Sinonasal Disease
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
1. Blackwell DL, Lucas JW, Clarke TC. Summary health statistics for U.S. adults: national health interview survey, 2012. *Vital Health Stat 10.* 2014(260):1-161.	Review/Other-Dx	34,525 adults	To present detailed tables from the 2012 National Health Interview Survey (NHIS) for the civilian noninstitutionalized adult population, classified by sex, age, race and Hispanic origin, education, current employment status, family income, poverty status, health insurance coverage, marital status, and place and region of residence.	In 2012, 61% of adults aged 18 and over had excellent or very good health. 11% of adults had been told by a doctor or other health professional that they had heart disease, 24% had been told on 2 or more visits that they had hypertension, 9% had been told that they had diabetes, and 21% had been told that they had some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia. 18% of adults were current smokers and 21% were former smokers. Based on estimates of body mass index, 35% of adults were overweight and 28% were obese.	4
2. Smith KA, Orlandi RR, Rudmik L. Cost of adult chronic rhinosinusitis: A systematic review. *Laryngoscope.* 2015;125(7):1547-1556.	Review/Other-Tx	N/A	To summarize the literature evaluating the costs associated with the management of adult CRS using Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines.	44 studies were identified for inclusion. The range for overall CRS-related healthcare costs was $6.9 to $9.9 billion 2014 USD per year. Indirect costs were estimated as $13 billion 2014 USD per year. Annual medication costs prior to ESS ranged between $1,547 and $2,700 2014 USD per patient, with a uniform reduction in costs after ESS. The overall US cost of outpatient ESS ranged from $8,200 to $10,500 2014 USD per case. The overall annual economic burden of CRS in the United States was estimated to be $22 billion 2014 USD (direct and indirect costs).	4
3. Anzai Y, Weymuller EA, Jr., Yueh B, Maronian N, Jarvik JG. The impact of sinus computed tomography on treatment decisions for chronic sinusitis. *Arch Otolaryngol Head Neck Surg.* 2004;130(4):423-428.	Observational-Dx	27 patients; 3 observers	Prospective cohort study in a medical center to determine the impact of sinus CT on treatment decisions by otolaryngologists and to explore the factors leading to choice of surgical treatment for patients suspected of having chronic sinusitis.	The treatment decisions were changed in 9/27 patients after the sinus CT scans were reviewed. Agreement of treatment decisions among the 3 surgeons was improved after they reviewed sinus CT scans. Study concludes that decision to perform surgery was changed by CT in a substantial number of patients.	3
4. Batra PS. Radiologic imaging in rhinosinusitis. *Cleve Clin J Med.* 2004;71(11):886-888.	Review/Other-Dx	N/A	To review imaging options and their recommended use in rhinosinusitis.	Imaging of rhinosinusitis is important in patients whose condition is refractory to treatment and those with chronic or recurrent acute rhinosinusitis or acute rhinosinusitis with complications.	4
5. Anand VK. Epidemiology and economic impact of rhinosinusitis. *Ann Otol Rhinol Laryngol Suppl.* 2004;193:3-5.	Review/Other-Dx	N/A	To review data regarding the epidemiology and economic impact of rhinosinusitis.	Rhinosinusitis is common in the United States (16% of the adult population is affected annually). It also has a huge economic burden.	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
6. Anzai Y, Yueh B. Imaging evaluation of sinusitis: diagnostic performance and impact on health outcome. *Neuroimaging Clin N Am.* 2003;13(2):251-263, xi.	Review/Other-Dx	N/A	To review role of imaging in diagnosis and treatment of sinusitis.	Sinus CT is the primary imaging modality and may provide pivotal objective information that affects treatment decisions for acute and chronic sinusitis.	4
7. Rosenfeld RM. Clinical practice guideline on adult sinusitis. *Otolaryngol Head Neck Surg.* 2007;137(3):365-377.	Review/Other-Dx	N/A	To alert clinicians to key evidence-based statements in a multidisciplinary, clinical practice guideline on adult sinusitis.	No results stated in abstract.	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
