

Predicting Attrition in a Pediatric Asthma Intervention Study

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Objectives To operationalize a comprehensive description of attrition, including pre-inclusion, dropout, and attrition due to intermittent missing data, and to test a predictive model of attrition using a data set from a randomized controlled intervention in pediatric asthma. **Methods** Participants included children, ages 4–12, diagnosed with asthma and their caregivers. Demographic variables and outcome measures of asthma morbidity were examined in 327 families to determine their association with attrition. **Results** Families who did not complete randomization and the intervention tended to have younger caregivers than did completers. Caregiver age emerged as the most consistent predictor of pre-inclusion and dropout attrition. There were no significant predictors of attrition due to intermittent missing data. **Conclusion** Younger caregivers may be at particular risk for attrition in pediatric asthma intervention studies and warrant special attention by investigators.

Key words attrition; pediatric asthma; intervention.

It is well recognized that sample attrition can bias a data set, result in a loss of statistical power, and reduce the internal and external validity of a study's findings (Bender, Ikle, DuHamel, & Tinkelman, 1997). Moreover, sample attrition is a general problem occurring in research in pediatric and child clinical psychology that requires empirical scrutiny (Drotar & Riekert, 2000). One of the most important obstacles in research on attrition with pediatric populations has been the variation in operational definitions. For example, attrition in pediatric populations has been reported as the percentage of potential subjects who do not consent to participate (Betan, Roberts, & McCluskey-Fawcett, 1995), as dropout occurring during baseline assessment (Walco, Varni, & Ilowite, 1992), as dropout occurring at any point during the study after recruitment (Aylward, Hatcher, Stripp, Gustafson, & Leavitt, 1985; Moser, Dracup, & Doering, 2000), and as dropout occurring during only follow-up (Senturia et al. 1998), or as a combination of the above definitions (Field et al., 1997; Riekert & Drotar, 1999).

Inconsistencies in operational definitions of attrition

have a number of problematic methodological consequences. For example, if attrition samples are not carefully and consistently described, researchers cannot determine the external validity of study findings. This is particularly important in prospective intervention studies in which participants may drop out of research at various phases in the study. Comprehensive operational definitions of attrition are also needed to guide studies of factors that predict attrition (critical to identifying its sources) and the impact on study findings and to facilitate comparisons of rates of attrition across different studies. Moreover, a more complete understanding of the predictors of sample attrition is needed to enhance recruitment procedures and maximize participation and retention rates, and consequently the representativeness of the research population.

To address the above needs, one purpose of the present study was to propose and operationalize a comprehensive operational definition of study attrition that can be used by investigators in a wide range of studies, especially intervention research. Based on previous research (e.g.,

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Betan et al., 1995; Howard, Krause, & Orlinsky, 1986), the comprehensive operational definition of attrition that was used in this study included three types: (1) pre-inclusion attrition, (2) dropout attrition, and (3) attrition related to intermittent missing data. Pre-inclusion attrition occurs when subjects who are otherwise eligible either do not consent to participate or cannot complete the requirements of the protocol prior to randomization (Betan et al., 1995; Flick, 1988). The second type of sample attrition, dropout attrition, results from participants prematurely discontinuing the treatment or study (Howard, Cox, & Saunders, 1990) and can affect external and internal validity. In randomized controlled trials, this is also referred to as postenrollment or postrandomization dropout. Finally, attrition related to intermittent missing data occurs when subjects do not complete follow-up portions of the study (Howard et al., 1986). All forms of attrition are of particular concern in studies with pediatric populations, as the available participant pools are usually small (Betan et al., 1995; Drotar, 1994).

Although attrition has received some attention in research concerning childhood chronic illness (e.g., Bender et al., 1997; Betan et al., 1995), to our knowledge, few if any studies have used a comprehensive operational definition of attrition to test whether the different types of attrition are influenced by similar factors. Such data would enhance scientific understanding of factors that limit the validity of study findings and could be used to target children and families who are at high risk for attrition and who might benefit from special efforts to prevent attrition.

