PREDICTORS OF ASTHMA TREATMENT ADHERENCE IN RURAL APPALACHIAN ADULTS WITH ASTHMA

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ABSTRACT

This descriptive, non-experimental study in a sample of 102 rural Appalachian adults with asthma evaluated relationships between treatment regimen adherence and health beliefs, attitude, behavioral intention, and age. Major predictors of adherence were health beliefs and attitude toward asthma. Findings provide partial support for the theorized relationships. Recommendations include future intervention studies designed to improve asthma care outcomes among rural Appalachian adults diagnosed with asthma.

INTRODUCTION

Helping individuals achieve adherence with prescribed asthma treatment regimens, including asthma medications, avoidance of allergens, and keeping follow-up asthma monitoring visits with the health care provider, is a major goal of nursing care to society. Adherence is defined in this study as the extent to which a person's behavior coincides with medical or health advice. Specifically, adherence with recommended asthma treatment regimens is defined as the extent to which a person's behavior coincides with recommendations for self-administering inhalers on time and at the prescribed daily doses; avoiding known environmental "triggers;" performing peak-flow readings daily, if prescribed; and keeping follow-up visits with the health care provider (National Institutes of Health, 1997). Little is known about factors that contribute to adherence with asthma treatment. This lack of knowledge about adherence behaviors in asthma is a concern for the nursing profession, considering that adherence is essential to minimizing asthma complications and that asthma complications are a major health care problem in the United States (National Institutes of Health, 1997, 2002).

In the United States, acute exacerbations of asthma are responsible for 466,000 hospitalizations, 1.9 million emergency department visits, and 5,500 asthma-related deaths, costing $11 million annually. While the prevalence of asthma increased 42 % between 1982 and 1992 in the U.S., it increased a dramatic 82% in the last 15 years in West Virginia, a rural Appalachian state. According to the National Institutes of Health Asthma in America Report, nearly 17 million persons, 5.5 % of the United States' population, suffer from asthma (National Institutes of Health, 1997, 2002). The number of asthma cases has more than doubled since 1980 and, nearly 3 million workdays are lost annually due to asthma exacerbations (Redd, 2002). Within rural Appalachia, in the state of West Virginia, alone, an estimated 69,000 adults suffer from asthma (West Virginia Department of Health and Human Resources, 2001).

Empirical evidence indicates that acute exacerbations of asthma intensify when patients do not adhere to asthma treatment regimens. Yet, little is known about the influence of health beliefs, attitude, behavior intention, knowledge of asthma, and demographic characteristics on adherence with asthma treatment (Lynch, Mahr, & Rooklin, 2001).

Periodic exacerbations may occur secondary to a triggering illness, such as a viral or bacterial infection or exposure to an allergen, even when asthma is being effectively treated. A landmark study conducted in a large, California-based health maintenance organization found that fewer than 50% of a sample of 5,580 adult asthmatics reported using their inhalers daily as prescribed (Legoretta, Christian-Herman, O'Connor, Hasan, Evans, & Leung, 1998). Documented clinical observation has revealed a consistent lack of adherence with asthma care regimens (Berg, Dunbar-Jacob, & Sereika, 1997; Legoretta et al. 1998; Tettersell, 1993). The potentially serious complications and consequences of non-adherence to recommended asthma care regimens are often not fully realized by the adult asthma patient, resulting in costly complications, and even death in some instances (Klaus & Grodesky, 1997).

Adherence with asthma care is especially challenging for people living in medically underserved areas and in poverty because they have fewer resources to cover health care costs (United Mine Workers of America, 2000). Rural is defined in this study according to the official United States Federal guidelines as places, incorporated or unincorporated, with fewer than 2,500 residents. A rural area is outside the boundaries of metropolitan areas, and has no cities with as many as 50,000 residents (United States Department of Agriculture, 2000; United States Census Bureau, 2001). The overall poverty rate in rural Appalachia is 15.3%, compared to the United States national poverty rate of 13.1%. To minimize the problem of asthma in rural Appalachian adults, the West Virginia Department of Health and Human Resources (2002) has recommended managing asthma according to established guidelines, which involves controlling exposure to environmental asthma triggers, adequate pharmacological management, and patient education. However, access to and availability of adequate health care is lacking in many areas of Appalachia (Appalachian Regional Commission, 2002). Despite the increasing prevalence of asthma and the magnitude of the problem of asthma complications, research related to asthma adherence behaviors in adults is sparse, and in rural adults is practically nonexistent. However, after a thorough electronic search of the PubMed and CINAHL databases during the time this study was designed in 2000, only three studies (Berg et al. 1997; Tettersell, 1993; Legoretta et al. 1998) were found specifically investigating adult asthma patient adherence issues, with only two of these studies focusing on rural adults with asthma.

REVIEW OF LITERATURE

Research Specific to Adherence with Asthma Treatment Regimen in Adults

First, Berg et al. (1997) studied 55 rural adults with asthma in a quasi-experimental study, evaluating adherence with prescribed inhalers using an electronic chronolog device and self-report after an educational intervention. Patients who received education regarding their medications were more adherent than those who had no

intervention. Medication adherence to inhaled corticosteroids was the focus of this study, not the entire asthma treatment regimen.

Second, Tettersell (1993) conducted a study in rural England using an instrument she developed to measure asthma patients' adherence with asthma drug therapy in a sample size of 108 adults. Adherence to asthma medications was measured by self-report of the patients. Patients over 50 years old were more adherent with use of their inhalers than the younger participants. The majority of the sample (73%), lacked knowledge related to the illness of asthma and medication knowledge. The study only examined asthma drug adherence and not other aspects of the asthma treatment regimen.

