Willingness to Pay for Sensory Attributes of Intranasal Corticosteroids Among Patients With Allergic Rhinitis

PARTHIV MAHADEVIA, MD, MPH; SHAILEN SHAH, MD; SALLY MANNIX, BA; JESSICA BREWSTER-JORDAN, BA; LEAH KLEINMAN, DrPH; CHRISTOPHER LEIBMAN, PharmD, MS; and LIZA O'DOWD, MD

ABSTRACT

OBJECTIVE: Sensory attributes of intranasal corticosteroids (INSs) differ by product based on chemical composition. We previously reported that patients are able to demonstrate preferences for certain INS sensory attributes, which may affect their willingness to adhere to therapy. As part of the same study, we also sought to determine if these same patients are willing to pay for products not containing certain sensory attributes.

METHODS: We conducted a 2-part cross-sectional study of 120 patients with allergic rhinitis at 4 allergy and immunology clinics in the United States in November and December 2003. In the first part of the study, the patients chose between pairs of hypothetical INS products that differed in the intensity of 6 sensory attributes (smell, taste, aftertaste, throat rundown, nose runout, and feel of spray in nose/throat; results were reported in the *Annals of Allergy, Asthma & Immunology* [2004;93:345-50]). In the second part of the study, reported here, discrete choice experiment methodology was used in which the patients chose among hypothetical INS products that differed in the intensity of the 6 sensory attributes and monthly copayments of $15, $30, and $50. Each sensory attribute was characterized by 3 intensity levels, e.g., no aftertaste (mild intensity), weak aftertaste (moderate intensity), or strong aftertaste (severe intensity). The strength of preferences, shown as marginal willingness to pay to avoid certain sensory attributes, was measured in U.S. dollars per month. We also evaluated the effect of annual household income on willingness to pay.

RESULTS: Demographic results indicated that 86.7% of participants had prior experience with at least 2 INS products. Seven patients (5.8%) were excluded from the willingness-to-pay analysis due to inconsistent responses to the logic checks used to confirm patient engagement in the study instrument. On average, the 113 remaining patients were willing to pay $11 (95% confidence interval [CI], $9-$13) per month in 2003 dollars to get an INS with no smell instead of strong smell, $12 (95% CI, $10-$14) for no taste instead of strong taste, $20 (95% CI, $18-$22) for no aftertaste instead of strong aftertaste, $10 (95% CI, $9-$12) for no throat rundown instead of a lot of throat rundown, $11 (95% CI, $9-$13) for no nose runout instead of a lot of nose runout, and $6 (95% CI, $4-$8) for a spray with a wet feel instead of a dry feel. Comparing moderate intensity levels of each sensory attribute with the mildest, only 3 attributes had statistically significant willingness to pay: aftertaste, throat rundown, and nose runout. Patients with a higher income were willing to pay more to avoid a lot of throat rundown and nose runout than those with a low income (P <0.01), but this relationship did not hold for the other sensory attributes.

CONCLUSION: Patients demonstrated significant willingness to pay to avoid certain sensory attributes of INSs. Sensory attributes of INS products appear to be potentially important considerations when evaluating alternative INS products for drug therapy selection or formulary placement.

KEYWORDS: Patient preferences, Allergic rhinitis, Intranasal corticosteroids, Willingness to pay

J Manag Care Pharm. 2006;12(2):143-51

Note: An editorial on the subject of this article appears on pages 168-72 of this issue.

Intranasal corticosteroids (INSs) are a mainstay in the clinical management of allergic rhinitis.[1] Consensus guidelines and reviews agree that of the 6 INSs on the U.S. market, none has shown advantages in efficacy or differences in safety profile.[1-6] However, INSs have unique formulations, chemical composition, and delivery devices that produce a variety of sensory perceptions.[7] Some sensory perceptions, such as aftertaste, can be unpleasant, leading to decreased preference toward a product and reductions in willingness to adhere to treatment.[7,8] Therefore, selection of an INS based on patient preferences of sensory attributes may increase satisfaction and treatment adherence.

INSs commonly used to treat allergic rhinitis include budesonide aqueous nasal spray (Rhinocort Aqua), flunisolide (generic and Nasarel), beclamethasone dipropionate (Beconase AQ), fluticasone propionate nasal spray (Flonase), mometasone furoate nasal spray (Nasonex), and triamcinolone acetonide nasal spray (Nasacort AQ). Prior head-to-head studies of sensory attributes conducted with these INSs have shown that patients can discern sensory attribute differences among INSs and formulate clear preferences. An article by Shah et al.[9] reported the results of 2 randomized controlled trials in which a greater proportion of patients reported satisfaction with the sensory profile of budesonide aqueous nasal spray than fluticasone propionate nasal spray. The sensory attributes included in these studies were smell, taste, aftertaste, feel of spray in nose/throat,

Authors

PARTHIV MAHADEVIA, MD, MPH, is associate director, global health economics, Amgen, Inc., Washington, DC (at the time of this study, he was a research scientist, MEDTAP Institute, Bethesda, Maryland); SHAILEN SHAH, MD, is an allergist, Allergy and Asthma Consultants of NJ-PA, Collegeville, Pennsylvania; SALLY MANNIX, BA, is an associate project manager, JESSICA BREWSTER-JORDAN, BA, is an associate project manager, and LEAH KLEINMAN, DrPH, is a senior research scientist, United BioSource Corporation, Bethesda, Maryland; CHRISTOPHER LEIBMAN, PharmD, MS, is director, pharmacoeconomics, Elan Pharmaceuticals, San Diego, California (at the time of this study, he was director, health economics and outcomes research, AstraZeneca LP, Wilmington, Delaware); LIZA O'DOWD, MD, is senior director, clinical research, AstraZeneca LP, Wilmington, Delaware.