Evans et al. (1999) indicated rates of pre-inclusion attrition and dropout attrition in a randomized clinical trial to reduce asthma morbidity in low-income African American children but compared characteristics (i.e., age, gender, frequency of asthma symptoms, and number and use of asthma medications) of noncompleters with completers only for pre-inclusion attrition. The groups differed significantly on one factor: Completers had a higher number of asthma medications. Bender and colleagues (1997) examined the impact of dropout attrition on outcome data in a longitudinal asthma medication trial. The primarily white sample included both children and adults. Pediatric noncompleters were more likely than completers to be female, to have more reactive airways, to have reduced scores on tests of intelligence and problem solving, and to have increased behavioral problems. The two groups did not differ in age, race, height, weight, asthma severity, duration of asthma, or achievement skills.

To address the above limitations, the present study used a data set from a randomized trial of medical and

psychosocial intervention designed to limit illness-related morbidity in pediatric asthma. The advantages of this illustration stem from the prevalence and importance of asthma (Adams, Hendershot, & Marano, 1999), the need for intervention studies to limit illness-related morbidity in this condition (Evans et al., 1999), and the fact that many of the participants in asthma intervention research are exposed to a range of risk factors including economic disadvantage (American Lung Association, 2001) that may predispose them to high levels of attrition.

Despite the relatively large number of intervention studies in pediatric asthma, little attention has been devoted to the impact of attrition rates in these long-term randomized controlled pediatric asthma studies. Of the few studies that reported attrition, nonconsent rates varied considerably. For example, some randomized clinical trials conducted to increase asthma knowledge among children had nonconsent rates ranging from 0% to 31.5% (Maslennikova, Morosova, Salman, Kulikov, & Oganov, 1998; Shields, Griffin, & McNabb, 1990). Other research on the self-management of asthma has found that between 17.6% and 36.2% of children drop out before randomization (Hughes, McLeod, Garner, & Goldbloom, 1991; Weingarten, Goldberg, Teperberg, Harrison, & Oded, 1985). In randomized controlled studies conducted to enhance the management of pediatric asthma and which included a run-in or prerandomization period lasting from 2 weeks to one month, dropout rates were shown to range from 0% to 25% (Bender et al., 1997; Evans et al., 1999; Tinkelman, Reed, Nelson, & Offord, 1993; Waalkens et al., 1993).

The present study addressed several important, but as yet unanswered, questions concerning research on attrition in studies of pediatric asthma intervention. First, studies have not used a comprehensive operational definition of attrition in describing and predicting attrition. Second, previous studies have not developed or tested a predictive model of attrition. Based on findings with adult and pediatric populations (Griffin, 1998), the following set of predictive factors were tested to determine their relationship to different types of sample attrition: (1) child characteristics (e.g., asthma severity), (2) caregiver characteristics (e.g., age, ethnicity, educational level, occupational status, marital status), and (3) environmental barriers (e.g., family income, number of people in the household) (see below under "Plan of Analysis").

Previous research with children with asthma found that children who dropped out of a longitudinal clinical trial experienced more asthma symptoms and had more reactive airways than children who remained in the study (Bender et al., 1997; Waalkens et al., 1993). Based on

these data, greater asthma severity was hypothesized to predict attrition.

To our knowledge, the impact of caregiver characteristics on attrition has not been studied with a pediatric asthma sample. Based on research with other pediatric populations, however, we predicted that caregivers who were younger, of only basic or rudimentary education (Janus & Goldberg, 1997), employed (Moser et al., 2000), single, and African American (Aylward et al., 1985) would not be likely to complete the asthma intervention study. Younger and less educated caregivers may be less likely to understand the value of research and participation in studies because they have not been exposed to research and its advantages. Employment can serve as a barrier to participation as it limits the time available for participation. Single caregivers may find it more difficult to bring the child in for appointments due to lack of child care for their other children. African American caregivers may be more suspicious of research and/or may not perceive participation to be beneficial or relevant to their child's health (Freimuth et al., 2001).

While, to our knowledge, the relationship of environmental barriers such as socioeconomic status to attrition has not been studied with a pediatric asthma sample, based on research with other pediatric populations (Aylward et al., 1985), we hypothesized in this study that low socioeconomic status will predict attrition. Families with fewer economic resources may have less ability to access health care and/or arrange transportation, which is needed to participate in research projects (Aylward et al., 1985). In addition, we hypothesized that a greater number of people in the household will predict attrition: The greater the number of people in the household, the greater the potential for competing responsibilities on the time and energy of the caregiver, causing participation and continuation in research studies less likely to occur.