Third, Legoretta et al. (1998) surveyed over 5,000 adult asthma patients in the Kaiser Permanente HMO in California and found that more than 50% of the sample did not take their daily asthma inhalers as prescribed by the health care provider. This study was a landmark study in adult asthma treatment adherence because it had the largest sample and it was one of the few studies located to address adherence among adults with asthma. In summary, the three studies reviewed focused mainly on asthma medication adherence only. Patient adherence to all aspects the recommended asthma treatment regimen, including inhaled medications (corticosteroids, bronchodilators), routine medical follow-up with exam, lung function monitoring, medication adjustment, and avoidance of triggers could potentially decrease morbidity and mortality among asthma patients (Lynch et al. 2001). Furthermore, health beliefs and attitudes are, theoretically, related to adherence with asthma treatment regimen (Scherer & Bruce, 2001). However, at the time this study was designed in 2000, no studies were located that evaluated the influence of health beliefs and attitudes on adherence with the asthma treatment regimen in adults with asthma. Therefore, a more holistic approach examining multiple aspects of asthma treatment regimen adherence is justified. Previous studies focusing on the adult asthma patient have shown that those diagnosed with asthma for a longer period of time, and older adults are more adherent with the treatment regimen compared to younger adults, and that attitude toward having the disease of asthma influences adherence to the asthma treatment regimen. Knowledge of asthma has been shown to increase adherence rates with the asthma treatment regimen in some instances, but not consistently in asthma research focusing on asthma patient's knowledge of the disease of asthma (Berg et al. 1997; Boulet, 1998; Scherer & Bruce, 2001).

Research of Adherence to Treatment Regimen for Other Chronic Diseases

Many recent studies in people with chronic diseases other than asthma have provided evidence of associations between the desired outcome of treatment regimen adherence and health beliefs, attitude toward their illness, and behavioral intention to adhere (Chesney, 2003; Coombs, Deane, Lambert, & Griffiths, 2003; Dunbar-Jacob, & Mortimer-Stephens, 2001; Dunbar-Jacob, Bohachick, & Sereika, 2003; Duncan, & Pozehl, 2003; Holland, Wiesel, Cavallo, Edwards, Halper, Kalb, Morgante, Narney, O'Leary, & Smith-Williamson, 2001; Johnson, 2002; Konkle-Parker, 2001; Lo, 1998; Lo, 2001; Lutfey, & Wishner, 1999; Mikhail & Petro-Nustas, 2001; Poss, 2000; Rose, Kim, Dennison, & Hill, 2000; Rosina, Crisp, & Steinbeck, 2003; Scherer, & Bruce, 2001; Stubblefield, & Mutha, 2002; Toljamo, & Hentisen, 2001; Vermeire, Hernshaw, Van Royen, & Denekens, 2001). Research in chronic illnesses other than asthma has

operationalized the concepts in the Health Belief Model and the Theory of Planned Behavior, including health beliefs, attitude, and behavioral intention, and demonstrated the influence of those concepts' over adherence behaviors with recommended treatment regimens. Specifically, knowledge, health beliefs, attitude, and behavioral intention have been correlated significantly with target behaviors and outcomes in hypertension, cancer, heart disease, and diabetes (Grady & Jaloweic, 1995; Landenpera & Kynagas, 2001). The positive correlations of these variables with treatment regimen adherence in patients with other chronic illnesses suggest that similar relationships may exist in asthma treatment regimen adherence, relationships that have not been investigated. These findings in patients with chronic diseases other than asthma, strengthens the evidence documenting the size and impact of the problem of adherence with asthma care. The limited research on adherence with asthma treatment regimens by rural adults justified this investigation. The purpose of this study was to investigate the influence of knowledge of asthma, health beliefs, attitude toward the illness of asthma, and behavioral intention to adhere on adherence behaviors with recommended asthma treatment regimens in rural Appalachian adults. This study was guided by the following two research questions:

1. Is there a significant relationship between the demographic variables of age, gender, education level, yearly income, age at diagnosis of asthma, number of family members with asthma, and adherence with prescribed asthma treatment regimens in rural Appalachian adults with asthma?
2. Does the combination of knowledge of asthma, health beliefs, attitude toward the illness of asthma, and behavioral intention to adhere predict adherence behaviors with prescribed asthma treatment regimens in rural Appalachian adults better than any single variable alone?

