

# An experiment using hypothetical patient scenarios in healthy subjects to evaluate the treatment satisfaction and medication adherence intention relationship

Suzan N. Kucukarslan PhD,\* Kristin S. Lee PharmD,† Tejal D. Patel PharmD† and Beejal Ruparelia PharmD†

\*Assistant Professor and †Student, College of Pharmacy, University of Michigan, Ann Arbor, MI, USA

## Abstract

### Correspondence

Suzan Kucukarslan, PhD  
Medication Safety Officer  
37931 Rhonswood Dr.  
Northville, MI 48167  
USA  
E-mail: Suzan.Kucukarslan@McLaren.org

### Accepted for publication

3 June 2013

**Keywords:** asthma, experimental design, illness perception, medication beliefs, treatment satisfaction

**Background** Treatment beliefs and illness consequence have been shown to impact medication adherence in patients with years of asthma experience. These relationships are unknown in patients with early experience.

**Objective** The purpose was to test the relationship between illness consequence, treatment beliefs, treatment satisfaction and medication adherence intentions in healthy subjects exposed to an asthma scenario.

**Methods** A 2×2×2 factorial design experiment was conducted in 91 healthy University student subjects. Each student was randomized to receive one scenario with varying levels of illness consequence (high/low), treatment concerns (high/low) and treatment necessity (high/low). After reading the scenarios the students responded to questions about treatment satisfaction and likelihood of using the medication as directed by the physician. A multiple regression model was used to test the impact of factors on treatment satisfaction and medication adherence at the 0.05 level of significance.

**Results** Treatment satisfaction was significantly predicted by treatment necessity with a moderating effect by illness consequence. Medication adherence intentions were significantly predicted by treatment satisfaction.

**Conclusion** Patients with early diagnosis of asthma are likely to form treatment satisfaction as a result of illness consequence and treatment necessity. Patients' perceptions of illness consequence are likely to influence (moderate) the impact of treatment necessity on treatment satisfaction; and their intentions to take medication as directed are likely to be influenced by treatment satisfaction rather than treatment beliefs or illness consequence early in the patient illness experience. These results are from an experiment that should be tested in a patient population.

Medication adherence can be defined as the degree to which patients take their medications as prescribed by their health-care providers. Poor medication adherence is a major barrier to positive treatment outcomes for patients, the result of which is roughly \$100 billion spent per year on preventable hospitalizations.<sup>1</sup> Adherence to medications for chronic diseases is especially inadequate – as many as 50% of patients will choose to discontinue their medications within 6 months of beginning treatment.

Asthma is a chronic disease that affects more than 22 million people in the United States. Because asthma cannot be cured, the purpose of treatment is to control symptoms and the disease.<sup>2</sup> Chronic asthma patients are commonly prescribed a long-term, preventive inhaled corticosteroid along with a rescue inhaler.<sup>3</sup> The adherence rate, commonly reported from 30 to 70%, is a major barrier to disease control.<sup>4</sup> It is therefore the patient's responsibility to take medication as prescribed to improve the health outcomes.

According to Leventhal's common sense model (CSM), the patient's decision to adhere to medication is impacted by illness perceptions. Illness perceptions are formed by (i) illness identity (perceived association of symptoms with illness), (ii) illness consequence (anticipated outcomes of illness), (iii) perceived control, (iv) cause (factors attributed to illness), and (v) timeline (chronicity of illness). Illness perceptions make up the cognitive-based assessment of illness and have a role in coping behaviour<sup>5</sup> and specifically in medication adherence.<sup>6</sup>

The CSM also states that patients will assess their decision (i.e. medication adherence) and revise their illness perceptions.<sup>7</sup> The Treatment Satisfaction Questionnaire for Medication (TSQM) was developed to evaluate patient experience with medication. The TSQM is based on the Decisional Balance Model that represents patient-valuation of treatment effectiveness with experiences of side effects and the inconvenience of using the medication. The resulting patient satisfaction with medication

has been shown to predict medication adherence.<sup>8</sup>

In addition to illness perceptions and patient satisfaction, patients' belief about medications can impact their decisions to take medication.<sup>9</sup> Patients' beliefs about treatment necessity and treatment concern are proposed to impact medication adherence decisions. Concerns about the negative effects of treatment such as adverse effects are weighed against the necessity of taking medication to improve a health condition. Patients alter their coping behaviours based on what is seen as the most crucial threat. For example, people with overarching treatment concerns regarding overuse or addiction to their medication are more likely to choose alternatives to medication.<sup>7</sup>