AUTHOR CORRESPONDENCE: Parthiv Mahadevia, MD, MPH, Associate Director, Global Health Economics, Amgen, Inc., 555 13th St. NW, Suite 600 West, Washington, DC 20004. Tel: (202) 585-9500; Fax: (202) 585-9729; E-mail: parthivm@amgen.com

TABLE 1 Study Inclusion/Exclusion Criteria

Inclusion criteria	• Confirmed diagnosis of allergic rhinitis (seasonal or perennial) for at least 1 year made by a medical professional • Use of intranasal corticosteroids in last month based on medical records or patient self-report • Age ≥18 years • Ability to understand the survey as judged by the site investigator • Ability to complete evaluation exercise and protocol requirements • Willingness and ability to participate and provide written informed consent
Exclusion criteria	• Self-reported smell or taste disturbance judged by site investigator to be clinically important • Established medical history of severe chronic sinusitis and nasal polyposis as judged by site investigator • Presence of active, acute upper respiratory infection • Presence of acute illness*, cognitive or other impairment (e.g., visual) that in the opinion of the site investigator would interfere with study requirements

** Acute illness was defined as an illness that would impact the patient's participation. Patients stated that they felt ill; conditions included febrile illness, exacerbation of allergic rhinitis or sinusitis, or a generalized illness.*

and amount of spray running out of nose or running down throat. Attributes were assessed using the Sensory Perceptions Questionnaire,[10] which has 23 items, 7 of which solicit patient preferences. In analyses that included all responding patients, 54.4% of patients in the first study preferred budesonide and 37.8% preferred fluticasone (P <0.022). In the second study, 47.4% preferred budesonide and 41.1% preferred fluticasone (difference was not significant).

In a randomized, double-blind, crossover trial, Bachert and El-Akkad[7] reported that patients preferred the odor of triamcinolone acetonide aqueous nasal spray and judged it to be less strong compared with fluticasone propionate or mometasone furoate nasal sprays, and the taste of triamcinolone acetonide aqueous nasal spray was preferred to mometasone furoate. Patient preferences were rated on a 14-item nasal spray evaluation questionnaire, which evaluates the acceptability of the drug and associated sensory perceptions immediately (10 items) and 2 minutes after (4 items) drug administration, using a 100-point rating scale. Both Bachert and El-Akkad[7] and Shah et al.[9] assessed patients' perceptions of and preferences for certain INS sensory attributes, but they did not assess the strength of patient preferences in terms of their willingness to pay for an INS with the sensory attributes they prefer or would like to avoid.

Reissman et al.[11] conducted a cost-efficiency study to determine the relative prescribed dosages of 4 INSs and compare economic differences resulting from these prescribing behaviors. In their study, using data from the IMS National Disease and Therapeutic Index for calendar year 2002, Reissman et al. found differences in the average number of sprays prescribed daily and, therefore, differences in the average cost per prescribed day of therapy among budesonide, fluticasone, mometasone, and triamcinolone nasal sprays.

Keith et al.[12] conducted a cost-benefit study with patients receiving either intranasal budesonide by Turbuhaler or aqueous spray. In this study, patients completed a willingness-to-pay questionnaire to measure treatment benefits; however, adaptive preferences were not assessed. Costs were then compared with the willingness-to-pay data as part of the treatment benefit analysis. Results of this study indicated there was no difference in cost, willingness to pay, or cost-benefit when comparing delivery modes. Additionally, it was suggested that willingness-to-pay questionnaires may be a useful method to assess a therapy's benefit. These previous cost studies, however, did not incorporate patient preferences for INS sensory attributes.

The aim of the current study was to integrate 2 important concepts: patient preferences for INS sensory attributes and treatment cost. We assessed allergic rhinitis patients' preferences for various sensory attributes and willingness to pay for products with certain sensory attributes as well as the potential impact of their preferences on self-reported willingness to adhere to prescribed allergic rhinitis therapy. We have reported, in a previous publication, the results of each attribute's relative importance and patients' willingness to adhere to prescribed therapy.[8] Here, we quantify the strength of patient preference for INS sensory attributes in a monetary amount defined as the patients' willingness to pay using discrete choice experiment methodology, a form of conjoint analysis, which accommodates the integration of preference and cost. This information may inform both physician prescribing and formulary decision making. Because allergic rhinitis is a common disorder[13,14] that is associated with decreased quality of life[15] and lower worker productivity,[16] understanding strength of preferences may lead to a more informed selection of INS therapy, which, in turn, may improve patient satisfaction, adherence to therapy, and possibly lower economic burden.