Conceptual Framework

The model for investigation (see Figure 1) was developed from selected concepts and their hypothesized relationships. The concepts are components from the Health Belief Model (Rosenstock, 1966; Becker, Drachman, & Kirsch, 1974) and the Theory of Planned Behavior (Ajzen, 1988; Ajzen, 1991), combined in an attempt to capture the complex phenomenon of adherence behaviors with recommended asthma treatment regimens. The Health Belief Model (Becker et al. 1974) postulates that in order for people to participate in behaviors that prevent illness, they must believe that they are personally susceptible to illness, that contracting the illness would have a negative impact on their life, that taking a particular action would be beneficial, and that taking action would not involve overcoming perceived barriers. The Theory of Planned Behavior (Ajzen, 1988) interprets social behavior on the level of decision-making. The conceptual elements of the Theory of Planned Behavior are attitude, subjective norm, perceived behavioral control, behavioral intention, and the behavior itself. Elements of the theory used for this study include attitude, behavioral intention, and the behavior itself (adherence).
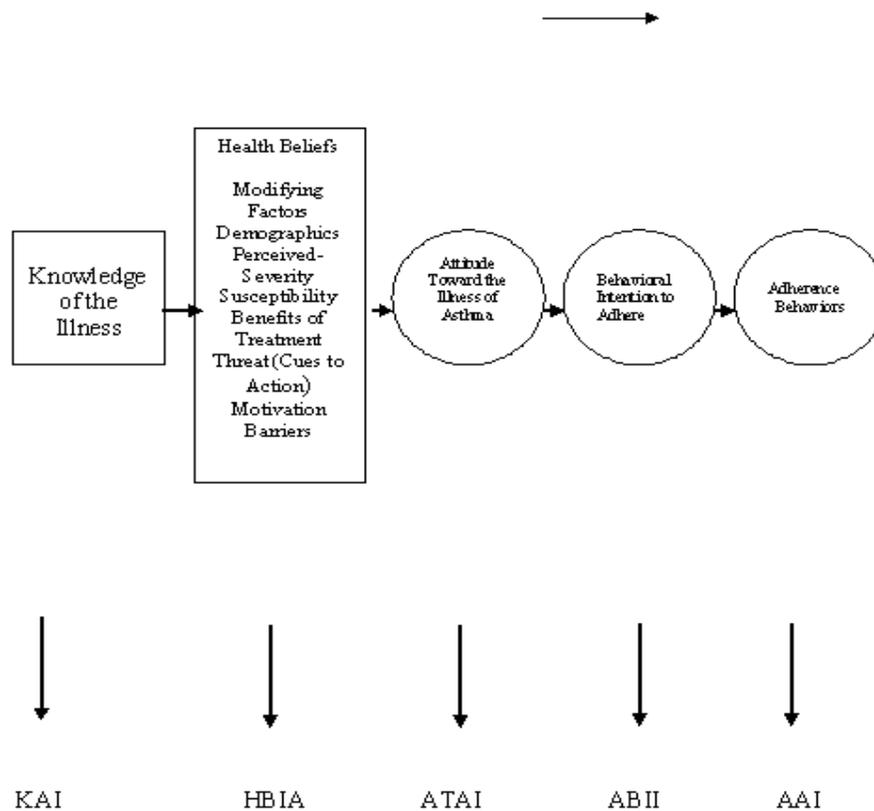
Figure 1. Schematic model of investigation depicting hypothesized relationships between variables and corresponding instruments for empirical measurement.

Note. The study instruments are represented by the following abbreviations in the figure; KAI = Knowledge of Asthma Instrument, HBIA = Health Belief Instrument for Adults Diagnosed with Asthma, ATAI = Attitude Toward Asthma Instrument, ABII = Asthma Behavioral Intention Instrument, AAI= Asthma Adherence Instrument

The model for investigation proposed sequential, linear relationships and postulated that knowledge influences health beliefs, which influence attitude toward the illness of asthma, which influences behavioral intention to adhere, which directly influences actual adherence behavior. Literature supports the use of a combination of concepts from the Health Belief Model and Theory of Planned Behavior through studies examining adherence behaviors with recommended treatment regimens in chronic illnesses, such as tuberculosis, diabetes, and heart disease, to more completely explain the phenomenon of the performance or nonperformance of a particular target behavior. Similar behaviors have been found in patients who deal with chronic illness. Patients with asthma and other chronic illnesses have a need to believe in the effectiveness of the

treatment regimen in terms of medication and other possible uncomfortable or undesirable treatments. In addition, patient attitude combined with health beliefs and the intent to be adherent to what is perceived by the patient as an effective and beneficial treatment regimen over an extended period of time, has been found to be essential to the success in treating many chronic illnesses, including asthma. The possible lack of perceived immediate threat to the asthma patient in comparison to other, possibly more immediate life threatening chronic illnesses, may be a difference which needs to be considered in the adult asthma patient compared to other patients with chronic illness. In addition, lack of immediate medical resources in rural Appalachia may additionally affect adherence to the recommended asthma treatment regimen (Fishbein, Bandura, Triandis, Kanfer, Becker, & Middlestadt, 1991; Berg et al. 1997; Poss, 2000; Vandlandingham, Suprasent, Grandjean, & Verasit, 1995).

An assumption of this study was that, while treatment regimens for asthma are specific and prescribed by health care providers, the health care provider and patient work in a collaborative relationship to achieve mutual goals and positive outcomes with asthma care. The patient is an active, participating member in their care. The concept of adherence in this study was examined as the performance of recommended asthma treatment regimens and quantified to measure an outcome, and not as a judgment or reflection of persons as good or bad or a reflection of personal characteristics.

METHOD

Setting

The setting for this descriptive, non-experimental study was a private allergy and asthma practice, located in western Maryland, with approximately 6,000 patients. This site was selected because the researcher had enter, being employed at the practice during the time of this study. The practice serves western Maryland, a large portion of northern West Virginia, a small area of northwestern Virginia, and western Pennsylvania, all areas classified as rural Appalachia by the United States government's Appalachia Regional Commission. There is not another specialty practice in allergy and asthma for an approximate 75-mile radius.