Patients with asthma are prescribed medication to prevent difficulty breathing. Yet many choose to not take their medication as prescribed. Horne and Weinman (2002)<sup>10</sup> found treatment concerns reduce medication adherence, whereas treatment necessity can increase it. Although illness consequence was hypothesized to enhance medication adherence, the opposite was found. Jessop and Rutter (2003) found external cause, cure/control and being certain of having asthma as predictors of medication adherence.<sup>11</sup> Both of these studies were conducted in patients with an average 20 years of asthma experience. Theoretically, patient experiences with illness and with treatment can impact illness perceptions and subsequent behaviours. This study was an experiment in healthy subjects (no illness experience) in which patient scenarios were created to elicit illness perceptions and treatment satisfaction; and then to evaluate the relationship of treatment satisfaction with medication adherence intentions.

The role of illness consequence, treatment necessity and treatment concern was tested in the medication adherence intention model, similar to the Horne and Weinman study.

## Methods

To evaluate the inter-relationships of illness consequence, treatment beliefs, treatment satisfaction

and medications adherence, an experiment in healthy adults was employed. An experimental study (2×2×2 factorial design) was conducted to assess the effects of three factors – treatment concerns, treatment necessity and illness consequences on treatment satisfaction and medication adherence intentions. Using an experimental design provides a way to eliminate the effects of prior patient experiences with the health condition. The scenario was based on a hypothetical student, named Chris. Each scenario had the following information:

1. Chris is a 22 year-old college student. He recently visited his family doctor because he has been experiencing fatigue and persistent coughing that has been disruptive and quite embarrassing while at school.
2. After reviewing his symptoms, his doctor diagnosed him with asthma. He prescribed a steroid inhaler, a safe and standard treatment for asthma. The doctor instructed Chris to use the inhaler once a day, every day, to control asthma symptoms (such as cough and difficult breathing).
3. Chris has purchased the inhaler and started using it. He has prescription drug insurance so cost is not an issue.

The next three components of the scenario was modified to elicit a weak or strong illness consequence, treatment concern and treatment necessity.

1. Before using the inhaler, he thought his asthma was very serious (+)/not serious (–). He started using the inhaler as he was instructed by the doctor for 1 month.
2. The inhaler improved Chris's breathing. He believes his inhaler is very necessary(+)/not necessary(–) for controlling his asthma and improving his breathing in the future.
3. But Chris still had questions about his medication. After reading the medication information sheet. Chris is very concerned(+)/not concerned (–) about possible side effects and long-term effects of his inhaler.
4. He is now trying to decide how he feels about his inhaler and if he should continue using it.

**Table 1** Study scenarios created for 2×2×2 factorial design study

Scenario	Illness consequence	Treatment necessity	Treatment concern
1	+	+	+
2	–	+	+
3	+	+	–
4	+	–	+
5	+	–	–
6	–	+	–
7	–	–	+
8	–	–	–

+: Wording to elicit strong effect; –: Wording to elicit weak effect.

Subjects were selected to test the impact of illness consequences, treatment concern and treatment necessity on treatment satisfaction and medication adherence intentions. Each subject received one of the eight study scenarios (Table 1).

The study population consisted of undergraduate and graduate students 18 years or older at one large public University. Participants were excluded from the study if they had been diagnosed with chronic asthma or had an immediate family member with chronic asthma. Participants were further excluded if they were health professional students in the medical, pharmacy, nursing and dental fields to minimize bias. Students in the medical professions are knowledgeable about illness diagnosis and treatment, differentiating them from the subject population. This project was reviewed and approved by the University IRB.

