Institutional Review Board, consecutive families of adolescents within the designated age range were approached during an outpatient appointment, informed about the study procedure, and invited to participate. Upon providing consent/assent, families completed questionnaires. In situations in which there was a secondary caregiver (most commonly a father) who did not attend the appointment, a questionnaire packet was sent home for that caregiver to complete and return in a postage-paid envelope. A medical chart review was subsequently conducted for information regarding disease characteristics. Compensation for participation was a $15 gift card for adolescents and a $15 gift card for parents.

### Measures

#### *Demographics*

Demographic information was collected via a parent report questionnaire developed for the current study. Information obtained included adolescent age, ethnicity, and sex, as well as caregiver age, ethnicity, sex, marital status, and annual family income.

#### *Medication Regimen Characteristics*

Adolescents and parents completed the Medication Adherence Questionnaire, which was modeled after the Medication Adherence Interview.[7] The Medication Adherence Questionnaire utilized the same questions as the Medication Adherence Interview, but it was completed in written format by participants rather than in interview format. Participants listed the medications and supplements that were being taken, the frequency of administration of each medication or supplement listed, and the frequency with which they had taken each listed medication or supplement exactly as recommended over the past 1 month.

Frequency of medication administration was calculated by dividing the number of times the medication was to be taken in a week by the number of days in a week. For example, a medication or supplement recommended to be taken at a frequency of once per week was coded as 1/7, whereas a medication recommended to be taken at a frequency of 7 times per week was coded as 7/7 or 1. A composite rating of frequency of medication administration was computed by summing the frequency ratings across each IBD medication for a given participant, with higher scores reflecting greater frequency of administration.

Ratings of adherence were made on a 5-point scale anchored by "0 = never" and "4 = always." Higher ratings reflected better adherence. In the present study, adherence ratings were dichotomized into perfect adherence (i.e., ratings of "always" across all medications) versus imperfect adherence (i.e., 1 or more rating of less than "always" across all medications).

#### *Barriers to Adherence*

Six questions were used to assess families' perceived barriers to adherence. These questions were based on a measure of adherence barriers developed for use with youth with chronic medical conditions.[10] Adolescents and parents completed this measure in which they were asked to endorse whether or not they have experienced any of the 6 barriers during the past 1 year. A total barrier score (possible range 0–6) was computed by summing the number of barriers endorsed across each of the 6 items, where higher total scores reflected the presence of more barriers.

### *Disease Activity*

Physician global assessment ratings were abstracted from the medical record. Physicians rated participant disease activity as no activity, mild, moderate, or severe. Higher numbers reflected greater disease activity. This rating has been demonstrated to correlate highly with more complex measures of disease activity such as Pediatric Crohn's Disease Activity Index.[11]

## Data Analyses

Descriptive statistics were conducted to summarize frequencies of barriers across reporters. Bivariate correlations or *t*-test analyses examined associations of barriers with demographic characteristics, disease characteristics, and medication regimen characteristics. Finally, independent samples *t*-tests were conducted to examine whether the number of barriers differed between those reporting perfect versus imperfect adherence. In descriptive analyses, data from adolescent, maternal, and paternal reports were included. For all inferential analyses, data based on adolescent and maternal reports were utilized and paternal data was excluded given the small number of participating fathers.

# RESULTS

## Participant Characteristics

Patient and parent demographic characteristics are presented in Table 1. Participating adolescents were similar to the population of adolescents diagnosed with IBD in Wisconsin with respect to adolescent sex, ethnicity, and age at diagnosis.[1] In the current sample, 48% of adolescents were taking 1 IBD medication or supplement (i.e., a steroid, immunomodulator, aminosalicylate, antibiotic, biologic, probiotic, vitamin or mineral supplement, or proton pump inhibitor), 36% were taking 2 IBD medications or supplements, 11% were taking 3 IBD medications or supplements, 3% were taking 4 IBD medications or supplements, and 2% were taking 5 IBD medications or supplements. Regarding frequency of medication administration, 49% of adolescents reported an overall frequency of medication administration of once or less per day (across all medications), while 51% reported a frequency of medication administration of more than once per day.

