

# A cross-sectional, population-based survey of U.S. adults with symptoms of chronic rhinosinusitis

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## ABSTRACT

**Background:** Chronic rhinosinusitis (CRS) is believed to create a substantial population-level disease burden in the United States due to its high prevalence and significant disease morbidity, but many studies of CRS epidemiology are based on administrative or historical record sources rather than primary population sources.

**Objective:** To characterize CRS symptoms, burden, and patient characteristics by using a primary U.S. population-based representative sample.

**Methods:** A demographically and geographically representative sample of 10,336 U.S. adults recruited from a general panel of 4.3 million were obtained by using three-stage randomization. Data collected included a range of respondent-reported CRS symptoms, symptom impact and severity, symptom duration, and treatment.

**Results:** Approximately 11.5% of the respondents ( $n = 1189$ ) reported defining symptom and duration criteria for CRS. A previous diagnosis of nasal polyps was reported by ~10% of this population. The remaining respondents reported severe (7.3%) or moderate (3.1%) symptom severity. The most frequently reported defining symptoms were nasal congestion and/or obstruction (94–97%) and drainage (89–92%). CRS participants reported a high average degree of symptom burden (e.g., on a 0–10 scale, 8.2 for CRS with nasal polyps, 8.4 for CRS without nasal polyps with severe symptoms, and 6.4 for CRS without nasal polyps with moderate symptoms). The participants with CRS reported high health-care use for CRS, adverse effects of CRS symptoms on multiple areas of daily life, and high dissatisfaction with currently available treatments.

**Conclusion:** More than 10% of the general U.S. adult population have CRS symptoms. Most report severe symptoms, lack of satisfaction with current treatment options, and a substantial adverse impact on daily functioning.

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Chronic rhinosinusitis (CRS) is a heterogeneous syndrome characterized by chronic inflammation in the nasal cavity and sinuses, which leads to multiple symptoms and substantial disease burden.<sup>1–3</sup> CRS is distinct from acute rhinosinusitis, with the latter usually due to infection rather than inflammation. “Chronic sinusitis” is almost always accompanied by concurrent nasal airway inflammation and is often preceded by rhinitis symptoms; thus, the term chronic rhinosinusitis has emerged to more clearly describe this condition.<sup>4</sup> Multiple U.S. and European sensus

statements and guidelines define CRS based on symptoms plus accompanying objective evidence of inflammation, with at least 8–12 weeks’ persistence. The main CRS syndrome presentations include CRS with nasal polyps (CRSwNP, benign inflammatory outgrowths of the mucosa and, less commonly, allergic fungal rhinosinusitis) and CRS without nasal polyps (CRSsNP).<sup>1,4–6</sup>

The burden of disease attributable to CRSwNP and CRSsNP is high, both at the individual and the societal level.<sup>2,3,7,8</sup> In 2017, the overall economic impact of CRS in the United States was estimated at \$30–\$33 billion for direct and indirect costs.<sup>9</sup> CRS impairs quality of life (QoL) to a degree similar to other serious chronic diseases (e.g., congestive heart failure and chronic obstructive pulmonary disease).<sup>3</sup> The diagnostically defining symptoms of CRS are nasal congestion and/or obstruction, mucopurulent drainage (rhinorrhea and/or postnasal drip), facial pain and/or pressure, and hyposmia or anosmia (reduction or loss of sense of smell), of which at least two must be present. Some guidelines suggest that one symptom must be either congestion and/or obstruction or rhinorrhea. Other symptoms of CRS are underappreciated despite their high frequency; these include fatigue, bodily pain,

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chronic sleep dysfunction (possibly due to difficulty breathing), and depression.<sup>1,5,10</sup> Despite the availability of a variety of therapeutic options and consensus treatment recommendations (including nasal saline solution irrigation, nasal corticosteroids, oral corticosteroids, and surgery), a substantial proportion of patients with CRS continue to experience a high symptom burden.<sup>4,11,12</sup>

Analysis of data from multiple previous studies indicates that CRS affects 5–15% of the population in Europe and the United States.<sup>13–16</sup> Estimates of U.S. adults with CRS vary from 15 to 40 million,<sup>17,18</sup> which suggests that CRS is one of the most common chronic conditions in the United States.<sup>13,17,18</sup> However, U.S. prevalence estimates were mostly derived retrospectively and/or from administrative population-subset health-care data bases<sup>17,18</sup> rather than primary general-population sources. Some research is considered inconclusive because clinicians have reported a lower CRS incidence in clinical practice compared with estimates from some self-reported studies.<sup>16</sup>