#### Study measures

The survey questions were based on the Beliefs about Medicines Questionnaire,<sup>12</sup> the Illness Perception Questions (Revised),<sup>13</sup> Treatment Satisfaction Questionnaire for Medication<sup>8</sup> and Medication Adherence Review (MAR).<sup>10</sup> Table 2 lists the study questions with the Cronbach's alpha statistics from the current study. One item from illness consequence, treatment concern and medication adherence were deleted to improve the Cronbach's alpha. The subjects responded to these statements using a 5-point

**Table 2** Study measures and survey questions

Study measure	Survey questions	Cronbach's alpha
Illness consequence	Chris's asthma is a serious condition.	0.690
	Chris's asthma has major consequences on his life.	
	Chris's asthma does not have much effect on his life.(Reversed)	
	Chris's asthma strongly affects the way others see him.	
	Chris's asthma causes him to have serious financial consequences.	
Treatment necessity	Chris's asthma causes difficulties for those who are close to him.*	0.727
	Chris's life would be impossible without his inhaler.	
	Without his inhaler, Chris would be very ill.	
	Chris's health, at present, depends on his inhaler.	
Treatment concern	Chris's health in future will depend on his inhaler.	0.793
	Chris sometimes worries about the long-term effects of his inhaler.	
	Having to take his inhaler worries Chris.	
Treatment satisfaction	Chris sometimes worries about becoming too dependent on the inhaler	0.834
	Chris's inhaler disrupts his life.*	
	How satisfied or dissatisfied is Chris with the ability of inhaler to control his asthma?	
	How satisfied or dissatisfied is Chris with the way the inhaler relieves his symptoms?	
	How satisfied is Chris that the good things (e.g. control of asthma symptoms) outweigh the bad things (e.g. side effects, having to use it daily) about the asthma inhaler?	
Medication adherence intention	Taking all things into account, how satisfied or dissatisfied is Chris with his asthma inhaler?	0.789
	What is the likelihood that Chris would continue to take his inhaler as prescribed by his doctor?	
	What is the likelihood that Chris would continue to take his inhaler, but less often than prescribed by his doctor? (Reversed)	
	What is the likelihood that Chris would continue to take his inhaler, but more often than prescribed by his doctor?*	
	What is the likelihood that Chris would stop taking his inhaler? (Reversed)	

\*Item deleted to improve Cronbach's alpha.

Likert scale. A summative score was calculated for each study measure.

Age, gender, race and quality of life were also surveyed.

#### Data collection

University student organization listserves available to the public were used to recruit subjects for the study. Study information was emailed. Interested students replied to the study investigator (SK). Subjects were emailed a link to the informed consent page and survey. The survey was administered by Qualtrics. Participants were mailed a \$10 payment for completing the survey.

Before implementing the main study with the eight scenarios, the modified survey questions

were evaluated for validity and reliability. The survey methodology was pre-tested using the same University student pool. These students were not part of the main study.

#### Data analysis plan

First, the experimental scenarios were evaluated to determine whether the desired effects occur. Analysis of Variance (ANOVA) was used to compare subjects in groups with high (+) vs. low effect (–) had the expected higher or lower study measure score. For example, if subjects were in the scenario with high illness consequence, a significantly higher illness consequence measure would validate the experiment. Effect size was also used to compare the mean scores for subjects in the low manipulation vs.

high manipulation scores. Effect size is the difference in mean scores divided by the standard deviation of the low manipulation group.<sup>14</sup>

Second, multiple regression analysis was used to test the treatment satisfaction model with illness consequence, treatment concern and treatment necessity as the independent variables. The three factor model was evaluated using the following multiple regression equation:

$$Y = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_1X_2 + B_5X_2X_3 + B_6X_1X_3 + B_7X_1X_2X_3 + e$$

Where  $Y$  is treatment satisfaction;  $X_1$  is illness consequence,  $X_2$  is treatment benefits and  $X_3$  is treatment concerns;  $X_1X_2$  is the interaction effect of  $X_1$  and  $X_2$ ;  $X_2X_3$  is the interaction effect of  $X_2$  and  $X_3$ ,  $X_1X_3$  is the interaction effect of  $X_1$  and  $X_3$ , and  $X_1X_2X_3$  is the interaction effect of  $X_1$ ,  $X_2$  and  $X_3$ .