Method

Participants

The present study included children, 4 to 12 years of age, and their primary caregivers who had participated in a pediatric asthma intervention study at a teaching hospital in the Midwest (Walders, 2001). Participants were included in the study if (1) they had physician-diagnosed asthma for a minimum of 3 months, (2) they had a history of one or more hospitalizations for asthma in the past year, and/or more than two emergency department visits in the past year at any facility (this criterion was used to document the need for intervention), (3) asthma was their only respiratory condition and sole chronic illness, and

(4) children were English speaking and residing with an English-speaking primary caregiver (1–2 families were excluded owing to this criterion).

Study Design

The present study of attrition involved a randomized controlled design including two groups: (1) an intervention group that received comprehensive interdisciplinary asthma management, including an individualized medical action plan for asthma and a session of problem-solving therapy targeting subject-specific primary asthma management barriers, designed to maximize family-based asthma management skills and treatment adherence as well as access to a 24-hour asthma hotline staffed by nurses with training in asthma management; and (2) a control group receiving state-of-the-art medical care, which consisted of an individualized medical action plan for asthma.

Preliminary findings of the impact of the intervention on the primary outcomes, which were asthma symptoms (e.g., symptomatic days), functional impact, and health care utilization, have been reported elsewhere (Walders, 2001). Measures described in this study were used to predict attrition.

Procedure

The institutional review board at Rainbow Babies and Children's Hospital approved the pediatric asthma intervention study. At the first visit, written informed consent from caregivers and assent from children was obtained, and participants underwent a baseline assessment of physical and psychological status. At the second visit, approximately 2 weeks after the baseline visit, subjects were randomized into either the intervention or the control group. Randomization was blocked and stratified for child age to ensure equivalent distribution of developmental levels represented in the group assignments. Patients who failed to come in for the second visit after a minimum of three scheduling attempts were dropped from the study. Within 1 to 4 weeks after randomization, the intervention group received a session of problem-solving therapy. Follow-up data visits, which were the primary means of assessing outcomes referred to above, occurred 6 and 12 months postrandomization. In addition, the families were called at 2, 4, 8, and 10 months to assess asthma symptoms. At the conclusion of all visits, including follow-up visits, caregivers were given \$30 in cash for their time. Children received their choice of a gift from a large toy chest filled with a variety of toys after all visits except the second visit, when they received a gift certificate to McDonald's restaurant for \$5.

In order to maximize the retention of participants in

this study, a minimum of 3 attempts (maximum of 12 attempts) were made to contact families by phone to schedule visits and collect follow-up data. Furthermore, letters were mailed to families who were unresponsive to the phone messages and who had disconnected phone numbers.

Measures

Demographic Information. At recruitment, basic information (e.g., child's name) and contact information (e.g., caregiver's home and work numbers) were collected. During the baseline visit, all eligible participants completed a demographic information form that included family composition (e.g., number of children in the home), economic status (e.g., total family income), and family background (e.g., caregiver education).

Asthma Severity. Asthma symptoms at initial evaluation were measured using items from the Children's Health Survey for Asthma (CHSA; American Academy of Pediatrics, 2000). Maximum symptom days was defined as the maximum of the total number of days with wheeze or the total number of days with asthma episode(s) in the previous 4 weeks as reported by caregivers. The frequency of shortness of breath, chest tightness, cough, and sleeping difficulty associated with asthma were additionally assessed. Asthma severity was determined by a pediatric pulmonologist with substantial experience

in clinical research and categorized on a 4-point scale of mild intermittent, mild persistent, moderate persistent, and severe persistent. Categorization was based on responses given on the CHSA and on standard guidelines from the National Heart, Lung, and Blood Institute (NAEPP, 1997).

Attrition. As shown in Figure 1, attrition was categorized into pre-inclusion, dropout, and intermittent missing data. Pre-inclusion attrition consisted of the percentage of eligible subjects who (1) did not consent to participate and (2) were not randomized. Dropout attrition was composed of the percentage of randomized participants who (1) did not complete the intervention (intervention group only) and (2) did not complete the final follow-up visit. Intermittent missing data attrition comprised the percentage of subjects who completed the final follow-up visit but did not complete earlier follow-up portions of the study.