Research that relies on insurance claims data bases, in which data are collected for billing purposes, *e.g.*, is subject to certain inherent limitations and surveillance bias.<sup>19</sup> For example, conditions or procedures that have financial incentive may be overrepresented or systematically miscoded in data bases used for analyses,<sup>19,20</sup> and diagnoses reported in data bases may lack documentation of diagnostic testing, which leads to uncertainty regarding accuracy.<sup>19</sup> Furthermore, administrative insurance data bases often lack data on patient health status or QoL, tend to represent homogeneous or select populations, do not provide direct information on disease severity, and may not be linked to treatments that do not generate billing codes.<sup>20</sup>

This survey was conducted to directly characterize the prevalence, burden of illness, and characteristics of the U.S. adult population with symptoms of CRS. By questioning a demographically and geographically representative sample of the general population, a comprehensive view of people with symptoms of CRS, whether or not they were currently seeing a physician for treatment, was obtained. Direct contact with patients also enabled the collection of data on previous treatments, including nasal and sinus surgeries and intranasal and oral steroids, as well as on satisfaction with care.

## METHODS

### Participants

A cross-sectional survey of U.S. adults was conducted from December 2014 to January 2015. The sample was selected from a general population panel structured to match the U.S. population by using Survey

Sampling International (Shelton, CT). Panel participants were recruited through a variety of approaches, including Web sites, electronic mail, telephone, online communities, and social networks. To ensure representativeness, panel participants were required to pass multiple quality controls and checks. Survey completion and loyalty mechanisms, *viz.*, points awarded to obtain gifts, were used for difficult-to-reach populations.

Respondents were randomly recruited from this general population panel by using a three-stage process. An initial sample was randomly chosen from the panel data base; these individuals were invited to indicate interest in participating; no follow-up was conducted with nonrespondents. Then, a random sample of interested participants was selected to participate. Finally, profiling questions regarding geographic distribution, age, socioeconomic status, education (data not shown), and comorbid illness were used to ensure that the respondents were representative of the U.S. adult population when compared with known distributions (*e.g.*, U.S. census data).<sup>21</sup> Patient selection was not weighted based on patient characteristics or toward any subpopulation. To ensure sample consistency and reliability during fielding, monitoring, security checks, and quality control procedures were used. These included digital fingerprinting, address certification, third-party verification, questionnaire quality control, and answer monitoring. Behavior patterns were monitored, and suspicious electronic mail addresses and behavior, as well as unrealistic completion times, were examined. Nonresponse to individual questions was handled on a casewise basis. Responses deemed flawed were excluded from analysis.

Data from all the final respondents were used to calculate population prevalence. Respondents to the population survey were defined as having CRS either if they had received a diagnosis from a physician or reported at least 8 consecutive weeks (within 12 months) of two or more of the following symptoms: nasal blockage and/or congestion, nasal discharge (anterior or posterior), facial pain and/or pressure, or hyposmia, one of which must have been either nasal blockage and/or congestion or nasal discharge.<sup>6</sup> The patients' CRS was categorized as "severe" if they met any of the following criteria: rated their CRS as "severe," rated the severity of their CRS symptoms as severe on a typical day in the past 12 months, rated the severity of their CRS symptoms as severe when they had not taken medication, or rated the bothersomeness of their CRS symptoms as 9 or 10 on a 0–10 scale (0, no bother at all; 10, extremely bothersome). The condition was categorized as "moderate" if the patients' CRS was not categorized as "severe" and met any of the following criteria: rated their CRS as "moderate," rated the severity of their CRS symptoms as moderate on a

**Table 1 Criteria to assess chronic rhinosinusitis symptom severity**

| Severity and/or Bothersome Criteria            | Method of Assessment                                                                                                                                                                              | Scale                                      |
|------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Severity of diagnosed condition                | Best describe the severity of each of your conditions in the past 12 mo                                                                                                                           | Mild, moderate, severe                     |
| Severity of symptoms on a typical day          | Best describe the severity of your symptoms on a typical day in the past 12 mo when you had symptoms (congestion, nasal drainage, facial pain and/or pressure, smell) and did not take medication | Mild, moderate, severe                     |
| Bother of symptoms                             | How bothersome are each of your symptoms (congestion, nasal drainage, facial pain and/or pressure, smell) on a typical day when you experience them?                                              | 0 (no bother) to 10 (extremely bothersome) |
| Take steroid nasal spray medications for >60 d | Have you taken steroid nasal spray medication in the past 12 mo to treat your condition and/or symptoms, and, if so, how many days have you taken it?                                             | Yes, no                                    |
| Take oral steroids for symptoms                | Have you taken oral steroids in the past 12 mo to treat your condition and/or symptoms?                                                                                                           | Yes, no                                    |
| No. flares                                     | In the past 12 mo, how many short-term increases in symptoms did you have when you needed to take medications more often, take different medications, or go to the physician?                     | Number reported                            |