8. Rosenfeld RM, Piccirillo JF, Chandrasekhar SS, et al. Clinical practice guideline (update): adult sinusitis. *Otolaryngol Head Neck Surg.* 2015;152(2 Suppl):S1-S39.	Review/Other-Tx	N/A	This guideline provides evidence-based recommendations on managing sinusitis.	The panel made strong recommendations that 1) clinicians should distinguish presumed ABRS from acute rhinosinusitis caused by viral upper respiratory infections and noninfectious conditions, and should diagnose ABRS when (a) symptoms or signs of acute rhinosinusitis are present 10 days or more beyond the onset of upper respiratory symptoms, or (b) symptoms or signs of acute rhinosinusitis worsen within 10 days after an initial improvement (double worsening), and 2) the management of ABRS should include an assessment of pain.. The panel made a recommendation against radiographic imaging for patients who meet diagnostic criteria for acute rhinosinusitis; unless a complication or alternative diagnosis is suspected. Recommendations that 1) if a decision is made to treat ABRS with an antibiotic agent, the clinician should prescribe amoxicillin as first-line therapy for most adults, 2) if the patient worsens or fails to improve with the initial management option by 7 days, should reassess the patient to confirm ABRS, exclude other causes of illness, and detect complications, 3) should distinguish CRS and recurrent acute rhinosinusitis from isolated episodes of ABRS and other causes of sinonasal symptoms, 4) should assess the patient with CRS or recurrent acute rhinosinusitis for factors that modify management, such as allergic rhinitis, cystic fibrosis, immunocompromised state, ciliary dyskinesia, and anatomic variation, 5) should corroborate a diagnosis and/or investigate for underlying causes of CRS and recurrent acute rhinosinusitis, 6) should obtain CT of the paranasal sinuses in diagnosing or evaluating a patient with CRS or recurrent acute rhinosinusitis, and 7) should educate/counsel patients with CRS or recurrent acute rhinosinusitis regarding control measures.	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
9. Mafee MF, Tran BH, Chapa AR. Imaging of rhinosinusitis and its complications: plain film, CT, and MRI. *Clin Rev Allergy Immunol.* 2006;30(3):165-186.	Review/Other-Dx	N/A	To provide an overview of modalities used to image rhinosinusitis.	No results stated in abstract.	4
10. Basu S, Georgalas C, Kumar BN, Desai S. Correlation between symptoms and radiological findings in patients with chronic rhinosinusitis: an evaluation study using the Sinonasal Assessment Questionnaire and Lund-Mackay grading system. *Eur Arch Otorhinolaryngol.* 2005;262(9):751-754.	Observational-Dx	22 patients; 2 observers	To assess the correlation between preoperative symptom scores using the validated Sino-Nasal Assessment Questionnaire (SNAQ) and CT scores in patients undergoing ESS.	No statistically significant correlation between SNAQ and Lund-Mackay scores (P=0.5), but there was a very strong correlation (P<0.001) between the scoring of scans by the 2 observers, while there was a moderate degree of discrepancy in the grading of anterior ethmoid sinuses and osteo-meatal complexes. Significant inter-rater variability exists in the grading of pathological changes in anterior ethmoid sinus and osteo-meatal complex as recorded in CT scans.	3
11. Bhattacharyya N. A comparison of symptom scores and radiographic staging systems in chronic rhinosinusitis. *Am J Rhinol.* 2005;19(2):175-179.	Observational-Dx	200 patients	Prospective study to determine if 1 of the popular CT scan staging systems (Kennedy, Harvard, and Lund) shows better correlation with sinonasal symptom severity in CRS.	Mean Lund score for all patients was 10.0 (standard deviation, 5.3). The Kennedy stage distributions were 40, 42, 84, and 34 patients for stages 1-4, respectively. The Harvard stage distributions were 17, 53, 85, and 45 patients for stages 1-4, respectively. Lund staging system had the best correlation between nasal symptom scores and CT stage in CRS, although the degree of correlation was small. All 3 systems were lacking in staging value for non-nasal sinonasal symptoms.	3
12. Bhattacharyya T, Piccirillo J, Wippold FJ, 2nd. Relationship between patient-based descriptions of sinusitis and paranasal sinus computed tomographic findings. *Arch Otolaryngol Head Neck Surg.* 1997;123(11):1189-1192.	Observational-Dx	221 patients	To prospectively compare paranasal sinus symptoms with coronal CT findings in a blinded study.	Sino-Nasal Outcome Test-20 (SNOT-20) scores ranged from 0 (normal) to 78 (mean=34). CT scores ranged from 0 (normal) to 24 (mean=4.07). 75 patients (34%) had normal findings on the CT scan. The SNOT-20 and CT scores failed to significantly correlate (r=0.11, P≤.09). When the subset of patients with "positive" or "very positive" CT scans were considered, no significant correlation was observed (r=0.12, P≤.16). For the 132 patients with facial pain, the mean CT score was lower than for patients without facial pain (3.78 vs 4.78, P=.21). Study recommends that CT be reserved for delineating the anatomy and pattern of inflammatory paranasal disease prior to surgical intervention.	3