Results

A total of 327 children and caregivers were eligible to participate in this study (see Table I). Children were 4–12 years old ($M = 7.28$, $SD = 2.42$). The majority of children were male (69%) and were diagnosed with mild intermittent or mild persistent asthma (57%). Caregivers were 19–70 years old ($M = 33.96$, $SD = 8.04$). The majority of caregivers were single (52%), employed full-time or part-

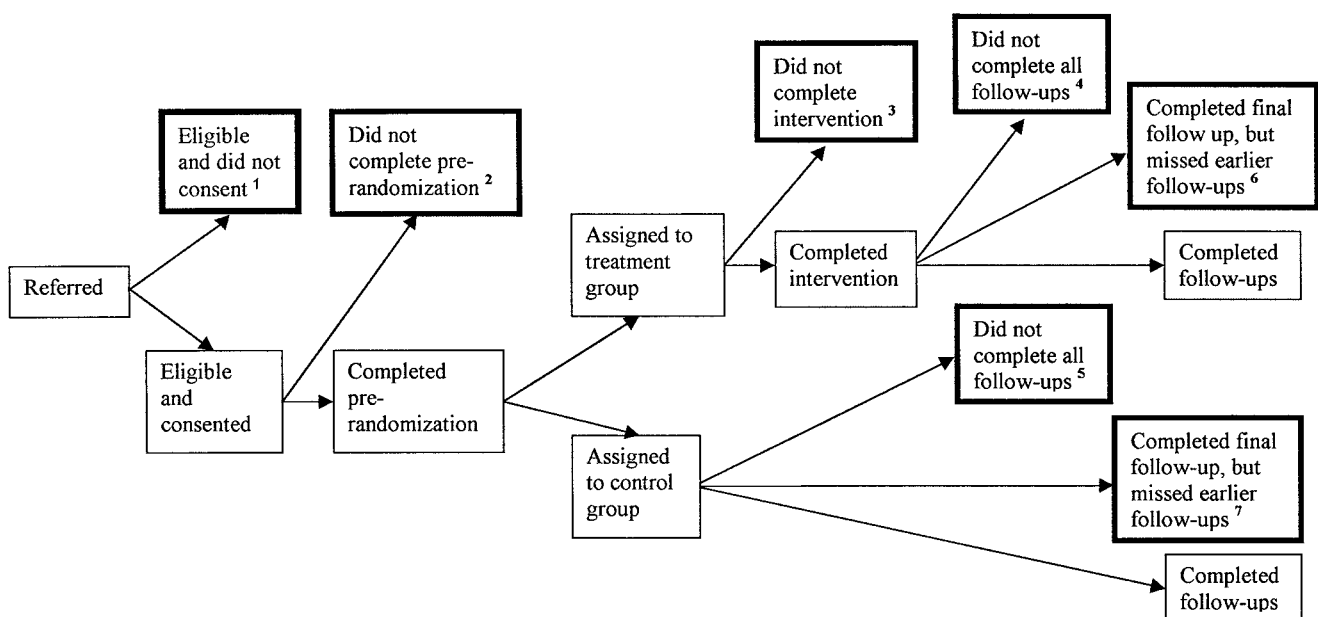


Figure 1. Types of Attrition Occurring in a Randomized Controlled Study

1, 2 Pre-inclusion

3, 4, 5 Dropout

6, 7 Intermittent missing data

time (66%), and had a high school degree or less (64%). Families generally were African American (85%) and had household incomes of less than \$30,000 (72%).

The sample obtained was representative of patients seen in this hospital setting who had problems in the management of their asthma as demonstrated by rates of emergency department visits and hospitalizations. The medical and nursing staff who helped conduct the research have substantial experience in providing clinical pediatric care for African American children with asthma.

Plan of Analysis

The analyses were designed to examine differences in the sample between those who demonstrated pre-inclusion attrition, dropout attrition, and intermittent missing data attrition versus those who completed the portions of the study (see Figure 1), based on the following predictor variables: child characteristics (e.g., asthma severity), caregiver characteristics (e.g., age, ethnicity, educational level, occupational status, marital status), and environmental barriers (e.g., family income, number of people in the household). Summary statistics, including mean and standard deviations for continuous data and frequencies and proportions for categorical data, were used to describe the attrition predictor variables. Comparisons were performed using *T* tests or Wilcoxon rank sum tests for continuous variables and Pearson chi-square tests for categorical data. Next, forward stepwise logistic regression analyses were conducted to examine the relative contributions of specific predictor variables on attrition status. Indicator variables were used for categorical predictor variables.