typical day in the past 12 months, rated the severity of their CRS symptoms as moderate when they had not taken medication, or rated the bothersomeness of their CRS symptoms from 4 to 8 on a 0–10 scale (Table 1). Because patients are often unaware of whether their CRS symptoms are accompanied by polyps, the participants were categorized as having CRSwNP only if they were aware that they had polyps as previously diagnosed by a physician.

## Survey

Data collected included general health symptoms, CRS-defining symptoms in the past 12 months, physician-diagnosed comorbid conditions, duration of nasal symptoms, medication(s) used in the past 12 months to treat nasal symptoms, the presence of known nasal polyps, and importance and/or severity (“bother”) of symptoms. “Bother” is a construct commonly used in patient-reported outcome studies because it is understood by a broad range of respondents and carries a negative connotation across physical, emotional, and social states. Data were also collected regarding previous surgery for nasal and sinus symptoms, visits to a physician or emergency department (ED), overnight hospitalizations, and computed tomography or magnetic resonance imaging for nasal and sinus symptoms.

Patient-reported clinical response to surgery was also assessed.

A random sample of participants who met the criteria for CRS was selected for an extended survey. The extended survey further queried the influence of CRS symptoms on daily activities, including missed days of work and/or school; symptom control; concerns about symptoms and flare-ups; QoL; dissatisfaction with and/or bother with using steroid nasal sprays; and comfort with medication routines. Self-reported disease days, disease significance, and persistence over the past 12 months were also assessed by measuring the number of days that respondents used corticosteroids (either intranasal or oral) for symptom control and the number of self-reported CRS flare-ups.

## Analysis

The participants who met diagnostic symptom criteria for CRS were categorized into subgroups based on symptoms and severity. One group included those who reported a previous physician diagnosis of CRSwNP. The second group, patients with CRS and not known to have polyps (CRSsNP), was subcategorized by severity. The number of people with CRS in the United States was projected from the survey sample by using 2016 U.S. Census Bureau<sup>21</sup> population

