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Public Knowledge and Factors Associated With Familiarity of Treatments for Rhinosinusitis

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Abstract

Objective. Rhinosinusitis is a common otolaryngologic condition with many over-the-counter (OTC), prescription, and surgical treatment options. This study seeks to evaluate public familiarity with treatments for rhinosinusitis.

Study Design. Cross-sectional survey

Setting. US adult (≥18 years) online survey respondents

Methods. A cross-sectional survey was administered to US adults via ResearchMatch. Questions included a demographic questionnaire, validated nasal obstruction surveys, personal history of chronic rhinosinusitis (CRS), as well as familiarity with various treatments for rhinosinusitis (5-point Likert scale). Descriptive statistics were utilized to describe results, and multivariable ordinal regression was utilized to describe factors associated with knowledge of any treatment and over-the-counter treatments.

Results. The cohort (n = 1086) was primarily female (75.7%), white (80.3%), married (47.5%), and college educated (36.6%). Highest rates of familiarity with treatment were reported for antihistamines (80%), decongestants (80%), and nasal corticosteroids (78%). Factors associated with knowledge of any rhinosinusitis treatment included age (odds ratio [OR]: 0.99 [95% confidence interval [CI]: 0.98-0.99]), literacy score (OR: 0.76 [95% CI: 0.71-0.82]), CRS diagnosis (OR: 2.91 [95% CI: 2.25-3.75]), and symptomatic score. Factors associated with knowledge of OTC treatments included female gender (OR: 2.40 [95% CI: 1.82-3.16]), literacy score (OR: 0.77 [95% CI: 0.72-0.83]), CRS diagnosis (OR: 2.94 [95% CI: 2.25-3.83]), and symptomatic score.

Conclusion. Individuals at risk for having lower familiarity with treatment options include males, older individuals, and those with lower health literacy. Future studies should evaluate the impact that public knowledge and primary care provider knowledge of treatment options for rhinosinusitis has on outcomes of rhinosinusitis.

Keywords

disparities, health literacy, rhinosinusitis, treatment

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Rhinosinusitis is an inflammatory condition of the sinonasal mucosa that has a variety of symptomatic sequalae, including but not limited to craniofacial pain, nasal obstruction, rhinorrhea, and smell disturbance.[1] The prevalence of rhinosinusitis varies greatly based on definition, but estimates generally reach up to 16% or greater.[2,3] Given the high prevalence of chronic rhinosinusitis (CRS) and other forms of rhinosinusitis, treatment for this condition has a very high economic cost, at an estimated $10 to $13 billion per year in the United States.[4] Ideally, depending upon the etiology of the rhinosinusitis symptoms, outpatient over-the-counter (OTC) treatment is the first step in management, which may include antihistamines, decongestants, intranasal corticosteroids, and intranasal saline rinses.[1,5,6] Subsequent treatment options include surgical and non-surgical options, such as antibiotics and endoscopic sinus surgery (ESS), occasionally involving the utilization of drug-eluting stents or balloon dilation, which have also been used independent of ESS.[7–9] Biologic therapy has also been introduced as an increasingly effective, though expensive, alternative to ESS in some cases.[10]

Ideally, individuals with rhinosinusitis should receive care and be introduced to the initial treatments for

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rhinosinusitis, such as intranasal saline rinses and nasal corticosteroids, early in the course of their disease. Unfortunately, there are a variety of significant barriers to care in the United States.[11–13] One especially important barrier to care is lack of knowledge about options for care among patients and physicians alike.[14–16] This is a particularly important topic in rhinosinusitis, as many of the previously mentioned initial treatments are available over the counter, representing a rare chance at inexpensive medical care for a common medical condition.

However, relatively little is known about public familiarity with treatments for rhinosinusitis. Additionally, little is known about which groups of people may be more or less likely to have knowledge of such treatments. Thus, in this study, we seek to evaluate public familiarity with treatments for rhinosinusitis as well as predictors of familiarity with treatment options. We hypothesize that symptoms of rhinosinusitis will be common, but knowledge of rhinosinusitis treatment options will be relatively poor except among those who have previously received diagnosis of chronic rhinosinusitis (and likely treatment). Furthermore, we hypothesize that groups with higher levels of health literacy, education, and social support will be more likely to be familiar with common treatments of rhinosinusitis.

Methods

This study is an online-based cross-sectional survey study. The study received exempt approval from the University of Southern California Institutional Review Board (UP-23-01128).