With respect to ratings of medication adherence, adolescent and maternal reports of adherence were significantly correlated ($r = 0.26$, $P = 0.05$), with 65% of youth and 66% of mothers reporting perfect adherence.

## Prevalence of Medication Adherence Barriers

Overall, 24% of adolescents, 27% of mothers, and 18% of fathers reported encountering 1 adherence barrier during the past year. Fifteen percent of adolescents, 5% of mothers, and no fathers reported 2 barriers to adherence over the past year; while 10% of adolescents, 3% of mothers, and 4% of fathers reported 3 barriers. Finally, 2% of adolescents, 2% of mothers, and 4% of fathers reported encountering 4 barriers to adherence over the last year.

**TABLE 1.** Participant Demographic Characteristics

| | |
|---|---|
| Adolescent age; mean (SD) | 15.13 (2.32) |
| Adolescent gender (% male) | 50% |
| Adolescent race (% Caucasian) | 97% |
| Diagnosis (% Crohn's disease) | 82% |
| Months since diagnosis; mean (SD) | 36.43 (26.02) |
| Physician global assessment of disease activity (% no disease activity) | 76% |
| Mother age; mean (SD) | 44.84 (5.11) |
| Mother race (% Caucasian) | 97% |
| Mother marital status (% married or living with partner) | 89% |
| Father age; mean (SD) | 45.24 (6.12) |
| Father race (% Caucasian) | 92% |
| Father marital status (% married or living with partner) | 92% |
| Median annual family income | $100,000–$119,999 |

Lack of time was the most commonly reported barrier to adherence across all reporters and was endorsed by 33% of adolescents, 20% of mothers, and 12% of fathers (Table 2). Medication side effects were another commonly reported barrier across adolescent, maternal, and paternal reports. Adolescents also reported discontinuing medication because of feeling well and the belief that the medication was not working as other barriers to adherence, while parents reported these barriers less often. Overall, fathers reported far fewer barriers than did adolescents or mothers.

## Associations of Barriers with Demographic Characteristics

Adolescent age was not significantly associated with total adolescent reported barriers ($r = -0.03$, $P = 0.80$) or maternal reported barriers ($r = -0.15$, $P = 0.24$). Similarly, *t*-tests indicated no differences by sex in mean levels of barriers based on adolescent ($P = 0.15$) or maternal ($P = 0.15$) reports.

## Associations of Barriers with Disease Characteristics

Associations of adherence barriers with time since diagnosis (in months) and disease activity were also examined. Time since diagnosis was not significantly associated with barriers based on adolescent ($r = -0.19$, $P = 0.14$) or maternal ($r = -0.17$, $P = 0.20$) reports. Disease activity was not significantly related to adolescent ($r = 0.19$, $P =$

**TABLE 2.** Frequency of Adherence Barriers by Reporter

| Barrier | Adolescent Report *n* (%) | Maternal Report *n* (%) | Paternal Report *n* (%) |
|---|---|---|---|
| Lack of time | 21 (33%) | 12 (20%) | 3 (12%) |
| Medication side effects | 9 (14%) | 7 (12%) | 2 (8%) |
| Feeling well | 10 (16%) | 2 (3%) | 1 (4%) |
| Belief medication was ineffective | 9 (14%) | 3 (5%) | 2 (8%) |
| Pharmacy barriers (e.g., pharmacy did not stock medication, difficulty accessing pharmacy) | 5 (8%) | 4 (7%) | 1 (4%) |
| Insurance barriers (e.g., no insurance, insurance did not cover medication) | 3 (5%) | 4 (7%) | 1 (4%) |

0.15) or maternal ($r = 0.19$, $P = 0.16$) reported adherence barriers.

### Associations of Barriers with Regimen Characteristics

Relationships between numbers of barriers and complexity of treatment regimen were examined in several ways including through analysis of associations between barriers and number of daily IBD medications, through examination of associations between barriers and frequency of medication administration, and by examining differences in barriers between those on biologics only (a less demanding regimen in terms of frequency of medication administration) and those on any other treatment regimen.