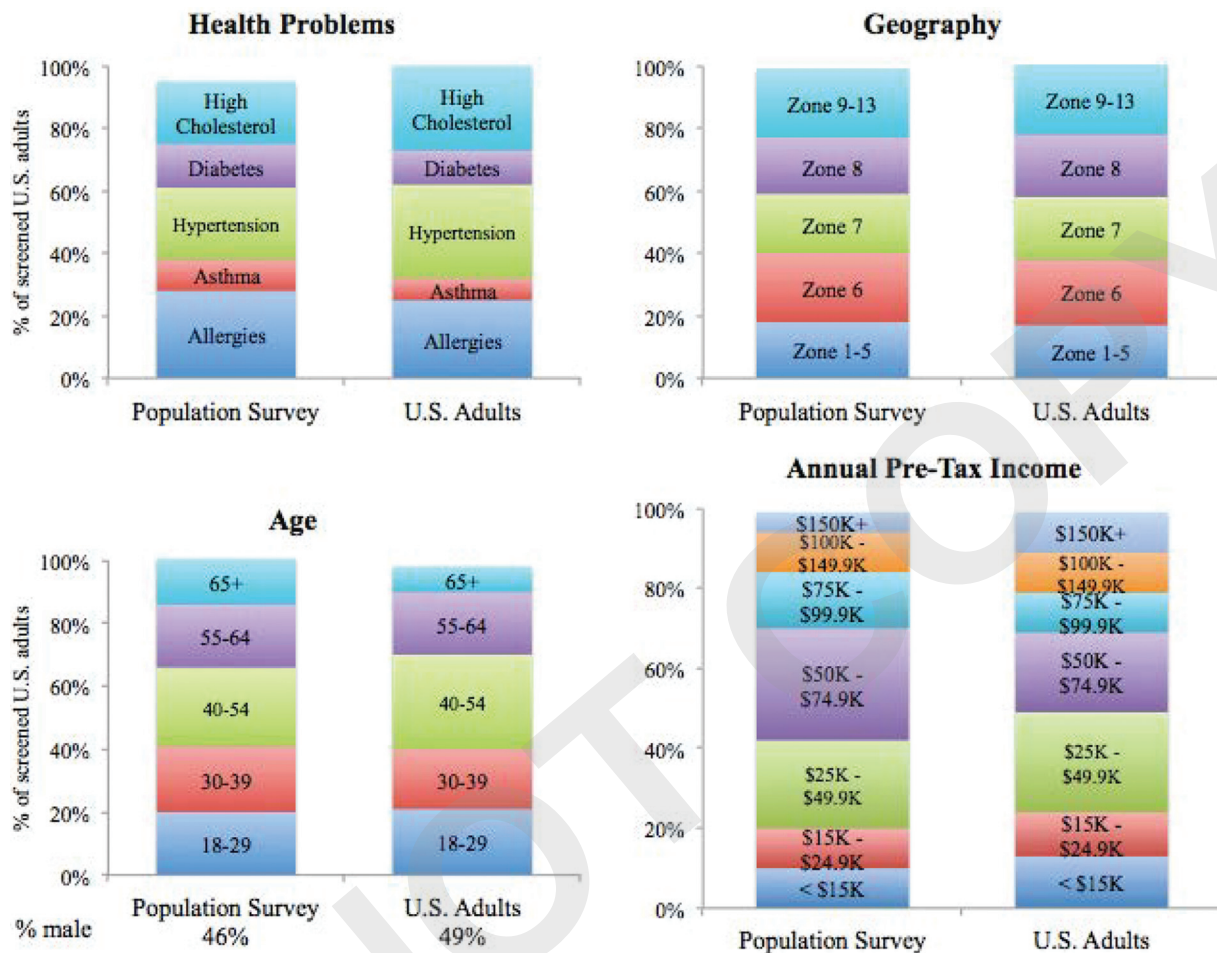


Figure 1. Comparison of survey respondent data with U.S. adult population.

estimates, which reported the total national adult population at 249,454,440.

## RESULTS

A total of 10,336 U.S. adults were surveyed from the representative population panel of 4.3 million. From this sample, 1189 respondents (11.5%) met the study criteria for CRS. Extended surveys were completed by a random subset of 438 of the 1189 respondents with CRS. When compared with U.S. Census Bureau<sup>21</sup> distributions, the survey respondents were representative of the U.S. adult population in geographic distribution, age, socioeconomic status, education, and comorbid illnesses (Fig. 1).

### Patient Subgroups

Nasal polyps were reported to have been previously diagnosed by a physician in 1.1% of all the respondents (thus categorized as CRSwNP). An additional 10.4% of the respondents met study criteria for CRS but did not report knowing that they had nasal polyps (categorized as CRSsNP). Most of the 10.4% categorized as CRSsNP fell within the “severe” subcategory (70% of

CRSsNP; 7.3% of the total survey population), with a smaller group classified as “moderate” severity (30% of CRSsNP; 3.1% of the population); few patients who met study criteria for CRS were classified as “mild” (Fig. 2). Extrapolating from the 2016 U.S. Census, the prevalence of CRS among adults is ~28.7 million, of whom ~18 million have severe symptoms without being aware of having nasal polyps and with an additional ~2.74 million previously diagnosed with nasal polyps.

### Burden of Illness

The most frequently reported defining symptoms were nasal congestion and/or obstruction (95% in CRSwNP, 96% in CRSsNP) and drainage (89% in CRSwNP, 91% in CRSsNP). The patients with CRSwNP reported higher rates of facial pain and/or pressure (60%) and hyposmia (56%) compared with CRSsNP (55.7% and 38.6% for pain and/or pressure and hyposmia, respectively). Patients reported a high overall level of disease burden over the previous year, as assessed by responses to the question, “How bothersome have your symptoms been over-