Sample

A total of 250 patients met the specific criteria for the study, and were invited to participate. The patients were selected by manual chart review conducted by the researcher, and all patients who met the inclusion criteria were invited to participate. Inclusion criteria were being an adult (18 years or older), living within the geographical study setting, and responsible for self-care. Potential participants were diagnosed with asthma for varying lengths of time, ranging from 6 weeks to years; currently prescribed a daily inhaler (corticosteroid), an "as needed" bronchodilator (beta-agonist), also known as a "rescue" inhaler; and have been allergy tested and instructed to avoid specific environmental "triggers," such as cats, dogs, dust mites, cut grass, weeds, and molds, all important aspects of asthma control, and stressed in the asthma treatment regimen. A potential participant was required to have been seen at the office at least one time prior to

participation in the study. Criteria for inclusion in the study was determined by the researcher based on the diagnosis of asthma, medication regimen, and being a consenting adult. Due to the limited number of eligible participants (many of the asthma patients seen at the practice are children), all adult patients being seen at the practice, meeting the inclusion criteria, were invited to participate in the study to maximize the sample size. Power analysis was performed using the Sample Power computer program (Borenstein, Rothstein, & Cohen, 1997). The minimal sample size was determined to be 98 based on the number of variables in the study.

Instruments

The Asthma Questionnaire, consisting of a compilation of five different instruments, was developed for this study because no instruments existed that measure all of the specific study variables in an asthma population (Putman, 2002; Scherer, & Bruce, 2001). The table in the Appendix presents selected sample items from each instrument used in this study. The questionnaire had a section with 11 questions asking pertinent demographic data and the following five instruments: Knowledge of Asthma Instrument (KAI) (7 items), Attitude Toward Asthma Instrument (ATAI) (11 items), Health Belief Instrument for Adults Diagnosed with Asthma (HBIA)(14 items), Asthma Behavioral Intention Instrument (ABII) (6 items), and the Asthma Adherence Instrument (ACI) (4 items). All instruments were written at the 5th grade level, according to the Flesch-Kincaid readability scale, and current Medicaid and Medicare reading level requirements for written materials as guidelines (Flesch, 1974).

Content validity for all instruments used in this study was established by a panel of five health care practitioners with expertise working with adults with asthma. Two members of the panel were medical doctors specializing in asthma care and treatment; one was a nurse practitioner; one a clinical nurse specialist; and one, an asthma nurse educator employed by a large pharmaceutical company. The content validity index was obtained for all instruments after the expert panel rated the relevance of each item in the instruments using a 4 - point rating scale on a content validity form. The Likert scale on the content validity form ranged from 1 = not relevant, 2 = somewhat relevant, 3 = quite relevant, and 4 = very relevant (Burns & Grove, 1997). Each instrument had the following calculated content validity index; The Knowledge of Asthma Instrument (KAI) .96, Attitude Toward Asthma Instrument (ATAI) .95, Health Belief Instrument for Adults Diagnosed with Asthma (HBIA) .89, Asthma Behavioral Intention Instrument (ABII) .96, Asthma Compliance Instrument (ACI) .93.

The Asthma Questionnaire was pilot tested with a total of 32 rural Appalachian adults with asthma. To avoid a potential confounding variable, patients included in the pilot study were excluded from participation in the main part of the study. Patients in the pilot study consisted of those having an office visit during a specific 6-week time period and met the study inclusion criteria. A total of 35 patients were invited to participate in the study when they came in for an office visit, and 32 agreed to participate. A registered nurse explained the study to the patient, obtained informed consent, and administered the Asthma Questionnaire. Most patients were able to complete the entire questionnaire within 15 minutes.

Reliability was evaluated using Cronbach alpha for internal consistency reliability. The Cronbach alphas ranged .62 to .76 in the pilot (n = 32) and .69 to .84 in the study (n = 102). The minimal acceptable internal-consistency reliability coefficient was based upon .7 for a newly designed instrument (Burns & Grove, 1997). Construct validity for all instruments except the Knowledge of Asthma Instrument (criterion-referenced instrument in multiple choice format), was established using exploratory factor analysis (Tabachnick & Fidell, 2001). Items below the accepted eigenvalue of .3 were dropped after the pilot study and items above the .3 value were retained, unchanged and utilized in the sample of 102 patients. Instruments were not retested in this study. The following describes each instrument in detail.

Attitude Toward Asthma Instrument (ATAI). The ATAI, measuring attitude toward the illness of asthma, was designed based on suggestions by Wigal, Stout, Brandon, Winder, McConnaughy, Creer, and Kotses (1993), researchers working on instrument development and testing with the concepts of attitudes and self-efficacy focusing on adults diagnosed with asthma. Specifically, suggestions from those researchers that were addressed in the design of the ATAI included constructing the instrument on a 5-point Likert scale format, and focusing on aspects of patient attitude toward managing asthma from day to day. Items included in the ATAI are topics regarding the patient, healthcare provider relationship, attitudes toward taking asthma medications and following the asthma care regimen. The ATAI contains 11 items in a 5-point Likert scale format (1 = strongly disagree; 5 = strongly agree) measuring attitude toward asthma meaning the participant's disposition to respond favorably or unfavorably to adhering to the performance and following of a regimen (inhalers, environmental precautions, etc.), institution, or event (disease of asthma) (Ajzen, 1988). Patient scores on the ATAI were obtained by summing the responses. The minimum possible score on the ATAI is 11, and the maximum possible score is 55. The internal consistency reliability of the ATAI was α = .70 in this study.

Health Belief Instrument for Adults Diagnosed with Asthma (HBIA). The HBIA, measuring health beliefs, is based on a review of the literature (Bennett, Milgrom, Champion, & Huster, 1997) and the clinical asthma care experience of the investigator. The HBIA contains 14 items in a Likert scale (1 = strongly disagree; 5 = strongly agree) format measuring perceptions about the severity, susceptibility, threat, and seriousness of asthma, as well as the benefits of and barriers to performing prescribed asthma treatment regimens (Becker et al. 1974). Scores on the HBIA were obtained by summing the patient responses. The minimum possible score on the HBIA is 14, and αthe maximum possible score is 70. The internal consistency reliability was = .77 in this study.