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
13. Cousin JN, Har-El G, Li J. Is there a correlation between radiographic and histologic findings in chronic sinusitis? *J Otolaryngol.* 2000;29(3):170-173.	Observational-Dx	60 patients 131 sinuses	Retrospective analysis to determine if the degree of radiologic changes noted on CT scan correlate with the severity of histologic changes.	Of 51 ethmoid sinuses, agreement between the radiographic and histologic grading occurred in 32 (62.7%). In the maxillary group, a 57.1% (24/42) correlation was noted. Of the 20 frontal sinuses, agreement occurred in 8 or 40%, whereas, a 22.2% (4/18) correlation was present in the sphenoid group. Study suggests that the severity of sinus disease based on preoperative CT scan does not correlate with the histologic degree of disease.	4
14. Devaiah AK. Adult chronic rhinosinusitis: diagnosis and dilemmas. *Otolaryngol Clin North Am.* 2004;37(2):243-252, v.	Review/Other-Dx	N/A	To review criteria for diagnosing adult CRS and problems involved in using criteria.	Study suggests that a careful assessment of different subjective and objective measures together may improve diagnostic accuracy. Nasal endoscopy and CT are objective measures that can increase accuracy. Endoscopic observation of pus, polyps, or other significant mucosal derangements helps solidify the diagnosis. CT staging systems can improve reliability of disease detection. The most accurate method of CRS diagnosis may be outlining specific criteria for objective studies in the context of subjective patient symptoms.	4
15. Hwang PH, Irwin SB, Griest SE, Caro JE, Nesbit GM. Radiologic correlates of symptom-based diagnostic criteria for chronic rhinosinusitis. *Otolaryngol Head Neck Surg.* 2003;128(4):489-496.	Observational-Dx	125 consecutive patients	Prospective blinded study to evaluate correlations between the Task Force on Rhinosinusitis (TFR) diagnostic criteria and radiologic findings on sinus CT scans.	115/125 patients met symptom criteria for CRS. 40/115 had negative scans despite meeting the diagnostic criteria for rhinosinusitis. 75/115 had positive scans. Of the 10 patients who had negative diagnoses for rhinosinusitis, 9 had a positive CT scan. The Kappa coefficient was –0.103 (±95% CI, –0.201 to –0.004), indicating poor agreement between CRS positivity and CT positivity. The sensitivity of TFR criteria for detecting a positive scan was 89%, but the specificity was 2%.	3

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
16. Kenny TJ, Duncavage J, Bracikowski J, Yildirim A, Murray JJ, Tanner SB. Prospective analysis of sinus symptoms and correlation with paranasal computed tomography scan. *Otolaryngol Head Neck Surg.* 2001;125(1):40-43.	Observational-Dx	273 patients	Prospective blinded study to determine if a correlation exists between the severity of sinus symptoms and the severity of paranasal CT scan.	Severity of 5 symptoms (fatigue, sleep disturbance, nasal discharge, nasal blockage, decreased sense of smell) correlated with severity of disease on CT scan. Headache and facial pain or pressure had no correlation. Study concludes that the certainty of a clinical diagnosis of rhinosinusitis requiring treatment is enhanced in patients with high severity scores for the 5 symptoms.	3
17. Wabnitz DA, Nair S, Wormald PJ. Correlation between preoperative symptom scores, quality-of-life questionnaires, and staging with computed tomography in patients with chronic rhinosinusitis. *Am J Rhinol.* 2005;19(1):91-96.	Observational-Dx	221 patients	Prospective cohort study to evaluate the correlation between preoperative symptoms, quality-of-life questionnaires (CSS survey and SNOT-20), and staging with CT in patients with CRS.	No significant correlation between the SNOT-20 questionnaire and the Lund-MacKay CT score (P=0.026; P=0.764) and between the CSS and the Lund-MacKay CT score (P= –0.158; P=0.058). No significant correlation between a single visual analog scale symptom score relating to overall sinonasal symptom severity and the Lund-MacKay CT scan score (P=0.135; P=0.121). Weak but statistically significant correlation was found between the visual analog scale score based on the sum of 5 sinonasal symptoms and the Lund-MacKay CT scan score (P=0.197; P=0.020).	3