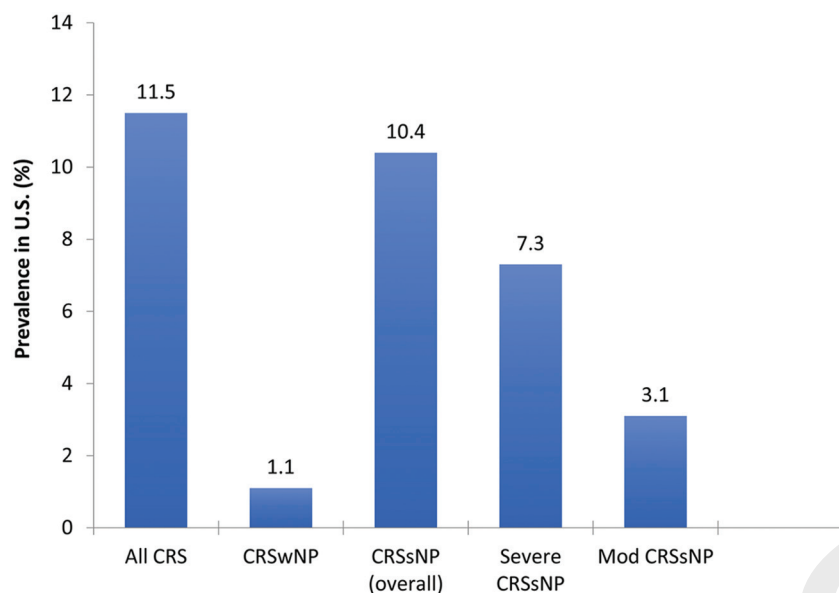


**Figure 2.** Prevalence of moderate-severe chronic rhinosinusitis with and without nasal polyps.

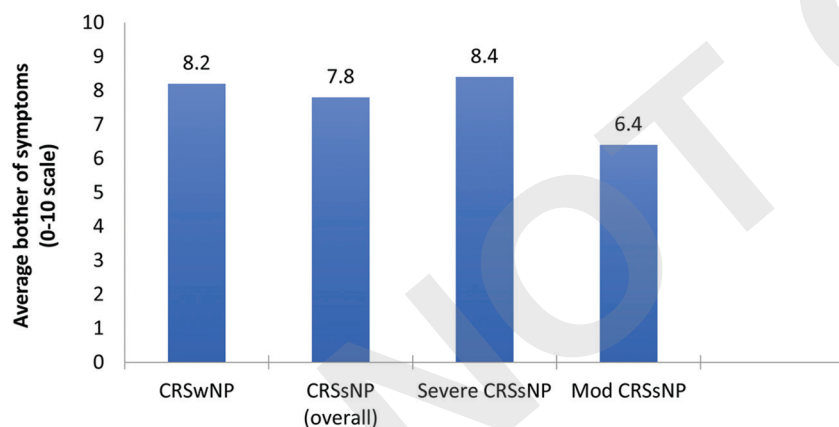


**Figure 3.** Severity of chronic rhinosinusitis (CRS) symptoms in the past 12 months. Population Survey Question 6: In the past 12 months, how bothersome have your symptoms been overall? Please use a 0–10 scale, in which 0 means “no bother at all” and 10 means “extremely bothersome.”

all” on a 0–10 point scale (“no bother” through “extreme bother”), with a mean score of 8.2 for CRSwNP, 8.4 for severe CRSsNP, and 6.4 for moderate CRSsNP (Fig. 3).

Adverse impact in multiple areas of daily life were reported, with the greatest effects on sleep and mood. The worst scores were reported by the patients with CRSwNP, followed by severe CRSsNP.

Other domains were also negatively affected including work and/or school, social activities, exercise, and recreation, with a mean score >5 (0–10 scale: 0, “not at all affected”; 10, “completely affected”) in all the categories for both CRSwNP and severe CRSsNP (Fig. 4). Patients with CRSwNP and patients with severe CRSsNP reported 13 and 6 days of absenteeism, respectively, and 29 and 18 days of presenteeism, respectively, during the preceding 12 months. Patients with CRS reported high health-care use, with 58% of respondents categorized as CRSwNP or severe CRSsNP reported five or more physician visits for nasal and sinus symptoms in the past 12 months. Both the CRSwNP and severe CRSsNP groups also self-reported more ED

visits or overnight hospitalizations than the moderate CRSsNP group (Table 2).

### Previous Treatment

A substantial proportion of patients with CRS reported previous medical or surgical intervention for CRS symptoms (Table 3). For example, more than half of the patients (52.2%) categorized as having CRSwNP and 14.7% categorized as having CRSsNP reported previous nasal surgery. Among the patients with CRSwNP, 92.5% reported previous steroid nasal spray use and 71.2% had used oral steroids in the past 12 months. Among the patients with CRSsNP, 87.1% reported treatment with steroid nasal spray and 34.9% with oral steroids in the past 12 months.