Methods

Study Design and Participants

We conducted a two-part cross-sectional study of 120 patients with allergic rhinitis in 4 allergy and immunology clinics across the United States (n = 30 at each site in Georgia, Pennsylvania, Texas, and Utah) in November and December 2003. Participant inclusion/exclusion criteria are listed in Table 1. Investigators at the 4 allergy clinics were instructed to recruit patients through medical chart review or other relevant patient databases. The Essex Institutional Review Board (Lebanon, NJ) approved the study. This is the second part of a 2-part cross-sectional study of these 120 patients. In the first part of the study, the patients

chose between pairs of hypothetical INS products that differed in the intensity of 6 sensory attributes (smell, taste, aftertaste, throat rundown, nose runout, and feel of spray in nose/throat; results were reported in the *Annals of Allergy, Asthma & Immunology* [2004;93:345-50]).[8] In the second part of the study, reported here, discrete choice experiment methodology was used in which the patients chose among hypothetical INS products that differed in the intensity of the 6 sensory attributes and monthly copayments of $15, $30, and $50.

Discrete Choice Experiment Survey

Patients were administered an interactive computerized survey that elicited preferences using a discrete choice method, a form of conjoint analysis.[17-20] Conjoint analysis methods elicit preferences by showing respondents various hypothetical treatment options or health states that differ in terms of their core attributes and estimate strength of preference based on choice selection.

We described the 6 sensory attributes in detail to patients: smell, taste, aftertaste, amount of spray running down throat (throat rundown), amount of spray running out of nose (nose runout), and feel of spray in nose/throat. These 6 sensory attributes were selected based on focus groups and cognitive debriefing studies that have shown them to comprehensively capture salient sensory perceptions of INSs.[10] Questionnaires using these attributes, such as the Sensory Perception Questionnaire, have shown good preliminary construct and content validity, and they have been used successfully in clinical trials of INSs.[9,10] By including different amounts of money as an attribute in a conjoint analysis study design, estimates of willingness to pay for changes in the levels of the attributes of importance can be derived.[21] Therefore, a seventh attribute, monthly copayment amount, was added to determine how much patients would trade-off sensory attributes for a monthly cost burden. In our study, all attributes were described in terms of 3 mutually exclusive intensity levels: mild, moderate, and severe (Table 2). The levels described the varying quality of the attribute.

In the discrete choice section of the survey, participants were shown questions that consisted of 3 sets of hypothetical products. Each hypothetical product included 1 level from each attribute and a monthly copayment amount (see Table 3 for an example question). The participant was asked to choose between the hypothetical products by indicating which product profile was preferable and the strength of their preference. Because all possible combinations of attribute levels cannot feasibly be shown to each respondent, the computer program randomly generated 8 choice sets for each participant from a design matrix that was sampled to ensure an orthogonal and balanced study design.[22,23] Patients were reminded that each hypothetical product had the same efficacy and adverse event profile, information consistent with that stated in allergic rhinitis consensus guidelines and reviews.[1-6] (The site coordinators were instructed to tell each participant prior to the start of the survey: "Please assume that the products [intranasal steroid sprays] you are asked about all work the same and have the same side effects. The only differences between the products are the ones asked about in the survey.") Patients were also reminded to consider the long-term impact of costs when considering the monthly copayment amounts presented in each question.

The survey concluded with demographic (age, gender, income) and clinical questions that included frequency of INS use, number of prior INS medications used, and coexisting comorbidities.

TABLE 2 Sensory Attributes and Corresponding Intensity Levels

Attribute	Intensity Level		
	Mild	Moderate	Severe
Smell	No smell	Weak smell	Strong smell
Taste	No taste	Weak taste	Strong taste
Aftertaste	No aftertaste	Weak aftertaste	Strong aftertaste
Throat rundown	No spray dripping down throat	Some spray dripping down throat	A lot of spray dripping down throat
Nose runout	No spray running out of nose	Some spray running out of nose	A lot of spray running out of nose
Feel of spray in nose/throat	Moist	Neither moist nor dry	Dry
Monthly copayment*	$15	$30	$50

This table was modified and reprinted with permission: Mahadevia PJ, Shah S, Leibman C, et al. Patient preferences for sensory attributes of intranasal corticosteroids and willingness to adhere to prescribed therapy for allergic rhinitis: a conjoint analysis. Ann Allergy Asthma Immunol. 2004;93(4):345-50.[8]

** Attribute not reported previously.*

Pilot Study

Before initiating the full study, a 5-patient pilot study was conducted to determine if the survey was easy to understand and feasible. Results of the pilot study indicated that patients were able to understand the survey and found it easy to complete. There was no evidence of respondent fatigue.

Logic Check

To determine whether respondents were logically considering each choice set, we showed them 2 identical fixed choice sets that contained hypothetical products containing all mild, all moderate, or all severe levels of each attribute. Logically, respondents would be expected to select the "superior" choice set, in this case, the set with all attributes set at their mildest level and the lowest copayment. Respondents who did not choose the hypothetical INS with all mild attributes and the lowest copayment amount were assumed to be making inconsistent choices and were excluded from the analysis.

TABLE 3 Example of a Choice Set

If these were your *only options*, please indicate which 1 of these 3 products you would buy.