Pre-inclusion Attrition. Among the 327 eligible families approached to participate in this study, 22 families did not consent (7%) and 130 families did consent but left the study before randomization (40%). Minimal data were collected from families who did not consent to participate (i.e., ethnicity only). Compared with consenters who did not complete the run-in period prior to randomization, nonconsenters differed significantly with regard to ethnicity. African Americans were more likely to give consent and then leave the program prior to randomization (92%) than not to consent (8%). In contrast, non-African Americans were equally likely to consent than not to consent (50%).

As shown in Table II, participants who were not randomized (i.e., did not complete Visit 2) differed from those who were randomized on only one variable. Caregivers of noncompleters (*M* = 31.63, *SD* = 7.14) were on average younger than the caregivers of the completers (*M* = 34.51, *SD* = 8.16), *t*(214) = 2.08, *p* < .05 (two-tailed). The two

Table I. Demographic and Disease Characteristics of Eligible Participants

	<i>M (SD)</i>	<i>n (%)</i>
Child characteristics		
Child's age, y	7.28 (2.42)	
Child's gender (<i>N</i> = 327)		
Male		224 (69)
Asthma severity (<i>N</i> = 216)		
Mild intermittent		34 (16)
Mild persistent		88 (41)
Moderate persistent		67 (31)
Severe persistent		27 (13)
Caregiver characteristics		
Caregiver's age, y	33.96 (8.04)	
Ethnicity (<i>N</i> = 327)		
African American		277 (85)
White		46 (14)
Other		4 (1)
Educational level (<i>N</i> = 215)		
Partial high school or less		42 (20)
High school degree		95 (44)
Partial college		46 (21)
College degree		32 (15)
Occupational status (<i>N</i> = 216)		
Employed (full-time or part-time)	142 (66)	
Unemployed		74 (34)
Marital status (<i>N</i> = 216)		
Single		112 (52)
Married/cohabitating		70 (32)
Separated/divorced/widowed	34 (16)	
Environmental Barriers		
Family income (<i>N</i> = 214)		
<\$14,999		85 (40)
\$15,000–\$29,999		68 (32)
\$30,000–\$44,999		30 (14)
>\$45,000		31 (15)
Number living in household	4.52 (1.69)	

groups did not differ with regard to asthma severity, family income, number of people living in the household, and the following caregiver variables: ethnicity, educational level, occupational status, and marital status.

Dropout Attrition. Among the 175 participants who were randomized, 51 (29%) left the study at some point after randomization. As illustrated in Table II, among this group, noncompleters differed from those who completed the study on two variables. Caregivers of noncompleters (*M* = 31.88, *SD* = 7.49) were on average younger than the caregivers of the completers (*M* = 35.59, *SD* = 8.20), *t*(173) = 2.79, *p* < .01 (two-tailed). In addition, caregivers of non-completers (*M* = 75.71, *Mdn* = 2.00) were on average less

Table II. Comparison of Completer Groups and Attrition Groups

Type of Attrition	Variable	Completer Group <i>M (SD) or n (%)</i>	Attrition Group <i>M (SD) or n (%)</i>
Pre-inclusion		<i>N</i> = 175	<i>N</i> = 152
	Caregiver age, <i>y</i> *	34.51 (8.16)	31.63 (7.14)
Dropout		<i>N</i> = 124	<i>N</i> = 51
	Caregiver age, <i>y</i> **	35.59 (8.20)	31.88 (7.49)
	Caregiver education level ^a *		
	Partial high school or less	22 (18%)	14 (27%)
	High school degree	52 (42%)	24 (47%)
	Partial college	26 (21%)	9 (18%)
	College degree	23 (19%)	4 (8%)

Only variables indicating a significant group difference are included in the table. Other tested variables not included are asthma severity, family income, number of people in the household, and the following caregiver variables: ethnicity, occupational status, and marital status.

^a*N* = 123 for education level due to missing data.