The patients also reported that the intranasal steroids they used were suboptimal, with an overwhelming majority of patients with CRSwNP and patients with severe CRSsNP (86–87%) reporting frustration due to inadequate symptom relief (Fig. 5). In addition to ineffectiveness, the respondents also reported subopti-

**Figure 4.** Impact of chronic rhinosinusitis (CRS) symptoms on daily activities. The participants were asked the following: In the past 12 months, when you had these symptoms, on a typical day, how much did these affect you in the following areas? Please use a 0–10 scale, in which 0 means “not at all” and 10 means “completely.”

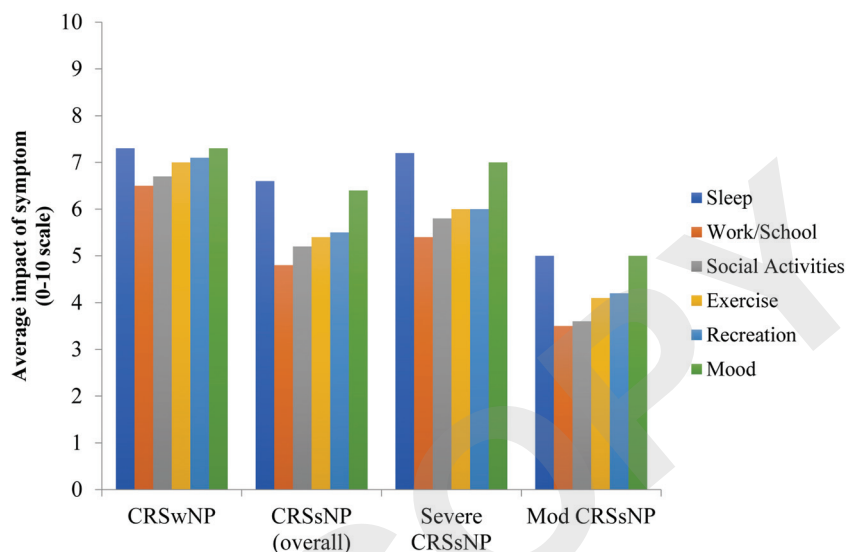


**Table 2** Patient-reported medical care sought in the past year

|          | Physician Visit and/or Prescription Medicine in the Past 12 mo, % | >5 Physician Visits in the Past 12 mo, % | 3–5 Physician Visits in the Past 12 mo, % | 1–2 Physician Visits in the Past 12 mo, % | ED and/or Overnight Hospital Visits in the Past 12 mo, % |
|----------|-------------------------------------------------------------------|------------------------------------------|-------------------------------------------|-------------------------------------------|----------------------------------------------------------|
| CRSwNP   | 99                                                                | 60                                       | 21                                        | 17                                        | 37                                                       |
| CRSsNP   |                                                                   |                                          |                                           |                                           |                                                          |
| Overall  | 93                                                                | 51                                       | 24                                        | 15                                        | 17                                                       |
| Severe   | 96                                                                | 58                                       | 23                                        | 13                                        | 20                                                       |
| Moderate | 87                                                                | 33                                       | 27                                        | 19                                        | 9                                                        |

ED = Emergency department; CRSwNP = chronic rhinosinusitis with nasal polyps; CRSsNP = chronic rhinosinusitis without nasal polyps.

**Table 3** Patient-reported treatments received for CRSwNP and CRSsNP

|          | Had Nasal or Sinus Surgery in the Past 12 mo, % | Ever Had Nasal or Sinus Surgery, % | Treated with Nasal Spray in the Past 12 mo, % | Took Oral Steroids for Nasal or Sinus Symptoms in the past 12 mo, % |
|----------|-------------------------------------------------|------------------------------------|-----------------------------------------------|---------------------------------------------------------------------|
| CRSwNP   | 8.0                                             | 52.2                               | 92.5                                          | 71.2                                                                |
| CRSsNP   |                                                 |                                    |                                               |                                                                     |
| Overall  | 1.5                                             | 14.1                               | 87.1                                          | 34.9                                                                |
| Severe   | 2.0                                             | 14.7                               | 86.3                                          | 36.3                                                                |
| Moderate | 0.3                                             | 12.8                               | 88.9                                          | 31.4                                                                |

CRSwNP = Chronic rhinosinusitis with nasal polyps; CRSsNP = chronic rhinosinusitis without nasal polyps.

mal perceived tolerance of steroid nasal sprays, with 55% who reported loss of drug down the back of the throat, 40% reported loss due to dripping out of the nose, and 41% reported dysgeusia.

In this cohort of patients who continued to meet symptom criteria for CRS, those with previous surgery reported a high rate of ongoing symptoms; although most patients reported symptom improvement after

surgery, ~80% stated that the symptoms had either not resolved or recurred.