Regarding number of daily IBD medications, adolescents on monotherapy reported significantly fewer barriers (mean = 0.58, standard deviation [SD] = 0.89) than adolescents on multiple medications (mean = 1.18, SD = 1.18) based on adolescent report of barriers ($t$ (62) = −2.29, $P = 0.03$). However, no differences in maternal reported barriers were documented between those taking only 1 IBD medication (mean = 0.37, SD = 0.61) compared to those on multiple medications (mean = 0.68, SD = 1.04) ($t$ (59) = −1.40, $P = 0.16$).

Regarding frequency of medication administration, adolescents whose medication administration frequency was once or less per day had significantly fewer barriers to medication adherence (mean = 0.55, SD = 0.83) than did adolescents whose medication regimen included more than 1 daily administration (mean = 1.24, SD = 1.23) ($P = 0.01$) based on adolescent report of barriers. The same finding was documented for maternal report of adherence barriers, with adolescents whose medication administration frequency was once or less per day (mean = 0.25, SD = 0.51) having significantly fewer medication adherence barriers than adolescents whose medication administration frequency was more than once per day (mean = 0.78, SD = 1.04) ($P = 0.01$).

Differences in perceived barriers between adolescents treated only with biologics compared to adolescents on other medication regimens were also examined. There was a trend for youth treated solely with biologics to have fewer barriers based on youth report (mean = 0.50, SD = 0.82) than youth on other medication regimens did (mean = 1.02, SD = 1.14) ($P = 0.10$). No differences in barriers between those on biologics only (mean = 0.27, SD = 0.59) compared to those on other regimens (mean = 0.61, SD = 0.93) was documented based on maternal report of barriers ($P = 0.19$).

### Relationship Between Adherence Barriers and Self-Reported Adherence

A series of *t*-tests were conducted to examine differences in frequency of barriers between those with perfect adherence (based on both adolescent and mother report) compared to those with imperfect adherence (Table 3). Individuals with imperfect adherence based on maternal report had significantly more barriers based on adolescent and mother reports than did those with perfect adherence. Individuals with imperfect adherence based on adolescent report had significantly more barriers to adherence based on adolescent report of barriers.

## DISCUSSION

This study is the first to formally examine barriers to medication adherence among adolescents with IBD from the perspective of multiple family members, as well as to document correlates of adherence barriers. Strengths of the study include attention to a group at risk for nonadherence, i.e., adolescents, as well as inclusion of descriptive data on perceptions of barriers from both mothers and fathers. Findings revealed that lack of time and medication side effects were barriers commonly reported by adolescents, mothers, and fathers. The presence of barriers did not vary as a function of adolescent age, sex, or time since diagnosis, suggesting that the presence of these barriers is

**TABLE 3.** Mean Differences in Barriers Between Families Reporting Perfect Versus Imperfect Adherence

| | Perfect Adherence | | | Imperfect Adherence | | | |
|---|---|---|---|---|---|---|---|
| | Mean | SD | *n* | Mean | SD | *n* | *t* |
| Adolescent report of adherence | | | | | | | |
| AR barriers | 0.63 | 0.94 | 41 | 1.41 | 1.18 | 22 | 2.84** |
| MR barriers | 0.41 | 0.82 | 39 | 0.76 | 0.94 | 21 | 1.51 |
| Maternal report of adherence | | | | | | | |
| AR barriers | 0.67 | 0.95 | 42 | 1.50 | 1.25 | 18 | 2.82** |
| MR barriers | 0.31 | 0.56 | 42 | 1.06 | 1.21 | 18 | 3.28** |

AR, adolescent report; MR, maternal report.
**$P < 0.01$.