Medication adherence intention was regressed with treatment satisfaction. Finally, medication adherence was regressed with illness consequence, treatment necessity and treatment concern to replicate the analysis of Horne and Weinman (2002). All statistical analyses were conducted at the 0.05 level of significance. SPSS version 20.0 (IBM, Armonk, NY, USA) was the statistical software used for the analyses.

A sample size of 90 participants was sufficient to conduct the multiple regression model described in the data analysis section. There were nine total parameters that were predicted in the regression model. Using the rule of thumb that 5–10 observations to estimate one parameter in the regression model, a total 90 observations were required.<sup>15</sup>

## Results

There were 91 subjects completing the study. The mean age was  $23.3 \pm 3.9$  years and approximately 75% were female. Subject demographics are detailed in Table 3. Only age correlated significantly with one of the study measures: treatment satisfaction; however, age was not a significant independent variable in the regression analysis.

**Table 3** Subject demographic information ( $n = 91$ )

Age (mean, standard deviation)	23.3 ( $\pm 3.9$ ) years
Gender	
Female	68 (74.7%)
Race/ethnicity	
White/Caucasian	61 (67%)
African American	13 (14%)
Hispanic	5 (5.5%)
Asian	9 (9.9%)
Other	3 (3.3%)
Quality of life	
Excellent	24 (26.4%)
Very good	46 (50.5%)
Good	28 (19.8%)
Fair	2 (2.2%)
Poor	1 (1.1%)

## Evaluation of experiment

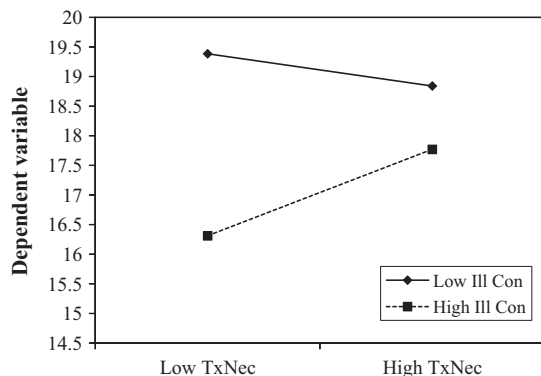
Illness consequence, treatment concern, treatment necessity were the experimental factors in the study. The scenario manipulations did have a significant impact on subjects' treatment concern. Subjects assigned to scenarios with a high treatment concern manipulation groups scored higher ( $11.74 \pm 1.74$ ) than those in the lower treatment concern manipulation groups ( $7.23 \pm 2.82$ ). The illness consequence manipulation did not result in a statistically significant difference in illness consequence scores; and the effect size was a small to moderate. There was no impact on treatment necessity. (See Table 4).

The treatment satisfaction regression model with interactions terms was significant with a 0.21 adjusted  $R^2$ . The independent variables treatment necessity, illness consequence were significant at 0.05 level of significance and treatment concern approaching significance at 0.06. The interaction term treatment necessity-illness consequence was also significant. Figure 1 illustrates the interaction term and the following interpretation is provided: Illness consequence serves as a moderator with its effect on treatment necessity. When illness consequence is weak (low), there is a negative association between treatment necessity and treatment satisfaction. When illness consequence is strong (high), the relationship is positive. (Table 5)

**Table 4** Comparison of high vs. low effects of experimental factors, mean and standard deviations reported ( $n = 91$ )

	Low	High	Significance*	Effect size <sup>†</sup>
Illness consequence	15.85 ( $\pm 3.46$ )	16.89 ( $\pm 2.72$ )	0.12	0.30
Treatment necessity	11.31 ( $\pm 3.04$ )	11.17 ( $\pm 2.63$ )	0.82	0.05
Treatment concern	7.23 ( $\pm 2.82$ )	11.74 ( $\pm 1.74$ )	0.00	1.60

\*Analysis of variance.