* *p* < .05

** *p* < .01

*** *p* < .001

educated than completers ($M = 92.39$, $Mdn = 2.00$), $p < .05$ (two-tailed). The two groups did not differ with regard to asthma severity, family income, number of people living in the household, and the following caregiver variables: ethnicity, occupational status, and marital status. Dropout attrition rates for the intervention group (27%) and the control group (31%) were not significantly different.

Intermittent Missing Data. Among the 124 participants who completed the study, 17 (14%) did not complete some aspect of the follow-up portion of the study. Non-completers did not differ from those who completed all portions of the follow-up visits. The two groups did not differ with regard to asthma severity, family income, number of people living in the household, and the following caregiver variables: age, ethnicity, educational level, occupational status, and marital status. Attrition rates due to intermittent missing data for the intervention group (11%) and the control group (16%) were not significantly different.

Attrition rates due to intermittent missing data significantly differed. More participants from the control group (59%) were noncompleters than from the intervention group (41%), $t(59) = -2.32$, $p < .05$. Noncompleters did not differ from completers within either the intervention group or the control group.

Regression Analysis

Forward stepwise logistic regression analyses, which enter one variable at a time and retain only those that meet preset probabilities ($p < .05$), were conducted to identify predictors of attrition, including pre-inclusion attrition, dropout attrition, and intermittent missing data. Variables considered for entry in the regression equation included child characteristics (e.g., asthma severity), caregiver char-

acteristics (e.g., age, ethnicity, educational level, occupational status, marital status), and environmental barriers (e.g., family income and number of people in the household).

Caregiver's age ($p < .05$) emerged as the only significant predictor of pre-inclusion attrition. For each one-year increase in caregiver's age, the odds of attrition decreased by 5% (odds ratio [OR] = .95, 95% confidence interval [CI] = .91–.998).

Caregiver's age ($p < .01$) emerged as the only significant predictor of dropout attrition. For each one-year increase in caregiver's age, the odds of attrition decreased by 6% (OR = .94, CI = .90–.99). There were no significant predictors of attrition due to intermittent missing data.

Discussion

The present study contributed to the pediatric psychology literature in several important respects. First, this study presented operational definitions of attrition and applied a comprehensive model of attrition to a specific data set, which may be generalized to other studies. In addition, while the study was not explicitly designed to include a primarily African American sample, the study did provide an important opportunity to study a population that is underrepresented in pediatric psychology research.

In comparison with previous pediatric asthma intervention studies, this study's rate of pre-inclusion attrition was greater (47% vs. 0–36%) (e.g., Evans et al., 1999; Hughes et al., 1991; Shields et al., 1990). Dropout attrition (29% vs. 0–34%) and intermittent missing data (14% vs. 12–14%) in this study were generally comparable to other intervention studies with African American and low-

income families (e.g., Evans et al., 1999) and to randomized controlled medication trials (e.g., Bender et al., 1997; Tinkelman et al., 1993).

Several additional factors may have influenced the relatively high rates of attrition, especially pre-inclusion attrition, in this study. First, the study's protocol involved multiple visits for assessments and intervention and was prospective, which increases the opportunity for dropout. Moreover, the study included a run-in method, which involved participation in study procedures prior to randomization to intervention group. Such procedures may have increased attrition based on the comprehensive definition used in this study. The episodic nature of asthma symptoms may also be a factor. For example, parents may be less interested in participating or continuing in research on asthma when their child is not symptomatic. Finally, a high proportion of the families participating in the study may be part of chaotic environments and lack resources (e.g., income, access to transportation or phone) that may be critical for participation and contact for follow-up.

Our study is one of the few that have examined predictors of attrition in research on pediatric asthma using a comprehensive definition of attrition. Caregiver age was the major predictor of attrition of all types, except for attrition due to intermittent missing data. Younger caregivers demonstrated higher rates of attrition. To our knowledge, only two pediatric asthma studies examined group differences regarding rates of attrition. Evans et al. (1999) found that completers (e.g., those who were randomized) were prescribed a higher number of asthma medications than noncompleters; however, the researchers did not examine potential predictors of attrition. Bender et al. (1997) examined only dropout attrition from a longitudinal clinical medication trial and found that, indeed, patient attrition had the potential to bias a study's outcome.