Asthma Behavioral Intention Instrument (ABII). The ABII, measuring how likely or unlikely an individual is to perform behaviors related to prescribed asthma and allergy treatment regimens, was designed from recommendations by Fishbein and Ajzen (1975) and Ajzen (1988). Specifically, suggestions from those researchers that were addressed in the design of the instrument were constructing the scale using a 7-point semantic differential format using the anchor terms of 1 = "unlikely" to 7 = "likely." The ABII contains six items using a 7 - point semantic differential scale format with anchor terms "likely" and "unlikely." Scores on the ABII were obtained by summing the patient responses. The minimum possible score on the ABII is 6, and the maximum possible score is 42. The internal consistency reliability was found to be α = .84.

Asthma Adherence Instrument (AAI). The AAI, measuring adherence, is based on literature related to adherence with asthma treatment regimens (Ajzen, 1991; Tettersell, 1993). The AAI contains four items constructed on a 4-point Likert scale format (1 = hardly ever; 4 = all of the time) and measures how often a person performs a specific component of the prescribed asthma regimen. Scores on the AAI were obtained by summing the patient responses. The minimum possible score on the AAI is 4, and the maximum possible score is 16. The internal consistency reliability result for the AAI was $\alpha = .69$.

Knowledge of Asthma Instrument (KAI). The KAI, a criterion referenced, multiple choice format test, was constructed to measure mastery of knowledge about asthma. The KAI is a 7- item, 7-point multiple-choice exam that tests numerous facets of asthma knowledge, including knowledge of the disease of asthma and concepts related to routine self-management of asthma. The KAI, developed by the investigator, is based on data included in the National Institutes of Health Guidelines for the Diagnosis and Management of Asthma (1997, 2002), current literature (Theodorakis, 2000), and the clinical asthma care experience of the investigator. Scores on the KAI were obtained by summing the patient responses. The minimum possible score on the AAI is 0, and the maximum possible score is 7. Analysis of test-retest reliability of KAI in future investigations is needed to establish evidence of reliability

Demographic Sheet

A demographic data sheet consisting of 11 items was included on the front the asthma questionnaire. Demographic data collected included gender, age, highest level of completed education, marital status, residential location, yearly income level, occupation, health insurance status, length of time diagnosed with asthma, age at diagnosis with asthma, and number of family members also diagnosed with asthma.

Procedure

Following university Institutional Review Board and study site approval, and a manual chart review by the researcher, all patients in the practice, who met the study inclusion criteria, received a mailed letter explaining the study, including contact information for questions regarding the study process, a cover letter, a questionnaire, and a stamped, addressed return envelope. Participants were instructed not to include any self-identifying information when returning the questionnaire. Study data were completely anonymous because questionnaires were not coded in any manner to link with patient identifiers. Return of the questionnaire implied consent. Dillman's (1978) Total Design Method was used to collect the data by mail. Consistent with the Dillman method and with the anonymous nature of this study, a postcard was sent out to each potential participant as a reminder one week after the initial mailing. Three weeks after the initial questionnaires were mailed out, a follow-up letter and replacement questionnaire were sent to each participant as a reminder. Data collection was stopped one week after this mailing, as specified by Dillman's Total Design Method.

Analysis

Bivariate correlation was used to analyze the relationships among all the variables to be examined as predictors of adherence to the recommended asthma treatment regimen. Simple and stepwise regression analysis was also calculated.

RESULTS

Descriptive Statistics of Sample

A total of 102 of the 250 patients sent the questionnaire participated in the study, a 41% response rate. The age range of the sample was 19 to 80 years, with an average age of 44 years. Twenty-five percent of the sample was male and 75% female, 100% were Caucasian and 93% of the sample reported having either public or private health insurance. Participants reported being diagnosed with asthma an average of 16.2 years, with the mean age of 16.8 years at diagnosis. The average number of other family members diagnosed with asthma was one person. For additional demographic data, see Table 1.

Table 1
Demographic Data by Category, Number and Valid Percent (N = 102)

Category	Number	Valid Percent
Gender		
Male	22	25.0%
Female	80	75.0%
Marital Status		
Single	14	14.7%
Married	70	68.6%
Separated/Divorced	14	13.7%
Widowed	3	2.9%
Income		
Up to $5,000	1	1.1%
$5,001-$10,000	11	10.5%
$10,001-$20,000	12	13.0%
$20,001-$30,000	20	21.7%
$30,001-$40,000	24	26.1%
$40,001 and above	24	26.1%
Education		
Junior High School	2	2.0%
High School	46	45.1%
Technical School	10	9.5%
College	32	30.5%
Graduate School	12	11.4%

Descriptive Statistics of Theoretical Variables

Measures of central tendency, variability, and skewness were obtained for the total scores on each instrument measuring the theoretical variables examined and are summarized in Table 2. Findings revealed a range of scores on the instruments. Scores on the Knowledge of Asthma Instrument (KAI), Attitude Toward Asthma Instrument (ATAI), Asthma Behavioral Intention Instrument (ABII), and the Asthma Adherence Instrument (AAI) were statistically skewed to the left, meaning that overall, participants had acquired knowledge about the disease of asthma, attitudes toward asthma were positive, and patients intended to follow-through with the recommended asthma treatment regimen. The mean range of scores answered by participants on the KAI were from 4 to 7 points, which suggests that participants had a high number of correct test items related to asthma knowledge. Mean scores on the ATAI ranged from 33 to 55, and on the ABII, the mean range of scores was 6 to 42. The scores on the ATAI and the ABII indicated an overall positive attitude toward asthma and intention to adhere to the recommended asthma treatment regimen. Participants reported a high adherence rate with the recommended asthma treatment regimen on the AAI, meaning that participants were adhering to the recommended asthma treatment regimen. The scores on the Health Beliefs Instrument for Adults Diagnosed with Asthma (HBIA) were approximately normally distributed. Participants' mean scores on the HBIA ranged from 44 to 70, indicating neutral results in regard to health beliefs, and no extremely skewed scores
.