## DISCUSSION

This large, cross-sectional, general population survey extended our understanding of the prevalence, burden of illness, and characteristics of U.S. adults who expe-

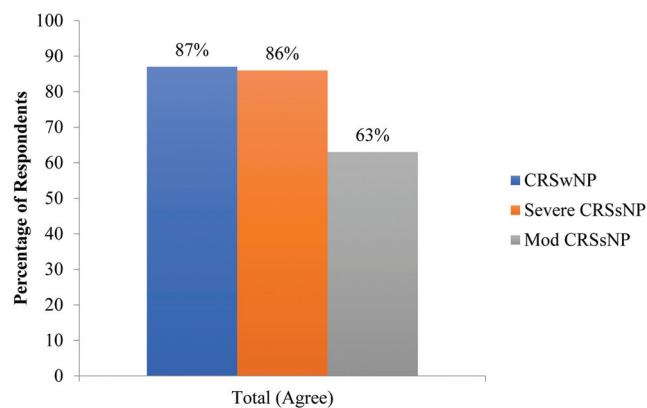


**Figure 5.** Participants frustrated with symptom relief provided by current intranasal steroid. The patients were asked the following: Please indicate how much you agree or disagree with the following statement: frustrated with symptom relief of current intranasal steroid.

rienced symptoms of CRS. The prevalence of diagnostic symptom criteria for CRS (11.5%) corresponded with ~28.7 million people. This was consistent with estimates from previous surveys and claims analyses (e.g., 12.5% total population prevalence, 9.2% for the adult population)<sup>14,17,18,22</sup> and strengthened evidence that supported the high prevalence of CRS. In addition, this study found that the respondents who reported CRS symptoms, and not already known to have nasal polyps (10.4% of the population), mostly had severe (70%) rather than moderate (30%) symptoms, and, despite extensive utilization of medical resources, most patients considered their condition to be “severe” and reported a substantial adverse effect on QoL and functioning. This was relevant because the severity of patient-perceived symptoms is not readily assessed in studies that rely on administrative data bases, which typically lack direct information on disease severity.<sup>19,20</sup> Because this study reports symptoms as experienced directly by patients, there is clinical relevance for symptoms but not the diagnostic specificity associated with physician assessment. Previous studies have found discrepancies between physician-diagnosed and self-reported CRS, with rates of physician-diagnosed CRS that vary between 1 and 9% of the general population; a European self-reporting study found 10.9% prevalence, although that study did not collect data on disease severity.<sup>16</sup>

Oral corticosteroids have broad anti-inflammatory activity and are usually helpful in this chronic inflammatory condition, although benefits are short lived after treatment discontinuation. Because of harms associated with long-course, and even short-course, oral steroids,<sup>23–26</sup> topically acting intranasal steroids are first-line therapy in multiple published guidelines.<sup>1,4,5,27</sup> There is evidence that currently available intranasal steroids (mostly nasal sprays) offer lim-

ited therapeutic benefit.<sup>28</sup> Unfortunately, a large majority of those who receive intranasal steroids (80%) report frustration due to inadequate symptom relief. The patients also reported loss of medication and sub-optimal tolerability with current steroid nasal sprays and cited medication dripping out of the nose and down the throat, and dysgeusia.

The inadequacy of current intranasal steroids is consistent with known limitations of current nasal administration (i.e., traditional nasal spray or pressurized metered-dose inhaler) that deposit drug primarily in anterior and inferior nasal regions. There is well-recognized inefficacy and variability in the ability of conventional delivery approaches to place steroids in the superior and/or posterior regions where sinuses normally drain and ventilate. This is due, for example, to the anatomically complex configuration of the nasal cavity (especially after varying surgical procedures), multiple variables that influence fluid dynamics during delivery (volume, pressure, Bernoulli forces), and significant variation in delivery technique. Together, the propensity to deliver to the wrong regions for CRS and inconsistency may seriously impair the efficacy of topical therapies for the nasal mucosa, even when the molecular mechanism of action is otherwise effective. Better results are seen when topical steroid reaches the middle meatus and enters the ostiomeatal complex of the nasal cavity, but most nasal spray delivery devices do not effectively deliver steroid to the middle meatus.<sup>29–32</sup>

The patients who had previous surgery that resolved their symptoms would not have been identified as patients with CRS in this survey; however, it is notable that, in this population-based survey, previous surgery was common and that a high proportion of patients reported incomplete symptom relief after surgery. Although numerous studies demonstrated that surgery is effective in improving symptoms and QoL in CRS,<sup>33–36</sup> a significant proportion of patients continue to use medication for symptom control after surgery, which indicates that surgical treatment alone is not sufficiently effective for many patients.