relatively uniform across different demographic characteristics of our sample. Although past research had documented poorer adherence among adolescents with inactive disease,[6] we did not find a consistent relationship between greater disease activity and fewer barriers. Research on adults with IBD has also documented that increasing complexity of the medication regimen (i.e., taking more than 4 medications) has been associated with poorer adherence.[12] Our findings based on adolescent perceptions of barriers to adherence parallel findings from the adult literature. Specifically, adolescents who were on monotherapy reported significantly fewer barriers to adherence than did those on multiple medications. Similarly, adolescents whose regimen consisted of 1 or less than 1 total medication administration per day had significantly fewer medication barriers based on adolescent report. Finally, there was a trend for adolescents being treated with biologics only (a regimen consisting of administration frequency of every few weeks) to have fewer adherence barriers (based on adolescent report) than those on other forms of treatment with more intensive regimens. In contrast, our findings related to maternal perceptions of barriers were less clearly related to the complexity of the medication regimen. Specifically, 1 or less than 1 daily medication administrations was associated with lower maternal perceptions of barriers, whereas monotherapy or taking only a biologic were not. These discrepant findings underscore the importance of assessing multiple family members and suggest that regimens that pose greater daily demands for families are also associated with more adolescent-perceived barriers to adherence.

Although relatively few barriers to adherence were reported overall (only 51% of adolescents, 37% of mothers, and 26% of fathers), the mean number of barriers reported was significantly higher among those with imperfect medication adherence in comparison to those with perfect medication adherence, suggesting that even when the quantity of barriers are relatively low, the presence of any barrier at all may have a detrimental impact on adherence.

The clinical implications of these findings are significant. Health professional assessment of adherence barriers in the context of routine clinical care may be beneficial in helping to identify and prevent nonadherence. Given that lack of time and medication side effects were the barriers reported consistently across adolescent, mother, and father reports, these may be particularly important targets for health professional intervention. For example, health professionals may help to simplify the treatment management regimen through altering medication dosing schedules to be complementary across different medications to the extent possible, thereby minimizing the number of different times per day a patient must take medication(s). Moreover, health professionals are in a prime position to help adolescents and families learn effective organizational strategies (e.g., use of pill boxes, planning to have a supply of pills in a purse or backpack for access when away from home, utilizing a reminder system such as cell phone alarms) for managing the adolescent's medication. Brief interventions around these issues may serve to reduce the time demands associated with the medication regimen and improve family organization with respect to medication administration, and thereby enhance adherence. Furthermore, because a significant subset of adolescents also reported medication side effects, feeling well, and belief that the medication was not working as reasons for nonadherence health professional education and assessment in these domains during routine follow up appointments may also be of value in correcting misperceptions before they detrimentally influence adherence. Hommel et al[13] offer additional recommendations for assessment and treatment of nonadherence in this population.

The findings of the current study should be interpreted within the context of several limitations. Since the current study was cross-sectional, one must be careful not to assume causal relationships between variables. Future research that is longitudinal in nature and examines mechanisms by which increased barriers influence adherence

would provide valuable insight. Second, the current study examined only the presence or absence of various barriers and did not examine the chronicity of the barriers, or the relative importance of certain barriers in comparison to others. Future research that attempts to look at not only the quantity of barriers but also the chronicity of the barrier would be of value in providing a more specific analysis of the role of barriers in medication nonadherence. Third, future studies that examine barriers in a wider age range of patients could help to elucidate whether the currently reported barriers are unique to the adolescent developmental period or have broader generalizability. Fourth, our sample was relatively homogeneous with respect to ethnicity and included a disproportionate number of middle to upper middle class families. Thus, future studies that employ a more ethnically and socioeconomically diverse sample of families would be of value. Finally, given that a sizable minority of participants indicated having experienced none of the 6 barriers, identification of additional barriers to adherence in future studies would be worthwhile to clarify whether there are other relevant factors that may be barriers to adherence. For example, adolescent behavioral functioning, coping skills, and family functioning are other domains that have been correlated with nonadherence in samples of youth with IBD.[6,7] Future research that examines the relative importance of different domains of barriers (i.e., treatment regimen barriers versus behavioral functioning barriers versus family barriers) in influencing adherence would also be of value in identifying potential targets for intervention. The current findings suggest that adherence barriers do exist and have implications for adherence among adolescents with IBD.

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