Table 2

Range, Mean, Standard Deviation (SD), Median, Mode, and Skewness for Study Instruments (N = 102)

Instrument/ Score Range	Actual Score	*M*/*SD*	*Mdn*	Mode	Skewness
KAI (0 – 7)	4-7	6.42/.75	7	7	-1.16
ATAI (11-55)	33-50	44.35/3.97	45	46	-.613
HBIA (44 – 70)	44-70	57.10/5.42	57	61	.029
ABII (6 – 42)	6-12	35.58/6.53	37	42	-2.19

Note. Instruments in this table are represented by the following abbreviations: KAI = Knowledge of Asthma Instrument, ATAI = Attitude Toward Asthma Instrument, HBIA = Health Beliefs Instrument for Adults Diagnosed with Asthma, ABII = Asthma Behavioral Intention Instrument, AAI = Asthma Adherence Instrument

Research Question 1: Is there a significant relationship between the demographic variables of age, gender, education level, yearly income, age at diagnosis of asthma, number of family members with asthma, and adherence with prescribed asthma treatment regimens in rural Appalachian adults with asthma?

Two demographic variables, age and length of time diagnosed with asthma, were found to have a significant relationship with adherence behaviors representing adherence with prescribed asthma treatment regimens in this sample of rural adult with asthma. Age

was found to be moderately related to adherence behaviors (r = .344, p = .01). The older the patient, the more likely the patient was to be adherent to an asthma treatment regimen. A weak relationship was found between the length of time diagnosed with asthma and adherence behaviors (r = .209, p = .05). The longer the patient had been diagnosed with asthma, the more likely the patient was to be adherent with recommended asthma treatment regimens. None of the other demographic variables were significantly related to adherence behaviors with prescribed asthma treatment regimens.

Research Question 2: Does the combination of knowledge of asthma, health beliefs, attitude toward the illness of asthma, and behavioral intention to comply predict adherence behaviors with prescribed asthma treatment regimens in rural Appalachian adults better than any single variable alone?

Relationships found between the study variables are presented in Table 3. Weak to moderate correlations were found among several of the variables, with the strongest relationship identified between health beliefs and attitude toward the illness of asthma (r = .586, p = .01). Simple linear multivariate regression analysis revealed that three of the variables significantly contributed to the predictive value of adherence behaviors with prescribed asthma treatment regimens. Health beliefs accounted for 16.7 % (p = .01) of the variance in adherence behaviors, with attitude toward the illness of asthma explaining 15.6 % (p = .01), and behavioral intention to comply explaining 12.6 % (p = .01) of the variance. Knowledge of asthma was not a significant contributing variable to the variance in asthma adherence behaviors.

Table 3
Intercorrelations Between Study Variables

Variable	1	2	3	4	5
1. Knowledge	---	.134	.202*	.041	.073
2. Health Beliefs		---	.586**	.305**	.409**
3. Attitude			---	.467**	.394**
4. Behavioral Intention				---	.354**
5. Adherence					---

*p = .05. **p = .01

When evaluating the relative contribution of the candidate predictors to adherence with recommended asthma treatment regimens using stepwise linear multivariate regression analysis, the best model explained 32.3% (R2 = .323, p < .0001, F = 20.033) of the variance in adherence and consisted of two variables: health beliefs (R2 = .167, p < .0001, F = 19.238) and attitude toward asthma (R2 = .156, p < .0001, F = 18.431) (Table 4). Thus, regression analysis showed that the combination of health beliefs and attitude toward asthma better predicted adherence behaviors with prescribed asthma treatment regimens among this sample of rural Appalachian adults diagnosed with asthma better than any one variable alone.

Table 4

Summary of Simple and Stepwise Regression Analysis for Variables Predicting Adherence Behaviors in Rural Appalachian Adults with Asthma (N = 102)

Variables	R^2	F Test	β
Simple Regression			
Knowledge	.000	.036	-.019
Attitude	. 156	18.431**	.394
Health Beliefs	.167	19.238**	.409
Behav. Int.	.126	14.356**	.354
Stepwise Regression			
Health Beliefs	.167	19.238**	.409
Attitude	.156	18.431**	.409
Health Beliefs and Attitude	.323	20.033**	.584

p < .0001**

DESCRIPTION AND IMPLICATIONS FOR PRACTICE

The findings that both health beliefs and attitude toward asthma were predictors of adherence with asthma treatment regimen provide the first empirical evidence from research of these theorized relationships in adults with asthma. These findings also suggest that the model for investigation be modified to reflect non-sequential, non-linear relationships prior to future investigations as suggested in by the relationships in Table 3. Also, the demonstrated relationships between adherence, age, and length of time since diagnosis suggest that patient characteristics be added to the model of investigation for future investigations because, in a larger sample, these variables may be predictors of adherence.