Study Cohort

Respondents were recruited from ResearchMatch—a national registry for research volunteer recruitment created and maintained by the National Institute of Health (NIH). ResearchMatch is a database of both healthy and symptomatic volunteers who have consented to be contacted by researchers for studies for which they may be eligible. ResearchMatch was created by several academic institutions with the support of the NIH,[17] and it has been utilized to recruit individuals participants for survey-based studies and randomized clinical trials alike.[18–20] Individuals were eligible for this study if they were adults (≥18 years) residing within the United States. Response rate for this survey was 3.0% (1086/35,991). While ResearchMatch has volunteers from all 50 US states, the sample is not nationally representative.

Survey Development and Distribution

An anonymous survey of 5-15 minutes in length was designed and implemented utilizing REDCap electronic data capture tools (Supplemental A, available online).[21] Survey questions started with a brief demographic questionnaire, followed by two validated surveys regarding nasal obstruction and symptoms, including the Sino-nasal outcome test (SNOT-22)[22] and Nasal obstruction Symptom Evaluation (NOSE) scale.[23] Subsequently, individuals were asked of their history of chronic rhinosinusitis and treatment history. Then individuals were asked to rate their familiarity with various treatments for chronic rhinitis, sinusitis, and rhinosinusitis on a 5-point Likert scale (1–5). Furthermore, to explore the potential impact of health literacy on knowledge, health literacy questions from the Center for Disease Control and Prevention's Behavioral Risk Factor Surveillance System (BRFSS) were used, as described previously.[24,25]

Demographic Characteristics and Outcome Measures

The primary outcome variable of the study was familiarity with treatment for chronic rhinitis, sinusitis, and rhinosinusitis. Familiarity with treatment was described by average 5-point Likert scale response to the question, "How familiar/aware are you of the following treatments for chronic rhinitis, sinusitis, and rhinosinusitis?" Outcomes included from 1 (*very unfamiliar*), 2 (*Somewhat unfamiliar*), 3 (*Neither familiar nor unfamiliar*), 4 (*Somewhat familiar*), and 5 (*Very familiar*).

Variables selected a priori to describe the cohort and act as predictors of treatment knowledge included age, gender, marital status, race, education, annual income, US census region, health literacy, SNOT-22, and NOSE score. Health literacy was calculated as the summative score of the BRFSS health literacy questions (score range 3-15; 3 represents maximum health literacy and 15 represents minimum health literacy). SNOT-22 and NOSE scores were analyzed categorically based on summative score, as previously described. SNOT-22 score was categorized as either "Minimal" (0-7), "Mild" (8-20), "Moderate" (21-50), and "Severe" (>50).[26] NOSE score was categorized as "Minimal" (0-4), "Mild" (5-25), "Moderate" (30-50), "Severe" (55-75), or "Extreme" (80-100).[27]

Statistical Analysis

Descriptive statistics, including mean, standard deviation, and confidence intervals of proportions were utilized to characterize our cohort. Diverging stacked barplots were utilized to describe knowledge of individual treatments for rhinosinusitis, including by particular characteristics. *t*-Tests and ANOVA were utilized to compare differences in mean treatment knowledge between groups divided by history of CRS diagnosis, SNOT-22 score category, and NOSE score category. Univariable and multivariable ordinal regression of factors associated with one level increase in familiarity with rhinosinusitis treatment was completed with factors analyzed including age, gender, marital status, race, education, annual income, US census region, health literacy score, SNOT-22, and NOSE categories. Familiarity with rhinosinusitis treatment was analyzed as average Likert-scale score of all treatments and for all over-the-counter treatments (including antihistamines, decongestants, nasal corticosteroids, and

intranasal saline rinses). Individuals with missing data points were excluded from multivariable analysis. Statistical significance was set at $P < .05$, two-tailed. STATA, version 16.1 (StataCorp LLC) was used for all analysis.

Results

Cohort Characteristics

Cohort characteristics (n = 1086) are described in **Table 1**. Overall, our cohort had mean age of 49.4 years and was mostly female (n = 820, 75.7%), white (n = 872, 80.3%), married (n = 516, 47.5%), college educated (n = 397, 36.6%), and had income of $50,000-74,999 (n = 173, 17.0%). The most commonly reported SNOT-22 score range was Moderate (n = 566, 52.1%) and NOSE score range was Mild (n = 512, 47.1%).

Reported Treatment Knowledge

Overall familiarity with various treatments in the cohort were described in **Figure 1**. Highest rates of familiarity (somewhat familiar or very familiar) with treatment were reported for antihistamines (80%), decongestants (80%), and nasal corticosteroids (78%). Treatments with the lowest amount of familiarity included drug eluting stents (6%), balloon dilation (12%), turbinate reduction (12%), and biologics (12%).