<sup>†</sup> $(\text{Mean}_{\text{high}} - \text{Mean}_{\text{low}}) / \text{Standard deviation}_{\text{low}}$ .**Figure 1** Interaction effect with treatment necessity as independent variable and illness consequence as moderating variable (dependent variable = treatment satisfaction).**Table 5** Regression analysis of treatment satisfaction ( $n = 91$ )

	Unstandardized beta	Standard error	Significance
Treatment concern	-0.837	0.450	0.066
Illness consequence	-0.969	0.309	0.002
Treatment necessity	-0.850	0.349	0.017
Treatment necessity-illness consequence (interaction)	0.057	0.027	0.035
Constant	33	5.1	0.000

Adjusted  $R^2 = 0.21$ .

The medication adherence intention regression analysis was significant (adjusted  $R^2 = 0.22$ ) predicted by treatment satisfaction (standardized beta = 0.47, significance = 0.00). The multiple regression model with medication adherence intentions as the dependent variable and independent variables illness consequence, treatment necessity, treatment concern and the interaction terms was not significant.

## Discussion

This experiment is the first of its kind where subjects with no illness experience were exposed to illness scenarios to test theoretical relationships. The methodology allows one to test the theoretical relationships controlling for the influence of prior illness experiences. The subjects responded to questions as they felt Chris, the hypothetical student with asthma, would respond. Each scenario included an element of illness consequence, treatment necessity and treatment concern plus a description of the medication response. The manipulation checks demonstrated that the experiment did elicit an effect for treatment concern, a small to moderate effect on illness consequence and no significant effect on treatment necessity. However, the regression analysis provided interesting results.

First, the impact of treatment necessity on treatment satisfaction is influenced by illness consequence. Patients who believe that there are no significant consequences resulting from their asthma and who feel their treatment is necessary are less likely to be satisfied with their asthma treatment. Conflicting sentiments arising from illness consequence and treatment necessity are likely to contribute to treatment dissatisfaction. On the other hand, patients believing there are consequences associated with their asthma and their treatment is necessary are more likely to be satisfied with their treatment. Ignoring patients' perceived illness consequences while counselling them on the necessity of taking their medication may result in unexpected sentiments and thus potentially poor medication adherence.

Treatment concern was a weaker independent variable in the treatment satisfaction



model, but it should not be ignored. Horne and Weinman (2002) found treatment concern to be an important predictor of medication adherence for patients with asthma.<sup>10</sup>

Treatment satisfaction was a significant predictor of medication adherence intentions. An increased treatment satisfaction (satisfaction with how the medication helped the patient with the illness) increases the likelihood of intending to take medication as prescribed. Treatment beliefs and illness consequences did not have a direct effect on medication adherence intentions.

Horne and Weinman (2002)<sup>10</sup> found treatment concerns reduces medication adherence while treatment necessity increases the likelihood of medication adherence. Jessop and Rutter (2003) found medication adherence increases with a strong illness identity, perceived cure or control of the condition and can decrease if there is an external cause attributed to asthma (i.e. pollution).<sup>11</sup> The results from the current study suggest medication adherence intention for patients with a recent diagnosis, specifically asthma, is likely impacted by treatment satisfaction. The role of treatment satisfaction in medication adherence for patients with no illness experience may be explained by cognitive appraisal theory. Emotions can result from cognitive appraisal, specifically outcome desirability.<sup>16</sup> Outcome desirability involves the cognitive appraisal of the decision and whether the outcome is good or bad with respect to personal well being. This process is evaluative and has a motivational component. In the current study, subjects with low illness consequence and high treatment necessity are likely to have lower treatment satisfaction; potentially resulting from a cognitive appraisal of their condition.

### Limitations

A limitation of this study is its generalizability to the patient population. Healthy subjects were recruited at a University to study the relationships between illness consequence and treatment beliefs. Recruiting subjects with no asthma

illness experience allowed for testing the relationships among variables by minimizing the influence of patient history. Also, the experiment simplifies the presentation of asthma. Patients experience concurrent factors – symptoms, physical limitations, medical costs and so on. However, simplifying the asthma case to evaluate the impact of specific factors on treatment satisfaction and medication adherence intentions should lend to future research to evaluate interventions to improve medication adherence. A second limitation is the focus on asthma. Other disease conditions with different characteristics such as chronicity, symptoms and mortality rate may result in different models of medication adherence.