The correlation between age and adherence was consistent with several studies looking at adults with asthma and adherence with and knowledge of asthma medications. Older patients tended to be more adherent to prescribed asthma medications and younger patients tended to be less adherent (Abdulwadud, Abramson, Forbes, James, Light, Thien, & Walters, 1997; Tettersell, 1993). This suggests that future programs designed to assist rural adult asthma patients with adherence behaviors related to prescribed asthma treatment regimens may need to have certain aspects of the program geared toward the specific needs of younger adults. Certainly, additional research is needed to examine age issues related to adherence behaviors in rural adults with asthma.

Health beliefs as a predictor of adherence with asthma treatment regimen is consistent with other findings in the literature examining adherence behaviors in other chronic illnesses (Bennett et al., 1997; Chesney, 2003; Holland et al. 2001; Lo, 1998). Nursing practice with the rural adult asthma patient must take into account the deeply grounded health beliefs held by individuals. This supports the team approach, collaborating with the patient in order to bring about the best outcomes in asthma care. By having an awareness of the patient's health beliefs, the nurse may be able to work with the patient to improve the overall success of long-term asthma treatment outcomes instead of imposing a situation, which, the patient feels has no value or benefit. These

results stress the need for congruence and consistency between the nurse and the adult with asthma. The nurse also needs to help the patient gain access to health care in a way that the patient feels is realistic and obtainable, in addition to being consistent with their perceived abilities.

Patient attitude toward the illness of asthma as a significant predictor of adherence behavior with the asthma treatment regimen also is consistent with research findings in other chronic illnesses and health conditions (Jennings, 1997; Jennings-Dozier, 1999; Poss, 2002). A careful baseline nursing evaluation of the rural adult asthma patient's attitude toward having asthma is needed prior to establishing a mutual care planning session with the patient. This will assist the nurse to have a unique perspective about the patient's perception of asthma, and facilitate an individualized approach with each patient, thus increasing the likelihood of a successful patient care asthma outcome.

Behavioral intention as a predictor of adherence with the asthma treatment regimen suggests that patients need to internalize the value of treatment regimens as beneficial. Nurses may stress the importance of adhering to specific treatment regimens; however, if the value of that regimen is not supported and internalized by the patient, it is likely that adherence will not occur. Again, the nurse needs to engage in a collaborative, team approach with the patient in an effort to stress the value and benefit of the treatment to the patient, thus potentially improving outcomes.

This study contributes to the literature of adherence behaviors related to prescribed and recommended asthma treatment regimens in rural adults with asthma, specifically focusing on rural Appalachia. Research related to asthma and adherence behaviors in rural adults with asthma is sparse, thus, this descriptive study was conducted to contribute to an understanding of rural populations of adults diagnosed with asthma. The study pinpoints variables that were significantly related to adherence behaviors including knowledge, health beliefs, attitude, and behavioral intention to comply with the recommended asthma treatment regimen.

Three of the four theoretical variables (attitude, health beliefs, and behavioral intention) and two patient characteristics (age and length of time diagnosed with asthma) were related to adherence behaviors. However, of those five variables, health beliefs and attitude toward asthma together were the strongest significant predictors of adherence behaviors with the recommended asthma treatment regimen. Although no comparable studies focusing on adults with asthma exist with which to compare these findings, they do provide support for some of the theorized relationships in the model investigated. Knowledge of asthma was not a significant correlate or predictor of adherence behaviors with this group of rural Appalachian adults with asthma, even though other studies in the literature suggest that knowledge is a significant predictor of adherence behaviors with varying groups of people diagnosed with other chronic illnesses (Boulet, 1998).

The findings suggest that the variables examined (knowledge, health beliefs, attitude, behavioral intention, and adherence behaviors) are not related in a linear, "domino effect" fashion as hypothesized. Adherence behaviors and factors that predict whether or not a person will be adherent are multifaceted. Human behavior does not follow a straight line, and must be viewed in a holistic manner, keeping in mind that the whole is greater than the sum of the parts. Adherence behavior is complex and is influenced by many factors in a person's life. Use of path analysis in future studies would reveal the direct and indirect effects of these variables on adherence.

Overall results of this study indicated that health beliefs and attitude toward asthma demonstrated significant predictive influence over adherence behaviors with prescribed asthma treatment regimens. Therefore, an in-depth understanding of factors influencing adherence behaviors is essential for nurses to employ the best strategies to improve asthma outcomes. This understanding will help practicing nurses have a better idea of the rural adult's personal experiences of living with and coping day to day with the chronic disease of asthma. These results have clinical implications for practicing nurses and researchers and provide a launching platform from which to proceed with further study. When nurses work with asthma patients, they need to work with the patient using a collaborative approach to "connect" and listen to the message the patient is sending and assist the patient to deal with possibly overwhelming feelings related to the self-management of asthma, in addition to respecting individual health beliefs and integrating those beliefs into the plan of care. The nurse needs to assess patients' health beliefs, attitude, and behavioral intentions to adhere in relation to chronic illness, in this case asthma. Care and treatment of rural adults with asthma must focus on the person, not simply the "nuts and bolts" of asthma care.

The nurse must function as an active listener, supporter, and mutual planner with the patient through a partnership that facilitates the achievement of the greatest degree of positive asthma care outcomes. Adult asthma patients need to be assisted to internalize the degree of their susceptibility to the detrimental effects of the disease of asthma and the benefits of adhering to the asthma treatment regimen into their belief system. It is premature to suggest specific nursing interventions on precisely how this can be achieved. However, based on the results of this study, future investigation with a larger sample that is more characteristic of the population in rural Appalachia is needed to better inform future nursing interventions to assist rural adults with asthma.