Product 1	Product 2	Product 3
Spray has **strong smell**	Spray has **no smell**	Spray has **weak smell**
Spray has **strong taste**	Spray has **no taste**	Spray has **weak taste**
Spray has **strong aftertaste**	Spray has **no aftertaste**	Spray has **weak aftertaste**
No spray dripping down back of throat	**Some spray** dripping down back of throat	**A lot of spray** dripping down back of throat
No spray running out of nose	**Some spray** running out of nose	**A lot of spray** running out of nose
Spray feels **moist**	Spray feels **dry**	Spray feels **neither moist nor dry**
$15 per prescription	**$50** per prescription	**$30** per prescription
❑	❑	❑

Please think how these costs affect you over *the entire time of treatment*.

TABLE 4 Demographic and Clinical Characteristics of Study Patients*

Demographic	Finding
Mean age (SD) in years	39.4 (11.4)
Male sex (%)	35.8
White race (%)	85.8
Patients with asthma (%)	28.3
Mean duration of allergic rhinitis (SD) in years	17.0 (12.9)
Frequency of INS use (%)	
Regularly	47.5
Only sometimes	51.7
Other	0.8
No. of INS products used previously (%)	
1	11.7
2	28.3
3	23.3
>3	35.0
Other†	0.8
Approximate annual household income (%)	
<$40,000	21.7
$40,000-$80,000	50.0
>$80,000	26.7
Missing	1.7

This table was modified and reprinted with permission from reference 8.

** Demographics are reported for the entire study sample (N=120). Seven patients were excluded after enrollment because of inconsistent responses identified during the logic checks; therefore, 113 patients were included in the analysis.*

† 1 patient responded "other."

INS = intranasal corticosteroid.

Outcomes and Statistical Analyses

Study outcomes were marginal willingness to pay for moderate or severe intensity levels compared with mild intensity levels of each attribute, share of preference (frequency that products containing a particular level of an attribute were chosen over the number of times that level was shown), and the effect of income on product selection. Using multinomial logistic regression, we estimated the marginal effect sizes of all levels and effect size per monthly dollar spent. Dividing the marginal effect size of a level with the marginal effect of a dollar change in copay (obtained in the univariate analyses), we estimated the marginal willingness to pay for each level of each attribute. Because income level can affect willingness to pay, we examined preferences for sensory attributes stratified by annual household income category. All statistical analyses were conducted using Sawtooth Software (Sequim, WA). Ninety-five percent confidence intervals that did not include 0 were considered to be statistically significant. If a level was statistically significant based on logistic regression, we rejected the null hypothesis that that level was equal to the lowest attribute level.

Results

Of 120 patients who met the study criteria, approximately two thirds were women, the mean age was 39 years, and the majority were white (Table 4). A little fewer than half reported using INS products regularly (patients were required to choose either "regularly," "only sometimes," or "other"; the definition of these terms was left to each patient's interpretation) and more than half had experience with 3 or more INS products. We excluded 7 patients from the analysis due to inconsistent responses to the aforementioned logic checks, leaving 113 patients for analysis. These patients provided responses to 904 choice sets and selected from 2,712 hypothetical INS products.

Previous publication of results from this study reported the patient preferences for the 6 attributes.[8] These results showed that the most important attribute in selecting a product was aftertaste (in 28% of patients), taste (in 19%), throat rundown (in 18%), nose runout (in 12%), smell (in 11%), and feel of spray (in 7%). Results from the current willingness-to-pay analysis depict the strength of preference for product attributes through monetary units. Based on the univariate analyses, the marginal effect sizes of copayment or cost was -0.06 utility score per dollar. For every $1 increase in price, there was a downward utility trend in preference. Table 5 shows the

TABLE 5 *Patients' Marginal Monthly Willingness to Pay* to Avoid Certain INS Sensory Attributes*

Attributes and Their Intensity Levels	Marginal Effect (95% CI†)	Patients' Marginal Willingness to Pay to Avoid Certain INS Sensory Attributes (95% CI†)
Smell (reference: no smell)		
Weak smell	-0.04 (-0.15, 0.08)	$0.60 (-$1.27, $2.47)
Strong smell	-0.66 (-0.77, -0.55)	$10.93 ($9.06, $12.80)
Taste (reference: no taste)		
Weak taste	0.04 (-0.07, 0.16)	-$0.73 (-$2.62, $1.16)
Strong taste	-0.74 (-0.85, -0.63)	$12.22 ($10.33, $14.11)
Aftertaste (reference: no aftertaste)		
Weak aftertaste	-0.13 (-0.24, -0.01)	$2.08 ($0.21, $3.95)
Strong aftertaste	-1.20 (-1.31, -1.08)	$19.79 ($17.92, $21.66)
Throat rundown (reference: no rundown)		
Some rundown	-0.22 (-0.33, -0.11)	$3.63 ($1.76, $5.50)
A lot of rundown	-0.63 (-0.75, -0.52)	$10.48 ($8.60, $12.35)
Nose runout (reference: no runout)		
Some runout	-0.14 (-0.25, -0.03)	$2.32 ($0.44, $4.19)
A lot of runout	-0.67 (-0.78, -0.55)	$10.99 ($9.12, $12.87)
Feel of spray in nose/throat (reference: moist)		
Neither moist nor dry	-0.08 (-0.19, 0.03)	$1.31 (-$0.56, $3.18)
Dry	-0.36 (-0.47, -0.24)	$5.92 ($4.05, $7.79)
Cost (per dollar)	-0.06 (-0.06, -0.06)	–

** As calculated by univariate analysis, the marginal effect size of copayment or cost was -0.06 utility score per dollar, i.e., for every $1 increase in price, there was a downward utility profile in preference. The willingness to pay was obtained by dividing the marginal effect size per attribute level with the marginal effect of cost per dollar.*

† 95% CIs (confidence intervals) that did not include 0 were considered to be statistically significant.