Future studies should replicate the experimental design, using other health conditions such as diabetes or hypertension to understand the mechanics of medication adherence behaviour in patients with early diagnosis. Also, behavioural interventions can be designed using what is learned from these studies. The impact of these interventions on patient outcomes should be measured to further validate these theoretical models and ultimately help improve patient care.

### Conclusions

Patients with early diagnosis of asthma are likely to form treatment satisfaction as a result of illness consequence and treatment necessity. Patients' perceptions of illness consequence are likely to influence (moderate) the impact of treatment necessity on treatment satisfaction, and their intentions to take medication as directed is likely to be influenced by treatment satisfaction rather than treatment beliefs or illness consequence early in the patient illness experience. These results are from an experiment that should be tested in a patient population.

### References

- Osterberg L, Blaschke T. Drug therapy: adherence to medication. *The New England Journal of Medicine*, 2005; **353**: 487–497.

- 2 National Heart, Lung, and Blood Institute. At-A-Glance: Asthma. Available at: [http://www.nhlbi.nih.gov/health/public/lung/asthma/asthma\\_atglance.pdf](http://www.nhlbi.nih.gov/health/public/lung/asthma/asthma_atglance.pdf), accessed 12 November, 2012.
- 3 Mayo Clinic. Asthma: Basics. Available at: <http://www.mayoclinic.com/health/asthma/DS00021>, accessed 2 August 2011.
- 4 Rand CS, Wise RA. Measuring adherence to asthma medication regimens. *American Journal of Respiratory and Critical Care Medicine*, 1994; **149**: S69–S76.
- 5 Hagger MS, Orbell S. A meta-analytic review of the common-sense model of illness representation. *Psychology and Health*, 2003; **18**: 141–184.
- 6 Kucukarslan SN. A review of published studies of patients' illness perceptions and medication adherence: lessons learned and future directions. *Research in Social and Administrative Pharmacy*, 2012; **8**: 371–382.
- 7 Leventhal H, Leventhal EA, Contrada RJ. Self-regulation, health, and behavior: a perceptual-cognitive approach. *Psychology and Health*, 1998; **13**: 717–733.
- 8 Atkinson MJ, Kumar R, Cappelleri JC, Hass SL. Hierarchical construct validity of the treatment satisfaction questionnaire for medication (TSQM version II) among outpatient pharmacy consumers. *Value in Health*, 2005; **8**: S9–S24.
- 9 Horne R. Representations of medication and treatment: advances in theory and measurement. In: Petrie KJ, Weinman JA (eds) *Perceptions of Health and Illness*. Amsterdam: Harwood Academic Publishers, 1997: 155–188.
- 10 Horne R, Weinman J. Self-regulation and self-management in asthma: exploring the role of illness perceptions and treatment beliefs in explaining non-adherence to preventer medication. *Psychology and Health*, 2002; **17**: 17–32.
- 11 Jessop DC, Rutter DR. Adherence to asthma medication: the role of illness representations. *Psychology and Health*, 2003; **18**: 585–612.
- 12 Horne R, Weinman J, Hankins M. The Beliefs about Medicines Questionnaire (BMQ): the development and evaluation of a new method for assessing the cognitive representation of medication. *Psychology and Health*, 1999; **14**: 1–24.
- 13 Moss-Morris R, Weinman J, Petrie KJ, Horne R, Cameron LD, Buick D. The Revised Illness Perception Questionnaire (IPQ-R). *Psychology and Health*, 2002; **17**: 1–16.
- 14 Kazis LE, Anderson JJ, Meenan RF. Effect sizes for interpreting changes in health status. *Medical Care*, 1989; **27**: s178–s189.
- 15 Hair JF, Anderson RE, Tatham RL, Black WC. *Multivariate Data Analysis*, 5th edn. Uppersaddle River, NJ: Prentice Hall, 1998: 166.
- 16 Watson L, Spence MT. Causes and consequences of emotions on consumer behavior: a review of integrative cognitive appraisal theory. *European Journal of Marketing*, 2007; **41**: 487–511.