Strengths and Limitations

The strength of this study is that it is the first to address adherence issues among rural adults with asthma using a combination of the Health Belief Model and the Theory of Planned Behavior. The findings of this study support the utilization of the model and theory together to explain some of the variance in adherence behaviors. The study had good internal validity. The instruments used to measure concepts had content and construct validity and internal consistency reliability. The study also presents several new instruments measuring health beliefs, attitude, behavioral intention, and adherence behaviors among rural adults with asthma, for consideration and further development and testing. Preliminary and limited psychometric testing has been performed on the newly developed instruments in this study. Testing with a larger sample size of adults with asthma needs to be considered in order to strengthen the validity of these instruments.

The limitation of the study pertains to external validity or generalizability, because the sample was not representative of the rural Appalachian population with asthma due to the nature of the convenience sample recruited from the asthma clinic. First, 70% of those who were eligible for participation in the study were women, while US Census Bureau (2001) statistics indicate that about 51.4 % of the rural Appalachian population are female. Second, the demographic data indicated that subjects were well-educated and earned relatively high incomes (52.2 % earned $30,000 and above annually).

These demographic data indicate the study sample is not typical of the population residing in the rural, geographical area in which this study was conducted.

Finally, an uncontrollable confounding event may have influenced participant response and profile, contributing to the lower response rate than usually achieved with the Dillman Method (Dillman, 1978) and to the sample not being representative of the rural Appalachian population with asthma. The Dillman Total Design Method is a recommended method to increase mailed survey returns. Questionnaires and cover letters were mailed to qualified patients. In one week, a postcard was sent out to each patient as a reminder including the topic of the study, and signed by the primary investigator. Three weeks after the initial mailing of the questionnaires, a follow-up letter and replacement questionnaire was sent to each patient as a reminder. Questionnaires were initially mailed on Monday, September 10, 2001, one day prior to a national crisis in the United States, the terrorist attacks at the World Trade Center in New York City, and the Pentagon in Washington, D. C. The fourth hijacked plane crashed within the rural area in which the study was being conducted. The problem with anthrax contamination in the US postal system occurred during the time for follow-up mailings for this study. The effect of these events on the return rate of questionnaires by mail and on study results is unknown.

Future Research

The results of the study are a beginning foundation of support for the future design of exploratory studies and resulting interventional programs that nurses may use in their practice to serve rural adult asthma patients by helping to decrease morbidity and mortality rates related to asthma.

Future study should focus on a replication of this study with a larger sample of rural Appalachian adults, which is more representative of the known rural adult Appalachian population mix. Additional research recommendations, based on the results of this study, include the design and implementation of interventional studies using a larger sample size to establish the best methods for delivering asthma education and treatment programs for rural adults with asthma. In addition, further confirmatory psychometric testing, expansion, and evaluation should be performed on the instruments designed for this research study. Little research has focused on the rural adult diagnosed with asthma and adherence behaviors with prescribed asthma treatment regimens indicating that this topic is in need of further examination and development.

CONCLUSIONS

The findings of this study are applicable to the clinical research setting. Preliminary results suggest that nurses who work with rural adults with asthma should be aware of specific variables, especially health beliefs, attitude, and behavioral intention to adhere to recommended asthma treatment regimens in order to deliver better and more effective nursing care to this population. Since this is the first study investigating these relationships specific to adults with asthma living in a rural setting, additional research is needed to confirm these findings. Additional psychometric testing must be performed on the instruments. Nurses must take into consideration the experiences and attitudes of rural adults with asthma to improve outcomes for these patients.

AUTHOR NOTE

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APPENDIX

Example of Selected Items from Instruments Comprising the Asthma Questionnaire

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Knowledge of Asthma Instrument (KAI) (multiple choice format)
What happens to a person's lungs during an asthma episode?
a.   swelling and inflammation
b.   muscles tighten
c.   mucus increases
d.   all of the above
What are the classic symptoms of asthma?
a.   coughing and/or shortness of breath
b.   loss of hair and/or acne
c.   wheezing and/or tightness in the chest
d.   a and c
Which of the following factors may trigger an asthma attack?
a.   history of a rib fracture
b.   tobacco smoke
c.   leg cramps
d.   an ingrown toenail

Attitude Toward Asthma Instrument (ATAI) (5-point Likert scale format)
Taking my asthma medication is important to me.
I want to work in partnership with my healthcare provider in taking care of my asthma.
Learning as much as I can about my asthma is important to me.
My asthma is not problem to me as long as I feel alright.
Health Belief Instrument for Adults Diagnosed with Asthma (HBIA) (5-point Likert scale format)
I believe I will always need my asthma medications.
I would have to change too many habits to follow taking my medications as prescribed by the doctor.
My asthma would be worse if I did nothing about it.
I believe my asthma medications will control my asthma.
I believe I can control my asthma.
Asthma Behavioral Intention Instrument (ABII) (7-point semantic differential format)

I will take my asthma medications daily as prescribed.
I will make an effort to avoid items in the environment that I know I am allergic to.
I will keep my next follow-up appointment with the allergist.
Asthma Adherence Instrument (AAI) (4-point Likert scale format)
How often over the past 3 months did you take the asthma medications prescribed by the doctor?
How much of the time during the last 3 months did you follow the environmental precautions for items you are allergic to as recommended by the doctor?
How much of the time during the past 12 months have you kept your follow-up appointment with the allergist?

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Note. Table includes a sample of items chosen from each instrument developed and utilized for this study.