INS = intranasal corticosteroid.

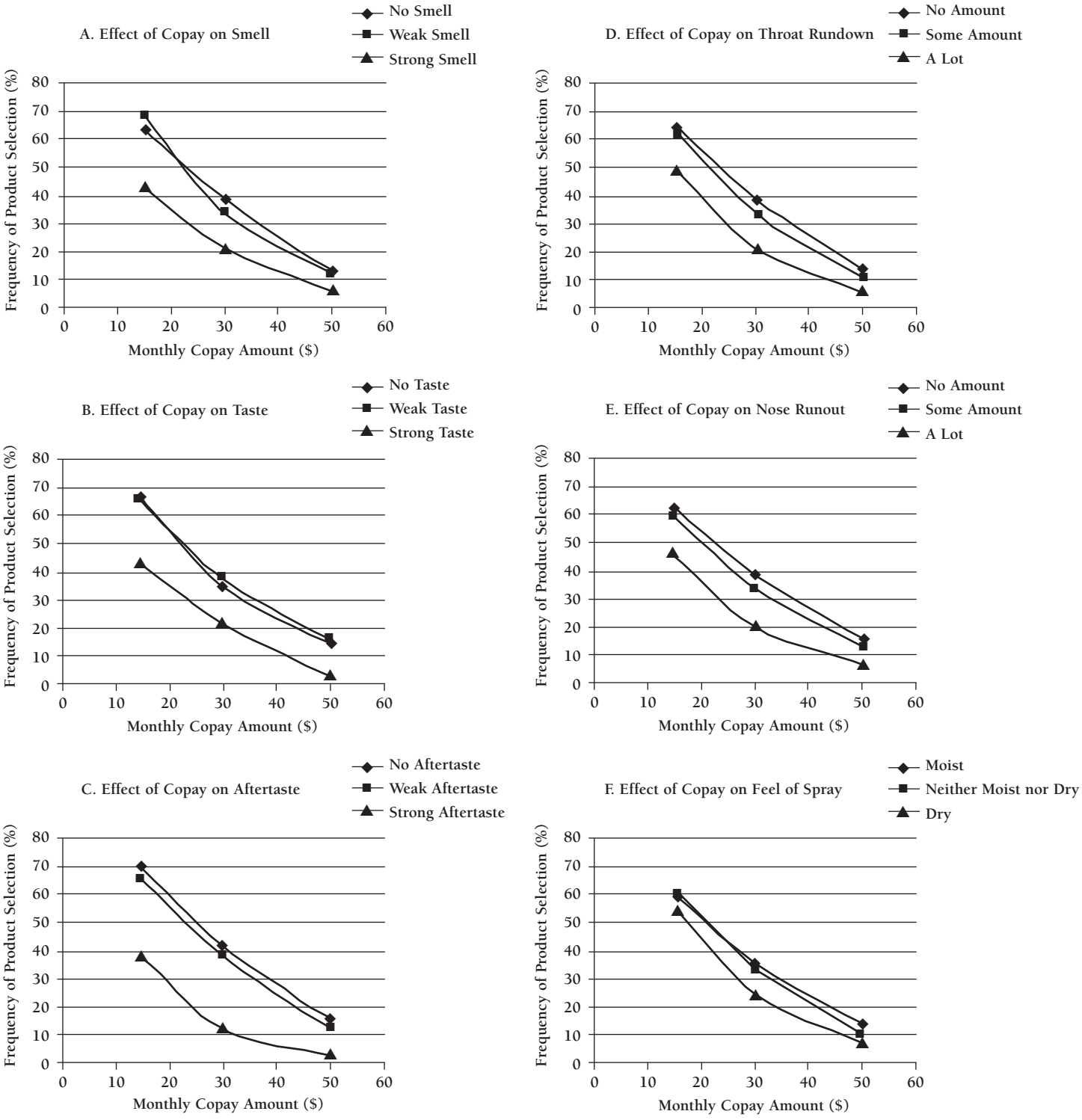
marginal willingness to pay to avoid certain sensory attributes of INS products. Comparing the severest intensity level of each sensory attribute with the mildest, patients were willing to pay more per month for an INS with no smell instead of strong smell, no taste instead of strong taste, no aftertaste instead of strong aftertaste, no throat rundown instead of a lot of throat rundown, no nose runout instead of a lot of nose runout, and a wet feel instead of a dry feel. Comparing the moderate intensity levels of each sensory attribute with the mildest, only aftertaste, throat rundown, and nose runout had statistically significant monthly willingness to pay (Table 5). When examined independently, preferences usually declined with increasing intensity levels of sensory attributes and with the increased amount of copayment. However, when copayment was incorporated into the model by examining patients' selection of products by differing amounts of copayment, a different pattern emerged. In this case, product selections for mild and moderate levels of individual sensory attributes at almost any level of copayment were similar (Figures 1A-F), whereas product selection for severe levels of sensory attributes at the lower levels of copayment were markedly different.