18. Gwaltney JM, Jr., Phillips CD, Miller RD, Riker DK. Computed tomographic study of the common cold. *N Engl J Med.* 1994;330(1):25-30.	Review/Other-Dx	31 patients complete evaluation; 79 patients no CT scan	Examine adult volunteers with self-diagnosed colds of 48 to 96 hours' duration for: information on symptoms, CT studies of the nasal passages and sinuses, mucosal-transport times, measures of nasal-airway resistance, and viral-culture studies.	Common cold is associated with frequent and variable anatomical involvement of the upper airways, including occlusion and abnormalities in the sinus cavities.	4
19. Holbrook EH, Brown CL, Lyden ER, Leopold DA. Lack of significant correlation between rhinosinusitis symptoms and specific regions of sinus computer tomography scans. *Am J Rhinol.* 2005;19(4):382-387.	Review/Other-Dx	94 patients	To examine correlation between rhinosinusitis symptoms and specific regions of sinus CT scans.	There was no correlation when total Lund-MacKay scores, opacification of individual sinuses, and size of the agger nasi and ethmoid bulla cells were compared with Rhinosinusitis Outcome Measure 31 subset scores and areas of facial pain or pressure. Study concludes that although sinus CT scan is a necessary tool for preoperative planning, it should not be used to predict symptoms or to localize areas responsible for facial pain or pressure.	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
20. Wittkopf ML, Beddow PA, Russell PT, Duncavage JA, Becker SS. Revisiting the interpretation of positive sinus CT findings: a radiological and symptom-based review. *Otolaryngol Head Neck Surg.* 2009;140(3):306-311.	Review/Other-Dx	50 consecutive patients	Retrospective cross-sectional survey was performed to compare sinus CT scan findings of asymptomatic, acutely symptomatic, and chronically symptomatic patients. To establish whether positive sinus CT scan findings, as defined by a Lund-Mackay score greater than zero, are indeed commonly present in asymptomatic patients. Patients from three study groups were reviewed. Group 1 consisted of patients without any sinus symptoms. Group 2 consisted of patients with acute headache symptoms. Group 3 consisted of patients with complaints consistent with chronic sinusitis.	In the asymptomatic patient group (group 1), 6 (3%) patients had positive sinus CT scan findings, compared with 11 (5.5%) in the acutely symptomatic group (group 2), and 32 (64%) in the chronically symptomatic group (group 3). In the chronically symptomatic group (group 3), 64% of patients were allergic compared with 18% of the acute headache group (group 2) and 8% of the asymptomatic patient group (group 1). Results suggest that symptomatic sinus patients are much more likely to have positive sinus CT scan findings than asymptomatic patients. Conversely, normal healthy patients should not be expected to have abnormal sinus CT scans.	4
21. Huang BY, Senior BA, Castillo M. Current Trends in Sinonasal Imaging. *Neuroimaging Clin N Am.* 2015;25(4):507-525.	Review/Other-Dx	N/A	To review current trends and potential future directions in the use of these modalities for sinus imaging.	No results stated in abstract.	4
22. Lau J, Zucker D, Engels EA, Balk E, et al. *Diagnosis and treatment of acute bacterial rhinosinusitis. Evidence Report/Technology Assessment No. 9 (Contract 290-97-0019 to the New England Medical Center).* Rockville, MD: Agency for Health Care Policy and Research; March 1999.	Review/Other-Dx	N/A	To summarize the published evidence on the diagnosis and treatment of community-acquired acute bacterial rhinosinusitis in children and adults.	In a meta-analysis of 6 placebo controlled trials, antibiotics reduced the incidence of clinical failures by one-half (risk ratio, 0.54; 95% CI, 0.37 to 0.79), although about two-thirds of the patients improved by 14 days without antibiotics. The risk of clinical failure did not differ significantly between amoxicillin (14 trials, RR, 0.85; 95% CI, 0.62 to 1.17) or folate inhibitors (eg, trimethoprim/sulfamethoxazole) (9 trials, RR, 1.01; 95% CI, 0.52 to 1.97) and newer, more expensive antibiotics. No serious complications from lack of treatment were reported.	4
23. Aalokken TM, Hagtvedt T, Dalen I, Kolbenstvedt A. Conventional sinus radiography compared with CT in the diagnosis of acute sinusitis. *Dentomaxillofac Radiol.* 2003;32(1):60-62.	Observational-Dx	47 consecutive patients	Prospective study to evaluate the accuracy of radiography in patients with clinical suspicion of acute sinusitis, using standard CT as a gold standard.	Specificity of radiographic examination was high, but sensitivity was low except for the maxillary sinus (sensitivity 80%). The sensitivity of radiography for detecting sinus opacifications was unacceptably low for the ethmoid, frontal and sphenoid sinuses.	2