One study found that, after surgery, patients had reduced physician and facility costs, but the average cost of prescription medications to manage symptoms did not change substantially, which indicated that the need for anti-inflammatory medications, such as intranasal steroids, does not decrease after surgery.<sup>12</sup> In addition, >150,000 nasal surgeries are performed annually on patients who have previously had surgery, which indicated that an incomplete response and/or disease recurrence are not rare. One large, prospective study that investigated long-term outcomes in a cohort of 1459 patients who underwent surgery for CRS found a 5-year revision rate as high as 19.1%, with the rate for patients with CRSwNP higher than for patients with

CRSsNP (21 versus 16%).<sup>36</sup> After surgery for nasal polyps, up to 60% of patients experience recurrence.<sup>1,5,36–38</sup>

The patients with CRS in this survey also reported a substantial adverse impact on sleep, mood, work and/or school, social activities, exercise, and recreation. Compared with chronic diseases, such as congestive heart failure, angina, and chronic obstructive pulmonary disease, patients with CRS have significantly lower scores in measures of bodily pain and social functioning. Patients with CRS also have significantly worse scores on the Short Form 36-Item Health Survey compared with populations with several other chronic diseases.<sup>39</sup>

Another study demonstrated that patients with CRS have reduced QoL due to poor sleep, fatigue, acute infections, bodily pain, and impaired workplace activity.<sup>40</sup> In a cross-sectional evaluation of a multicenter cohort, the majority of patients with CRS reported poor sleep quality as measured by the Pittsburgh Sleep Quality Index survey.<sup>41</sup> Individuals with CRS were found to have a much higher incidence of sleep dysfunction (75%) compared with both the general population (15–35%) and individuals with other chronic diseases (50–59%). Consistent poor sleep impacts an individual's performance, QoL, and mortality, and increases the likelihood of comorbid depression, among other adverse consequences.<sup>42</sup>

This survey found high health-care resource utilization in CRSwNP and severe CRSsNP, with increased physician visits for nasal and/or sinus symptoms and more ED visits and overnight hospitalizations. Previous research supports the finding of high resource utilization in CRS related to total health care, office-based care, prescriptions (notably antibiotic use, which carries unique risks related to emergence of resistance), and self-expended costs.<sup>43,44</sup>

In this survey, individuals with CRSwNP and those with severe CRSsNP also reported the loss of productivity due to absenteeism (13 and 6 days, respectively) and presenteeism (28 and 18 days, respectively). These findings are supported by a prospective, multi-institutional, observational cohort study by using 2012 U.S. National Census<sup>45</sup> and 2013 U.S. Department of Labor Statistics data, in which CRS was found to have a high productivity cost. The mean days of work lost to absenteeism for individuals with CRS was 24.6 days per year, and the mean days of work lost to presenteeism for individuals with CRS was 38.8 days per year. The overall annual per-patient productivity cost for individuals with CRS was \$10,077. CRS had higher annual productivity costs than other common diseases.<sup>45</sup>

### Strengths and Limitations

This cross-sectional, general-population survey confirmed the high prevalence (11.5%) of CRS symptoms

in U.S. adults as well as the high burden of illness. This direct population-based survey accessed a representative sample of the U.S. population and included questions regarding the burden of illness and disease characteristics. The analyses presented rely on self-reported data, which is both a strength and a limitation. This study did not rely on administrative data bases and avoided limitations associated with data bases gathered for billing or other nonresearch purposes. CRS case identification was based on symptoms and did not include objective evidence of disease, such as nasal endoscopy or computed tomography. Thus, the studied population, although having the reported symptoms and their consequences, may not precisely correspond to populations identified when using both symptom and objective criteria. Lastly, the requirement for 8 weeks of symptoms was based on older criteria for diagnosis rather than the more recently accepted criteria of 12 weeks.<sup>1,5</sup>

### CONCLUSION

Based on a large epidemiologic survey, it is estimated that ~28.7 million people in the United States, or 11.5% of the adult population, have severe or moderate CRS. Despite extensive use of medical resources, the patients with CRS reported a substantial medical, physical, and emotional burden that was frequently not adequately alleviated with current treatment options. At the population level, there is a substantial need for improvement in the care of CRS.

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