Higher annual household income level did not change the share of preference for smell, taste, aftertaste, and feel of spray. However, patients with a higher income were willing to pay more to avoid a lot of throat rundown and nose runout than those with a low income (Figures 2A-B; $P < 0.01$). Subgroup willingness-to-pay analysis of other demographic groups (frequent vs. intermittent INS users, age groups, gender, comorbid conditions) did not appreciably differ from our main findings (data not shown).

Discussion

Marginal willingness to pay depicts the strength of preference for product attributes through monetary units and has the advantage of providing easy-to-understand comparisons. Attribute levels with greater willingness to pay are more preferable than those with less willingness to pay. We found that patients with allergic rhinitis are willing to pay higher monthly copayments for products with mild intensity levels of each sensory attribute than those with higher intensity levels; that is, patients were willing to pay from $6 (spray with a wet feel) to $20 (for no aftertaste) to avoid the more severe intensity levels of a given attribute. Patients selected products with mild attribute intensity levels between 60% and 70% of the time when those products were presented. Aftertaste, throat rundown, and nose runout seemed to have higher willingness to pay to avoid both

FIGURE 1 *Impact of Monthly Copayment Amount on (A) Smell, (B) Taste, (C) Aftertaste, (D) Throat Rundown, (E) Nose Runout, and (F) Feel of Spray**



** Frequencies represent the proportion of times that a product containing that sensory attribute intensity level was chosen divided by the number of times it was shown to patients. Only 3 copay amounts were presented to patients: $15, $30, and $50.*

moderate and severe intensity levels. Smell, taste, and feel of spray had higher willingness to pay to avoid only the severe intensity level. This information may inform prescribing and formulary decisions. Based on results reported by the authors previously,[8] individual preferences for INS sensory attributes had some variation, e.g., some patients placed strong emphasis on aftertaste only, while others rated aftertaste and smell as equally important.

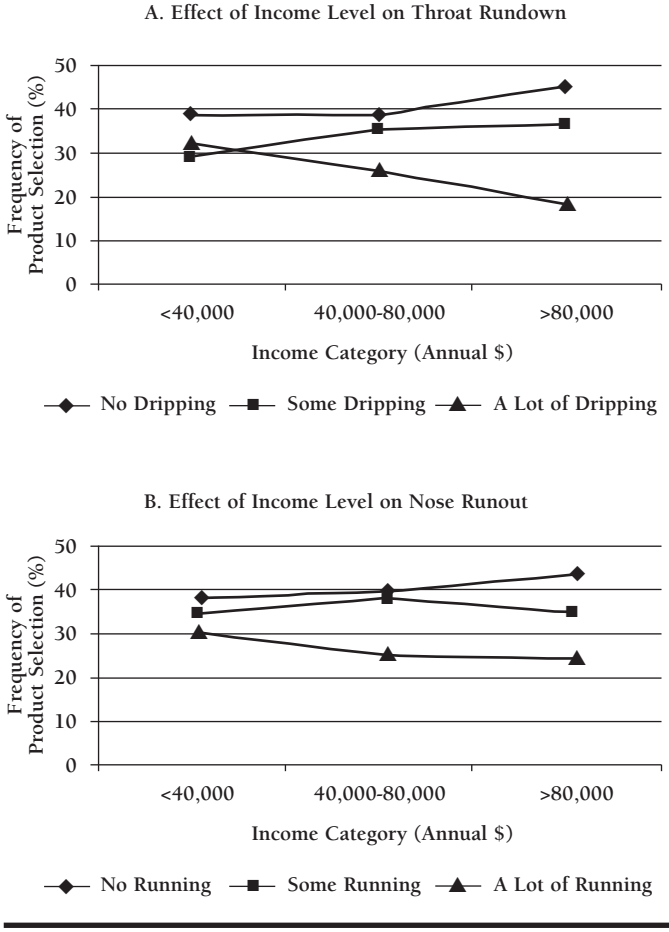
Other investigators have shown that patients perceive differences in INS sensory attributes and have preferences for certain attributes. Meltzer et al.[24] conducted a double-blind, crossover study of 100 patients with symptomatic allergic rhinitis randomized to receive mometasone furoate nasal spray (MFNS) 200 mcg followed by fluticasone propionate nasal spray (FPNS) 200 mcg, or vice versa, after which they rated the drugs using a sensory attribute questionnaire. The investigators reported that fewer patients perceived scent, immediate taste, and aftertaste with MFNS compared with FPNS; in addition, more than half of the patients expressed a preference for MFNS and stated that they would be likely to comply with this treatment (i.e., use it daily as directed).