Subsequently, reported treatment familiarity was analyzed by self-reported diagnosis of CRS (**Figure 2A**), SNOT-22 score category (**Figure 2B**), and NOSE score category (**Figure 2C**). Mean knowledge score was different for each treatment option when stratifying the sample of CRS treatment diagnosis (**Figure 2A**). For each treatment type, the percent of the sample that reported being somewhat or very familiar with treatment was higher in the group that reported having a history of CRS diagnosis.

When analyzing by SNOT-22 and NOSE score categories (**Figure 2B** and **2C**, respectively), familiarity scores varied significantly but were generally higher among those with higher symptomatic scores.

Predictors of Treatment Familiarity

Table 2 describes the factors associated with increased average reported familiarity with any treatment for rhinosinusitis based on multivariable ordinal regression. Increased age (odds ratio [OR]: 0.99 [95% confidence interval [CI]: 0.98-0.99] was associated with lower familiarity. Higher literacy score (lower literacy) was associated with decreased familiarity (OR: 0.76 [95% CI: 0.71-0.82]). Meanwhile, higher SNOT-22 score (OR: 1.01 [95% CI: 1.00-1.02]), higher NOSE score (OR: 1.01 [95% CI: 1.00-1.02]), and history of CRS diagnosis (OR: 2.91 [95% CI: 2.25-3.75]) were associated with increased familiarity. Compared to those from the Northeast, those from the South (OR: 1.44 [95% CI: 1.05-1.98]) were more likely to be familiar with treatment. Gender, race, education, income, marital status, and region type were not associated with familiarity with treatments.

Table 3 describes the factors associated with increased average reported familiarity with over-the-counter treatments (including antihistamines, decongestants, nasal corticosteroids, and intranasal saline rinses) for rhinosinusitis based on multivariable ordinal regression. Females

Table 1. Cohort Characteristics

Characteristic	n (%)
N	1086
Age, mean (%)	49.4 (17.3)
Gender	
Male	243 (22.4)
Female	820 (75.7)
Other	20 (1.8)
Marital status	
Married	516 (47.5)
Single	309 (28.5)
Long-term partnership	113 (10.4)
Separated/divorced	132 (12.2)
Other	16 (1.5)
Race	
White/Caucasian, Non-Hispanic	872 (80.3)
Hispanic/Latino	43 (4.0)
Black/African American	105 (9.7)
Asian American	29 (2.7)
Other	37 (3.4)
Educational level	
Some secondary/high school	8 (0.7)
High school degree	38 (3.5)
Some college	196 (18.1)
College graduate	397 (36.6)
Graduate school degree	333 (30.7)
Doctorate degree	112 (10.3)
Income	
Less than $25,000	130 (12.8)
$25,000-49,999	162 (15.9)
$50,000-74,999	173 (17.0)
$75,000-99,999	157 (15.5)
$100,000-149,999	199 (19.6)
$150,000-199,999	97 (9.5)
$200,000 or greater	98 (9.6)
Diagnosed with CRS	91 (27.9)
Sinonasal Symptom Severity (SNOT22)	
None	85 (7.8)
Mild	229 (21.1)
Moderate	566 (52.1)
Severe	206 (19.0)
Nasal Obstruction Symptom Severity (NOSE)	
Minimal	96 (8.8)
Mild	512 (47.1)
Moderate	301 (27.7)
Severe	133 (12.2)
Extreme	44 (4.1)