24. Campbell PD, Jr., Zinreich SJ, Aygun N. Imaging of the paranasal sinuses and in-office CT. *Otolaryngol Clin North Am.* 2009;42(5):753-764, vii.	Review/Other-Dx	N/A	Discuss imaging of the paranasal sinuses and in-office CT.	Latest development in CT technology, CBCT instrumentation, may change the way imaging of the nasal cavity and paranasal sinuses is performed in the future.	4

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25. Levin DC, Rao VM. Turf wars in radiology: the overutilization of imaging resulting from self-referral. *J Am Coll Radiol.* 2004;1(3):169-172.	Review/Other-Dx	N/A	To summarize the evidence that self-referral inevitably leads to much higher utilization of imaging services and that much of this increased utilization is unnecessary and wasteful.	Studies have consistently shown that when nonradiologist physicians operate their own imaging equipment and have the opportunity to self-refer, their utilization is substantially higher than among other physicians who refer their patients to radiologists. It has also been shown that the vast bulk of the recent increases in imaging utilization are attributable to nonradiologists who self-refer.	4
26. Levin DC, Rao VM, Parker L, Frangos AJ, Sunshine JH. Ownership or leasing of CT scanners by nonradiologist physicians: a rapidly growing trend that raises concern about self-referral. *J Am Coll Radiol.* 2008;5(12):1206-1209.	Review/Other-Dx	N/A	To examine recent nationwide trends in the ownership or leasing of CT scanners in private offices by nonradiologist physicians.	From 2001 to 2006, Medicare private-office CT scan volume in facilities owned by radiologists increased by 85%. CT scan volume in facilities owned or leased by nonradiologist physicians as a group increased by 263%. The nonradiologic specialties with the largest volumes in 2006 were primary care (192,255 scans), internal medicine subspecialties other than cardiology and medical oncology (184,991 scans), urology (125,850 scans), cardiology (104,739 scans), and medical oncology (61,976 scans). Excluding CT scans performed in independent diagnostic testing facilities (for which physician ownership cannot be determined), nonradiologists' private-office CT market share rose from 16% in 2001 to 28% in 2006. Majority of Medicare private-office CT scans are done in facilities owned by radiologists. However, nonradiologist physicians are acquiring or leasing CT scanners in increasing numbers, and the growth trend is much more rapid among them than it is among radiologists (85% among radiologists from 2001 to 2006, compared with 263% among nonradiologists). As a result, nonradiologists' market share has increased considerably.	4
27. Miracle AC, Mukherji SK. Conebeam CT of the head and neck, part 1: physical principles. *AJNR Am J Neuroradiol.* 2009;30(6):1088-1095.	Review/Other-Dx	N/A	To address the physical principles underlying CBCT imaging as it is used in dedicated head and neck scanners.	No results stated in abstract.	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
28. Miracle AC, Mukherji SK. Conebeam CT of the head and neck, part 2: clinical applications. *AJNR Am J Neuroradiol.* 2009;30(7):1285-1292.	Review/Other-Dx	N/A	To explore the clinical applications in the dentomaxillofacial and head and neck regions, with particular emphasis on diagnostic imaging of the sinuses, temporal bone, and craniofacial structures.	N/A	4
29. Fakhran S, Alhilali L, Sreedher G, et al. Comparison of simulated cone beam computed tomography to conventional helical computed tomography for imaging of rhinosinusitis. *Laryngoscope.* 2014;124(9):2002-2006.	Observational-Dx	361 patients	To determine how often clinically important findings would be missed if CBCT was used routinely for sinus imaging.	Maxillofacial CTs from 361 consecutive patients were included, of which 12 (3.3%) demonstrated findings that would have been missed on the theoretical CBCT. Of those, 4 (1.1%) would have resulted in a change in management. Effective radiation dose for our scanners ranged from 0.67 mSv to 2.15 mSv, compared to a published estimated dose of 0.2 mSV for CBCT.	3