Kaliner conducted 2 telephone surveys—1 with 100 family practitioners, general practitioners, and internists[25] and 1 with 503 patients with seasonal and perennial allergic rhinitis[26]—and found that 95% of physicians thought that their patients would prefer an INS with no aftertaste and no smell.[25] However, the author noted that 47% to 60% of patients reported that their physicians had not asked them about their satisfaction with the sensory attributes of the INS they were using,[26] and only 7% of physicians mentioned that they chose an INS because of patient preferences.[25] In addition, 86% of patients reported that they had not complained to their physician about a sensory attribute of their INS treatment.[26] These study results suggest that improved physician-patient communication about sensory attributes could improve selection of INSs. However, a description of sensory attributes is not part of current product labeling.

In the present study, monthly copayment amounts reduce product attribute preference and attenuate the differences between intensity levels. However, even at the highest monthly copayment of $50, patients had a higher share of preference for product attributes with milder intensity levels, suggesting that sensory attributes are important in patient decision making. We also found that income level affects willingness to pay, but this was not a consistent finding. Patients with incomes >$80,000 per year were willing to pay more to avoid excess throat rundown than those with incomes <$40,000 per year.

Choosing INS products that better fit patients' INS sensory attribute preferences may increase adherence.[8] In his telephone survey of 503 patients with seasonal and perennial allergic rhinitis, Kaliner noted that 45% of patients stated that sensory attributes do influence how often they use INSs.[26]

FIGURE 2 Effect of Income Level on Patients' Willingness to Pay to Avoid Products With Different Intensities of (A) Throat Rundown and (B) Nose Runout



Limitations

Foremost among the limitations of this study is its small sample size, involving only 113 patients distributed among 4 states. The population was also largely white and middle class, which limits the ability to generalize the results without further replication in more diverse samples.

Second, we did not identify, analyze, or report whether the study patients had seasonal or perennial rhinitis, and severity of symptoms has been found to be much higher among patients with perennial allergic rhinitis who are more likely to take an oral antihistamine than are patients with seasonal allergic rhinitis.[26]

Third, patients may not indicate consistent preferences if they have little experience with INS products. We sought to address this limitation by enrolling patients with allergic rhinitis

who had been diagnosed at least 1 year before and had used an INS within the last month. Our sample had been diagnosed with allergic rhinitis for a mean duration of 17.2 years with 86.7% of the patients having experience with 2 or more INS products.

Fourth, marginal willingness to pay may not necessarily predict real-life purchasing decisions.

Fifth, our analysis was limited to INS products and did not consider oral antihistamines and other therapeutic options in the treatment of allergic rhinitis.

Our study findings on patients' willingness to pay might be added to the information already available regarding barriers to informed patient decision making such as the lack of knowledge about treatment options, reluctance to discuss treatment with physicians, no inquiry by physicians about patients' preferences, or time constraints in physician schedules.[27,28] Routine patient-physician discussions could improve INS selection and should be encouraged.

Conclusion

We found that patients are willing to pay significant higher monthly copayments to avoid certain sensory attributes of INSs. Given the high prevalence of allergic rhinitis, its adverse effects on quality of life, and sizable social and economic costs, methods to promote physician-patient dialogue about sensory attributes are advisable. Personal preferences may also be important in selecting INS agents for drug formulary placement in copayment tiers. Understanding the strength of patient preferences for INS sensory attributes may lead to more informed selection of pharmacotherapy for allergic rhinitis.

ACKNOWLEDGMENT

The authors acknowledge the contributions of Jeanne McFadden, publications associate, AstraZeneca LP, Wilmington, Delaware, in the preparation of this manuscript.

DISCLOSURES

Funding for this research was provided by AstraZeneca LP, Wilmington, DE, and was obtained by author Christopher Leibman, who was an employee of AstraZeneca LP, at the time of this study; author Liza O'Dowd is currently an employee of AstraZeneca LP. The authors disclose no potential bias or conflict of interest relating to this article. Parthiv Mahadevia served as principal author of the study. Study concept and design were contributed primarily by Mahadevia, O'Dowd, and Leibman, with input from authors Shailen Shah, Sally Mannix, Jessica Brewster-Jordan, and Leah Kleinman. Data collection was the work of Mahadevia, Shah, Mannix, and Brewster-Jordan, with input from O'Dowd and Leibman; data interpretation was the work of Mahadevia and Shah, with input from the coauthors. Drafting of the manuscript and its revision was the work of Mahadevia, Kleinman, O'Dowd, and Leibman, with input from Mannix and Brewster-Jordan.

REFERENCES

1. van Cauwenberge P, Bachert C, Passalacqua G, et al. Consensus statement on the treatment of allergic rhinitis. European Academy of Allergology and Clinical Immunology. *Allergy.* 2000;55(2):116-34.

2. Corren J. Intranasal corticosteroids for allergic rhinitis: how do different agents compare? *J Allergy Clin Immunol.* 1999;104(4, pt 1):S144-S149.

3. Stern MA, Dahl R, Nielsen LP, Pedersen B, Schrewelius C. A comparison of aqueous suspensions of budesonide nasal spray (128 micrograms and 256 micrograms once daily) and fluticasone propionate nasal spray (200 micrograms once daily) in the treatment of adult patients with seasonal allergic rhinitis. *Am J Rhinol.* 1997;11(4):323-30.

4. McArthur JG. A comparison of budesonide and beclomethasone dipropionate sprays in the treatment of seasonal allergic rhinitis. *Clin Otolaryngol.* 1994;19(6):537-42.