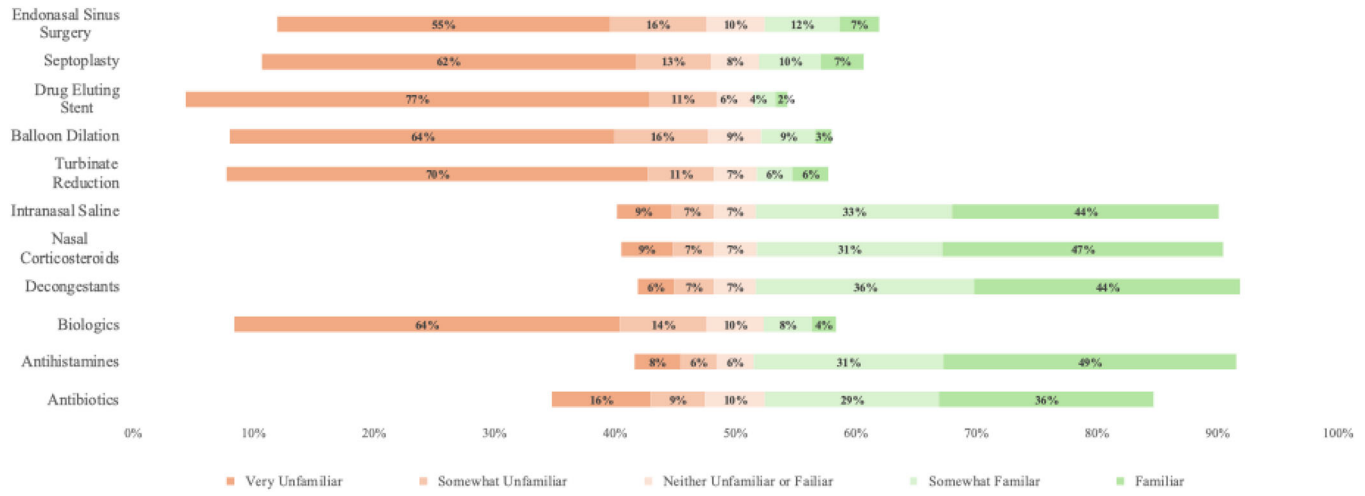

Figure 1. Cohort familiarity with various treatments for rhinosinusitis. Scores are based on response to 5-point Likert scale response to the question, "How familiar/aware are you of the following treatments for chronic rhinitis, sinusitis, and rhinosinusitis?"

had increased odds of familiarity with OTC treatments than males (OR: 2.40 [95% CI: 1.82-3.16]). College graduates had increased odds of familiarity when compared to those with only high school education (OR: 2.02 [95% CI: 1.11-3.67]). Individuals from the South were more likely to be familiar with OTC treatments than those from the Northeast (OR: 1.46 [95% CI: 1.05-2.03]). Higher literacy score (lower literacy) was associated with decreased familiarity (OR: 0.77 [95% CI: 0.72-0.83]). Higher SNOT-22 score (OR: 1.01 [95% CI: 1.00-1.02]), higher NOSE score (OR: 1.01 [95% CI: 1.00-1.02]), and history of CRS diagnosis (OR: 2.94 [95% CI: 2.25-3.83]) were associated with increased familiarity with OTC treatments. Age, marital status, income, region, and region type were not associated with familiarity with treatments.

Discussion

In this study, we evaluated public familiarity with treatments for rhinosinusitis and factors associated with familiarity with treatment options. As we hypothesized, symptoms of rhinosinusitis were quite common based on SNOT-22 and NOSE scores, though familiarity of treatment options was not as high, particularly among less commonly utilized treatments. Furthermore, as we hypothesized, several groups of individuals were more likely to be familiar with treatment options, including younger individuals, those with higher health literacy, those with history of a CRS diagnosis, and those with higher SNOT-22 and NOSE scores. When specifically analyzing familiarity with OTC treatments, females and college graduates were also more likely to be familiar with treatment options.

Generally, these results fall in line with predictors of treatment familiarity shown from other studies. Among individuals with asthma and heart failure, severity of disease has been shown to be a significant driver of knowledge.[28,29] Logically, this difference in knowledge is mediated by more frequent follow-up and education with specialty care providers. Still, it is noteworthy that there is a strong association between familiarity with over-the-counter treatment options and SNOT-22 and NOSE scores, given that individuals with relatively low scores may receive significant benefit from over-the-counter treatment of sinonasal symptoms.[30]

However, we demonstrated that health literacy—generally defined as one's interest, willingness, and ability to engage in learning about health-related topics—was perhaps the strongest mediator of familiarity with treatment options.[31] In our study, health literacy is defined primarily by individuals interest in health information-seeking (as analyzed via the BRFSS questionnaire),[25] though we also demonstrated the impact of education, which may be a proxy for an individual's ability to engage in this learning.

While health literacy has been shown to routinely play a role in patient's engagement with corrective health behaviors,[32–34] this is particularly important to consider in the case of treatment for rhinosinusitis. Since many treatments for rhinosinusitis are over-the-counter, there is a unique opportunity for patients to self-treat this common condition. However, our study showed there are many modifiable factors that affect familiarity with any treatment for rhinosinusitis, including education and health literacy. When analyzing over-the-counter treatments specifically, disparities between different populations emerged, including lower familiarity among older patients and males. This is particularly concerning among older age groups for whom rhinosinusitis is more common.[35]

Given this, we suggest investigation into the association between lower familiarity with rhinosinusitis treatments and negative health outcomes. With the high economic cost of sinusitis[4] and the efficacy of many over-the-counter treatments,[36] it is reasonable that knowledge of over-the-counter treatments for rhinosinusitis could lead to less

costly and more effective initial treatment for rhinosinusitis. If higher knowledge leads to earlier treatment and improved outcomes for rhinosinusitis, this would suggest the need for public health interventions to increase public awareness of these options. To achieve this, it is important that individuals who do seek information on rhinosinusitis treatment receive high-quality information, so public health agencies and healthcare systems alike should make an effort to increase the quality of already available education tools, which may be of low quality.[37,38] Given the high prevalence of sinonasal symptoms, it is important that primary care physicians are provided with updated education on these treatment options with encouragement to share and promote the effective OTC treatment options that are currently available.