One the other hand, the findings of this study are consistent with those of other studies examining chronic illness populations (e.g., Janus & Goldberg, 1997) in that younger caregivers may be more likely to drop out of a study prematurely. Unlike Moser et al. (2000), who examined caregivers of infants at risk for cardiopulmonary arrest, the present study did not find other variables, such as occupational status, to be predictors of attrition. Of equal interest is the number of factors that did not distinguish between the various types of attrition and their respective completer groups (i.e., asthma severity, family income, number of people living in the household, and the following caregiver variables: ethnicity, occupational status, marital status).

As shown by the present data, one advantage of the present comprehensive approach to describing attrition

used here is that the specific types of attrition are clearly identified and can be considered separately in analyses of predictors. An alternative strategy of describing study attrition by combining the subgroups of attrition may be misleading because different predictors may be found for different subgroups. For example, in the present study, caregiver age predicted attrition for those families who left the study at some point after randomization and did not complete the final follow-up visit, but not for those who completed the final follow-up visit. We anticipate that the comprehensive definition of attrition used here can be adapted to studies of a wide range of pediatric populations.

Limitations and Future Directions

Some limitations of the present study suggest potential directions for future study. The present sample consisted primarily of African Americans and families from low socioeconomic backgrounds, which, while representative of the population of children with asthma who were served by this hospital, restricted the range and variability of these predictor variables. This may have limited sensitivity to the predictions of attrition based on ethnicity and income. In addition, generalizations of our findings to non-African Americans and families from high socioeconomic backgrounds should be made with caution. Larger, more heterogeneous samples will be needed to clarify the specific impact of ethnicity and socioeconomic status on attrition in studies of pediatric asthma.

A second potential limitation of this study was the selection of predictor variables of attrition. The present asthma intervention study was not designed to specifically study attrition, although it provided a useful opportunity to do so. A more complete examination of predictor variables should be examined in future research. First of all, self-efficacy beliefs and perceived expectations toward research may influence attrition rates in intervention studies (Davis & Addis, 1999). For example, families who believe they can adequately manage their child's illness and/or those who do not believe in the value of research may feel that participation in research is not advantageous and beneficial to them. Second, the level of adherence to medical treatment may also predict attrition (Riekert & Drotar, 1999). Families who have difficulty adhering to medical treatment recommendations may be chaotic and not have the organizational skills needed to complete the requirements of the research study. Third, the level of attrition may be influenced by the family's perceptions of barriers to participation (e.g., belief that study demands are unmanageable, lack of consistent access to transportation to the research site) as well as the amount of stress, both chronic and transitory, the family is expe-

riencing (Kazdin, Holland, & Crowley, 1997). Finally, child-specific characteristics, such as academic difficulties, behavioral problems, and psychological problems, may either directly or indirectly influence parents to withdraw their family from studies (Kazdin & Mazurick, 1994).

A third limitation concerned the generalizability of the study, which involved children with asthma and their parents. It is possible that the environmental barriers and child/caregiver characteristics examined here as predictors of attrition may operate differently in affecting attrition in studies of other chronic conditions. For this reason, additional research should evaluate the generalizability of findings across other chronic illnesses.

Finally, our findings suggest that there is some advantage for future research studies to describe the three types of attrition and address the impact of attrition at each phase of the study (Betan et al., 1995). Moreover, due to the significant ethnic difference found within the pre-inclusion attrition group, a comparison between non-consenters and consenters who did not complete the run-in period prior to randomization might be clinically meaningful. A comprehensive description of the sample should be provided (relevant demographic and clinical characteristics), as well as an analysis of the similarities and differences between attrition and completer groups (Drotar & Riekert, 2000).

Understanding and identifying predictors of attrition may help investigators maximize participation of subjects in research studies (Riekert & Drotar, 1999). The relationships between the predictor variables (e.g., caregiver age) and attrition in the present study suggest the need to target subgroups at especially high risk for attrition and indicate that techniques to prevent dropout in pediatric groups with young caregivers are warranted. An increased sensitivity to the issues faced by these families may improve the likelihood of engaging them in research protocols. Researchers may need to use a range of methods to enhance consent rates and reduce attrition due to dropout and intermittent missing data. Techniques for retention of study participants include, but are not limited to, incentives for participants, continual mail or telephone contacts by project staff, providing postage-paid postcards for participants to inform the researcher of a change in address or telephone number, and attempts at tracking participants if contact is lost (Drotar & Riekert, 2000; Senturia et al., 1998).

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