5. Gross G, Jacobs RL, Woodworth TH, Georges GC, Lim JC. Comparative efficacy, safety, and effect on quality of life of triamcinolone acetonide and fluticasone propionate aqueous nasal sprays in patients with fall seasonal allergic rhinitis. *Ann Allergy Asthma Immunol.* 2002;89(1):56-62.

6. Dykewicz MS, Fineman S. Executive summary of Joint Task Force Practice Parameters on Diagnosis and Management of Rhinitis. *Ann Allergy Asthma Immunol.* 1998;81(5, pt 2):463-68.

7. Bachert C, El-Akkad T. Patient preferences and sensory comparisons of three intranasal corticosteroids for the treatment of allergic rhinitis. *Ann Allergy Asthma Immunol.* 2002;89(3):292-97.

8. Mahadevia PJ, Shah S, Leibman C, et al. Patient preferences for sensory attributes of intranasal corticosteroids and willingness to adhere to prescribed therapy for allergic rhinitis: a conjoint analysis. *Ann Allergy Asthma Immunol.* 2004;93(4):345-50.

9. Shah SR, Miller C, Pethick N, Uryniak T, Jones MK, O'Dowd L. Two multicenter, randomized, single-blind, single-dose, crossover studies of specific sensory attributes of budesonide aqueous nasal spray and fluticasone propionate nasal spray. *Clin Ther.* 2003;25(8):2198-2214.

10. Lennox RD, Fowler I, Gore M, Jones MK, Pethick N, O'Dowd L. Psychometric validation of a patient-reported sensory perception and preference instrument: the Sensory Perceptions Questionnaire. *Adv Ther.* 2004;21(3):162-72.

11. Reissman D, Price T, Leibman C. Cost efficiency of intranasal corticosteroid prescribing patterns in the management of allergic rhinitis. *J Manag Care Pharm.* 2004;10(1)(suppl S-a):S9-S13.

12. Keith PK, Haddon J, Birch S. A cost-benefit analysis using a willingness-to-pay questionnaire of intranasal budesonide for seasonal allergic rhinitis. Rhinocort Study Group. *Ann Allergy Asthma Immunol.* 2000;84:55-62.

13. Turkeltaub PC, Gergen PJ. Prevalence of upper and lower respiratory conditions in the US population by social and environmental factors: data from the second National Health and Nutrition Examination Survey, 1976 to 1980 (NHANES II). *Ann Allergy.* 1991;67(2, pt 1):147-54.

14. Sibbald B. Epidemiology of allergic rhinitis. *Monogr Allergy*. 1993;31:61-79.

15. Juniper EF. Measuring health-related quality of life in rhinitis. *J Allergy Clin Immunol.* 1997;99(2):S742-S749.

16. Dupclay L, Jr., Doyle J. Assessment of intranasal corticosteroid use in allergic rhinitis: benefits, costs, and patient preferences. *Am J Manag Care.* 2002;8(suppl 13):S335-S340.

17. Ryan M, Farrar S. Using conjoint analysis to elicit preferences for health care. *BMJ.* 2000;320(7248):1530-33.

18. Ryan M, Scott DA, Reeves C, et al. Eliciting public preferences for healthcare: a systematic review of techniques. *Health Technol Assess.* 2001;5(5):1-186.

19. Curry J. Understanding Conjoint Analysis in 15 Minutes. Sequim, WA: Sawtooth Software; 1996.

20. Fraenkel L, Bogardus ST, Concato J, Felson DT, Wittink DR. Patient preferences for treatment of rheumatoid arthritis. *Ann Rheum Dis.* 2004;63(11):1372-78.

21. McIntosh E, Donaldson C, Ryan M. Recent advances in the methods of cost-benefit analysis in healthcare: matching the art to the science. *Pharmacoeconomics.* 1999;15:357-67.

22. Maddala T, Phillips KA, Reed Johnson F. An experiment on simplifying conjoint analysis designs for measuring preferences. *Health Econ.* 2003;12 (12):1035-47.

23. Phillips KA, Maddala T, Johnson FR. Measuring preferences for health care interventions using conjoint analysis: an application to HIV testing. *Health Serv Res.* 2002;37(6):1681-1705.

24. Meltzer EO, Bardelas J, Goldsobel A, Kaiser H. A preference evaluation study comparing the sensory attributes of mometasone furoate and fluticasone propionate nasal sprays by patients with allergic rhinitis. *Treat Respir Med.* 2005;4(4)289-96.

25. Kaliner MA. Physician prescribing practices: the role of patient preference in the selection of nasal steroids. *Allergy Asthma Proc.* 2001;22(6 suppl 1): S17-S22.

26. Kaliner MA. Patient preferences and satisfaction with prescribed nasal steroids for allergic rhinitis. *Allergy Asthma Proc.* 2001;22(6 suppl 1):S11-S15.

27. Storms WW. Introduction: patient preference of inhaled nasal corticosteroids. *Allergy Asthma Proc.* 2001;22(6 suppl 1):S1-S3.

28. Storms WW. Consensus and conclusions: patient preference of inhaled nasal corticosteroids. *Allergy Asthma Proc.* 2001;22(6 suppl 1):S27-S28.