Our study has limitations. First, this study did not utilize a representative sample of the US population, so familiarity with treatments reported by respondents was

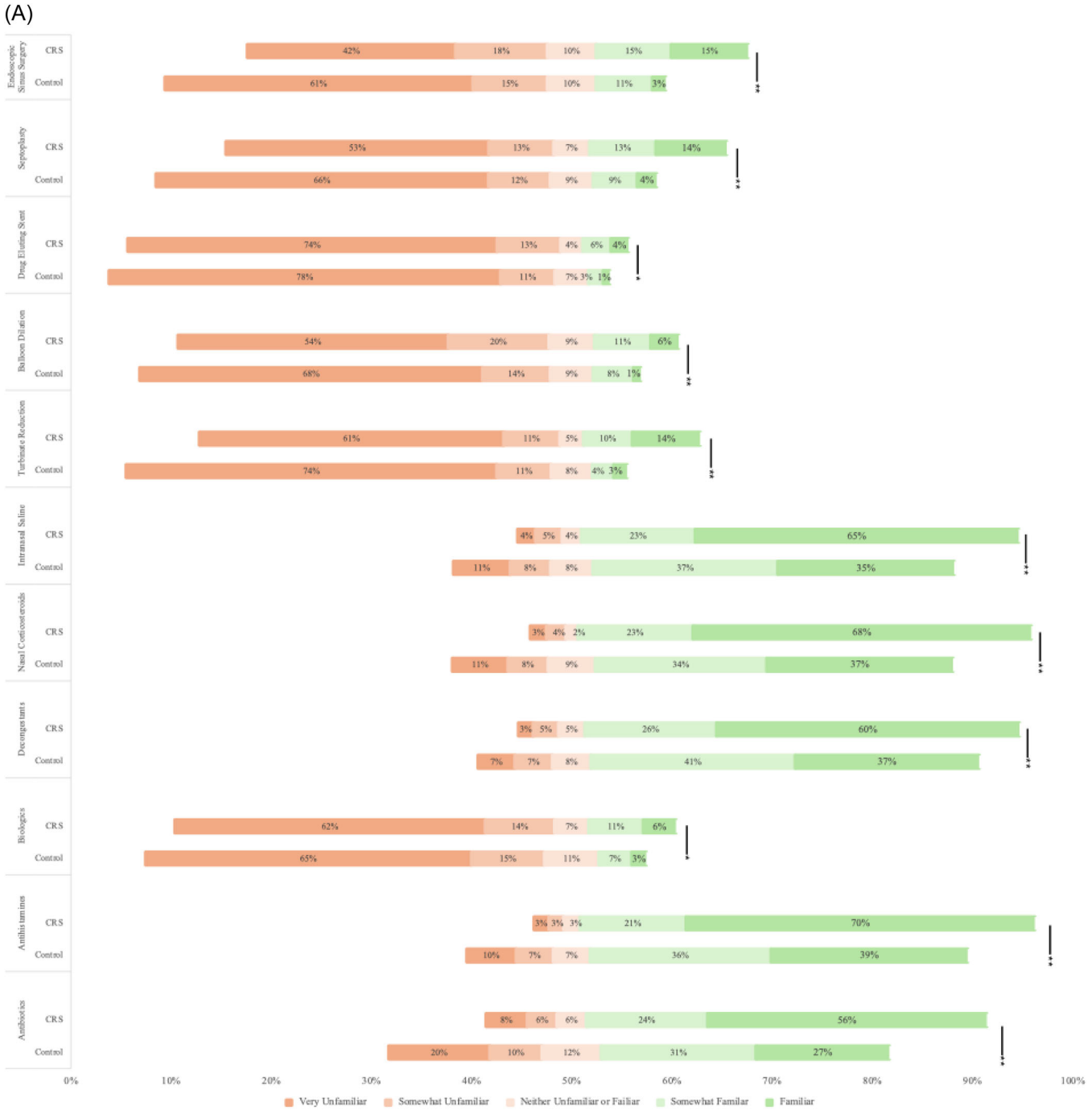

FIGURE 2 Multiple bar graph demonstrating mean treatment familiarity scores by (A) chronic rhinosinusitis (CRS) diagnosis history, (B) Sinonasal-outcome Test (SNOT-22) score, and (C) Nasal Obstruction Symptom Evaluation (NOSE) score.

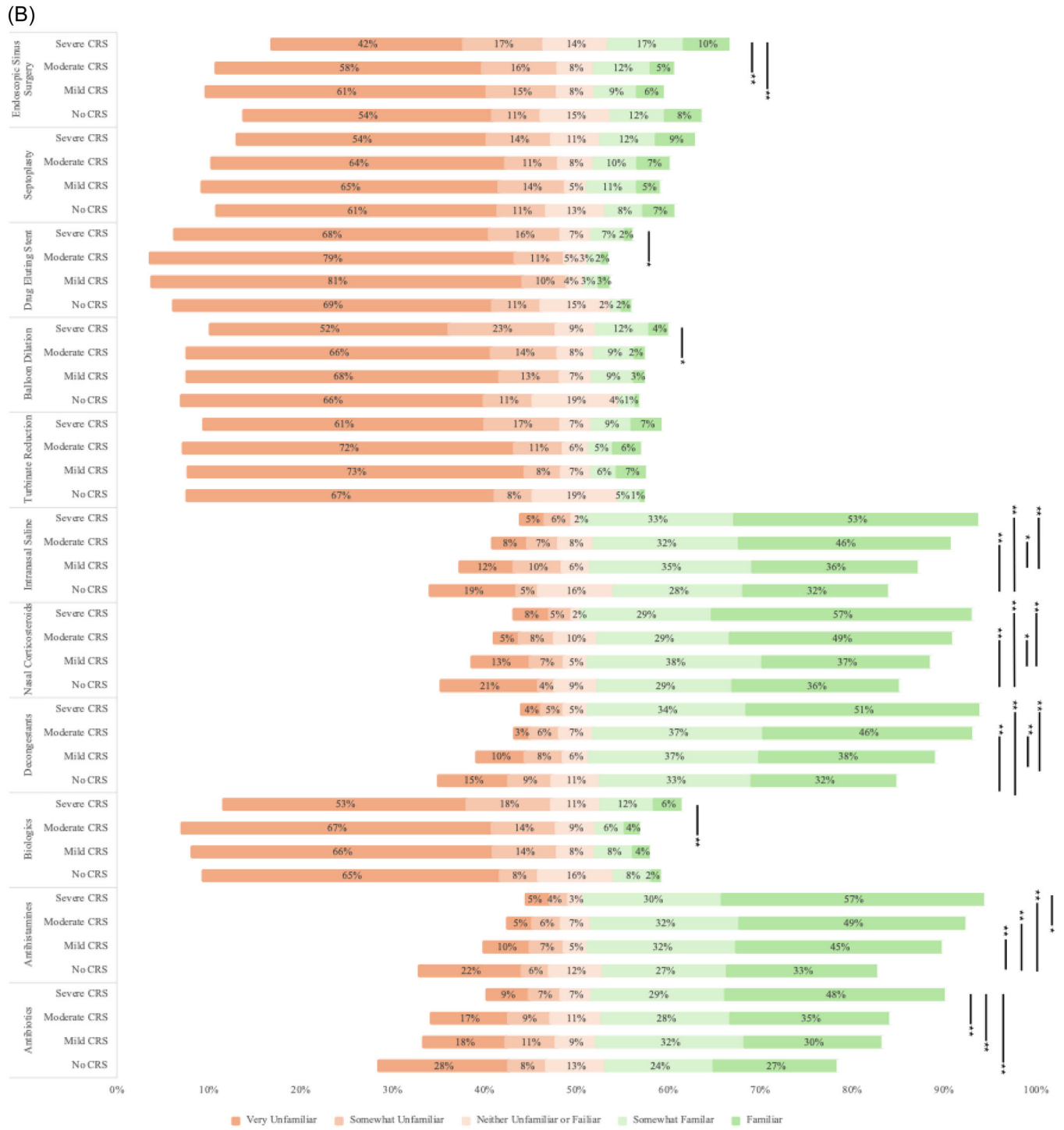

FIGURE 2 Continued

specific to this sample and should not be extended to the US population. The low response rate likely further biases these results, as those interested in the topic may have been more likely to respond. Unfortunately, response rates below 20% are frequent utilizing ResearchMatch.[39,40] However, the large sample size of this study is a strength that allows for multivariable statistical analysis to analyze the impact of various qualities of individuals on familiarity with treatment options for rhinosinusitis in a meaningful way. Furthermore, results of this study were based on personal reports rather than objective data. In the case of diagnosis of rhinosinusitis, this may be a limitation, as self-reported diagnostic data may be inaccurate. However, in the case of some outcomes, such as SNOT-22 scores, it is often preferable to have patient-reported outcomes data, as this may be more likely to suggest interest in seeking out

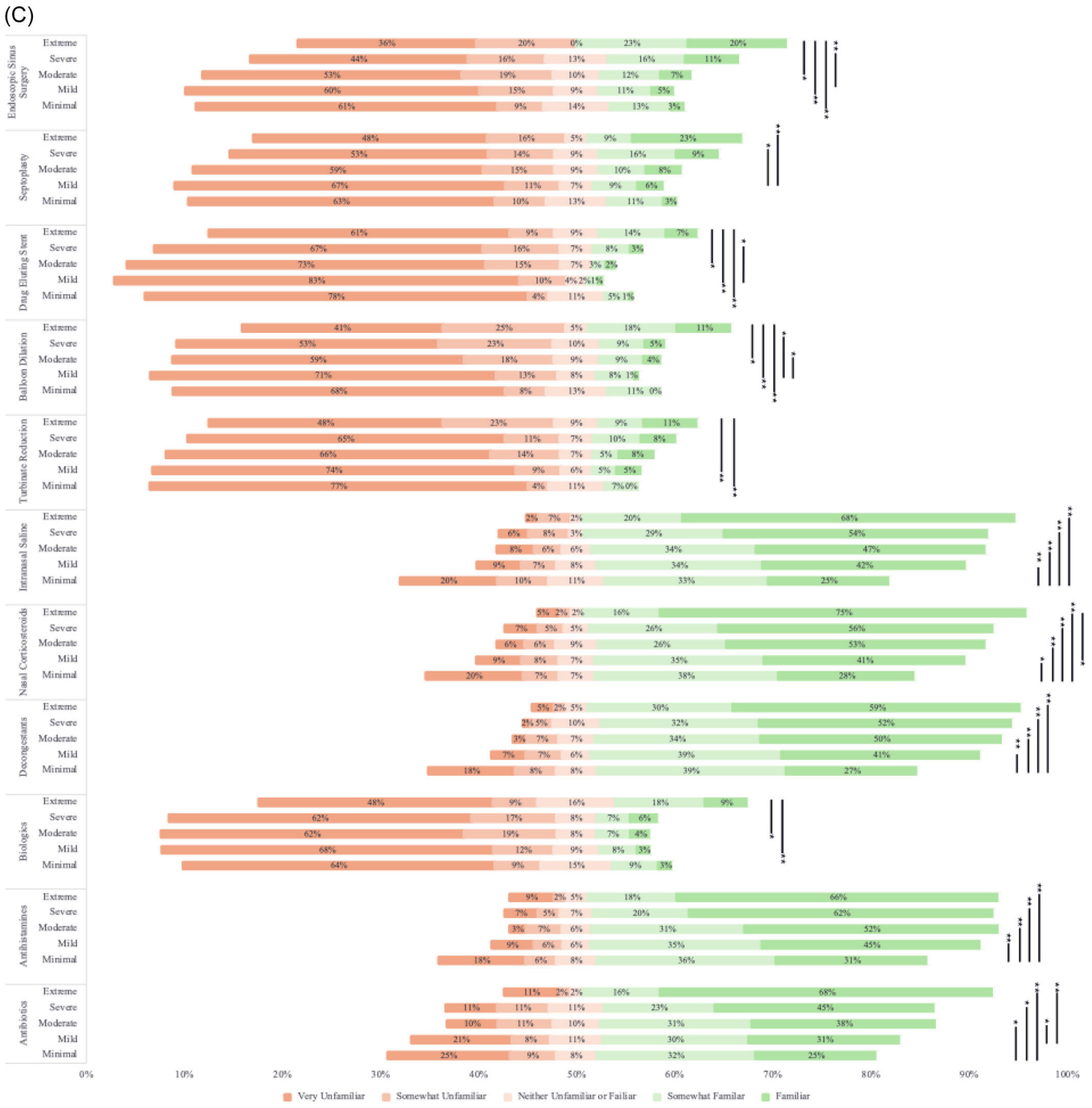

FIGURE 2 Continued

knowledge about rhinosinusitis treatment options. We are also limited by the lack of clarity on the accuracy of participant knowledge regarding rhinosinusitis treatment options. While several options, such as saline irrigation and antihistamine use, are simple and highly encouraged, other treatment options, such as decongestant use, can often be deleterious when used improperly. Further studies should evaluate the potential impact that familiarity with treatment options for rhinosinusitis has on outcomes of rhinosinusitis, as an association between these factors would suggest the need for public health interventions to increase knowledge of these options.

Conclusion

This study suggests that despite high prevalence of sinonasal symptoms, public familiarity with treatment is limited. Individuals at risk for having lower familiarity with treatment options include males, older individuals, and those with lower health literacy. Future studies

Table 2. Multivariable Ordinal Regression of Factors Associated With All Treatment Familiarity[a]

	Multivariable		
Characteristic	Odds Ratio	95% CI	*P* value
Age	0.99	(0.98-0.99)	**<.001**
Gender			
Male	-	-	
Female	1.20	(0.91-1.58)	.194
Other	0.77	(0.32-1.83)	.550
Race			
Non-White	-	-	
White	0.90	(0.67-1.20)	.453
Marital status			
Non-married	-	-	-
Married	1.07	(0.82-1.39)	.638
Education			
High school	-	-	
Some college	1.49	(0.80-2.76)	.208
College graduate	1.78	(0.98-3.24)	.059
Graduate school degree	1.36	(0.74-2.52)	.327
Doctorate degree	1.31	(0.66-2.60)	.436
Income			
Less than $25,000	-	-	-
$25,000-49,999	0.76	(0.50-1.14)	.188
$50,000-74,999	1.26	(0.83-1.93)	.279
$75,000-99,999	1.21	(0.77-1.90)	.416
$100,000-149,999	0.95	(0.61-1.47)	.803
$150,000-199,999	0.98	(0.57-1.66)	.926
$200,000 or greater	1.57	(0.93-2.65)	.093
Region			
Northeast	-	-	-
West	0.98	(0.69-1.39)	.893
South	1.44	(1.05-1.98)	**.024**
Midwest	1.05	(0.75-1.47)	.789
Region type			
Urban	-	-	-
Suburban	0.93	(0.72-1.20)	.582
Rural	1.06	(0.76-1.48)	.731
Literacy score	0.76	(0.71-0.82)	**<.001**
SNOT-22 score	1.01	(1.00-1.02)	**.012**
NOSE score	1.01	(1.00 -1.02)	**.001**
CRS diagnosis	2.91	(2.25-3.75)	**<.001**

Bold values indicate statistically significant at $P < .05$.
Abbreviation: CI, confidence interval.
[a]Familiarity score is defined by mean self-reported Likert scale (1-5) familiarity with all treatment options.

Table 3. Multivariable Ordinal Regression of Factors Associated With Over-the-Counter Treatment Familiarity[a]

	Multivariable		
Characteristic	Odds ratio	95% CI	*P* value
Age	0.99	(0.98-1.00)	.254
Gender			
Male	-	-	-
Female	2.40	(1.82-3.16)	**<.001**
Other	1.21	(0.53-2.78)	.656
Race			
Non-White	-	-	-
White	1.11	(0.83-1.49)	.472
Marital status			
Non-married	-	-	-
Married	0.91	(0.69-1.19)	.474
Education status			
High school	-	-	-
Some college	1.52	(0.83-2.83)	.176
College graduate	2.02	(1.11-3.67)	**.022**
Graduate school degree	1.57	(0.85-2.90)	.154
Doctorate degree	1.42	(0.71-2.84)	.325
Income			
Less than $25,000	-	-	-
$25,000-49,999	0.85	(0.55-1.29)	.440
$50,000-74,999	1.33	(0.86-2.06	.203
$75,000-99,999	0.98	(0.61-1.56)	.920
$100,000-149,999	1.20	(0.76-1.90)	.442
$150,000-199,999	1.42	(0.82-2.47)	.209
$200,000 or greater	1.65	(0.96-2.83)	.070
Region			
Northeast	-	-	-
West	0.84	(0.59-1.20)	.334
South	1.46	(1.05-2.03)	**.023**
Midwest	1.08	(0.76-1.54)	.656
Region type			
Urban	-	-	-
Suburban	1.18	(0.91-1.53)	.200
Rural	1.15	(0.81-1.63)	.437
Literacy score	0.77	(0.72-0.83)	**<.001**
SNOT-22 score	1.01	(1.00-1.02)	**.038**
NOSE score	1.01	(1.00-1.02)	**.003**
CRS diagnosis	2.94	(2.25-3.83)	**<.001**

Bold values indicate statistically significant at $P < .05$.
Abbreviation: CI, confidence interval.
[a]Familiarity score is defined by mean self-reported Likert scale (1-5) familiarity with over-the-counter treatment options, including antihistamines, decongestants, nasal corticosteroids, and intranasal saline rinses.

should evaluate the utility of interventions to improve public knowledge and primary care provider knowledge of treatment options for rhinosinusitis.

Author Contributions

Tyler J. Gallagher, conception and design of work, data acquisition, data analysis, interpretation of data, drafting of manuscript, critical revision; **Rishabh Shah**, interpretation of data, drafting of manuscript, critical revision; **Michelle Koh**, interpretation of data, drafting of manuscript, critical revision; **Catherine Julien**, interpretation of data, drafting of manuscript, critical revision; **Matthew E. Lin**, interpretation of data, drafting of manuscript, critical revision; **Kevin Hur**, conception and design of work, data acquisition, data analysis, interpretation of data, drafting of manuscript, critical revision.

Disclosures

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Supplemental Material

Additional supporting information is available in the online version of the article.

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