30. Kaszuba SM, Stewart MG. Medical management and diagnosis of chronic rhinosinusitis: A survey of treatment patterns by United States otolaryngologists. *Am J Rhinol.* 2006;20(2):186-190.	Review/Other-Dx	80 members of the American Academy of Otolaryngology-Head and Neck Surgery	To identify current patterns of diagnostic criteria and medical treatment for CRS by otolaryngologists in the United States.	The overall response rate was 40.0%. Of respondents, 73% defined CRS as lasting >12 weeks. 73% also believed radiological imaging was necessary for definitive diagnosis, but only 30% believed nasal endoscopy was necessary. Regarding treatment, respondents reported use of oral antibiotics (94%) and nasal corticosteroids (94%) as part of maximum medical management; oral decongestants, oral mucoevacuants, and allergy testing were used only by about one-half of the respondents, and less frequently topical decongestants (38%), oral corticosteroids (36%), and oral antihistamines (27%) were used. Oral corticosteroids were more likely to be used by specialists that self-classified as rhinologists than by other otolaryngologists (P=0.005), but rhinologists were less likely to use radiological imaging (P=0.04) as a diagnostic criterion. Pediatric otolaryngologists used allergy testing in medical management more frequently than other otolaryngologists (P<0.001). Overall, the basis for choice of maximal medical management was personal clinical experience (74%), rather than clinical research results or expert recommendations.	4

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31. Dykewicz MS, Hamilos DL. Rhinitis and sinusitis. *J Allergy Clin Immunol.* 2010;125(2 Suppl 2):S103-115.	Review/Other-Tx	N/A	To describe the pathophysiology, symptoms, differential diagnosis; symptoms, treatments and management of rhinitis and sinusitis as well as the association to each other.	No results stated in abstract.	4
32. Peters AT, Spector S, Hsu J, et al. Diagnosis and management of rhinosinusitis: a practice parameter update. *Ann Allergy Asthma Immunol.* 2014;113(4):347-385.	Review/Other-Tx	N/A	To update a practice parameter.	No results stated in abstract.	4
33. Aribandi M, McCoy VA, Bazan C, 3rd. Imaging features of invasive and noninvasive fungal sinusitis: a review. *Radiographics.* 2007;27(5):1283-1296.	Review/Other-Dx	N/A	To review imaging features of invasive and noninvasive fungal sinusitis.	Fungal sinusitis can be noninvasive or invasive with 5 major subtypes. The subtypes have different clinical and radiologic features with different treatment strategies and prognoses. Important for radiologist to know the subtypes and radiologic features.	4
34. Bhattacharyya N. Clinical and symptom criteria for the accurate diagnosis of chronic rhinosinusitis. *Laryngoscope.* 2006;116(7 Pt 2 Suppl 110):1-22.	Observational-Dx	703 patients	Prospective, double-blinded study to define clinically based diagnostic criteria and to determine a classification scheme that would allow for the accurate diagnosis of CRS.	The diagnosis of CRS based on symptom criteria is difficult because most symptoms (except dysosmia) do not distinguish between radiographically normal and diseased patients. Classification analysis showed that presence of polyps, absence of dental pain, and low congestion/obstruction scores in the presence of dental pain predicted true CRS.	3
35. Bhattacharyya N, Fried MP. The accuracy of computed tomography in the diagnosis of chronic rhinosinusitis. *Laryngoscope.* 2003;113(1):125-129.	Observational-Dx	171 consecutive patients; 130 control group	Prospective dual cohort study to determine the sensitivity, specificity, and diagnostic accuracy of CT in the diagnosis of CRS.	In the disease-positive group of patients with CRS, the mean Lund score was 9.8 (95% CI, 9.0-10.6). The mean inflammatory grade on histopathological study was 2.3 (range, 0-4). For the control group (without disease), the mean Lund score was 4.3 (95% CI, 3.5-5.0). Sinus CT showed sensitivity of 94%, specificity of 41% for selecting a Lund score cut-off value of greater than 2 as abnormal. Increasing cut-off value to 4 changed the sensitivity to 85%, and specificity to 59%. Study concluded that combining CT with history and physical findings may help in the diagnostic accuracy of CRS.	3

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36. Rosenfeld RM, Andes D, Bhattacharyya N, et al. Clinical practice guideline: adult sinusitis. *Otolaryngol Head Neck Surg.* 2007;137(3 Suppl):S1-31.	Review/Other-Dx	N/A	To provide a guideline on adult sinusitis to improve diagnosis of adult rhinosinusitis, reduce inappropriate antibiotic use, reduce inappropriate use of radiographic imaging, and promote appropriate use of ancillary tests (nasal endoscopy, CT, testing for allergy and immune function).	Panel did not recommend radiographic imaging for patients who meet diagnostic criteria for acute rhinosinusitis; unless a complication or alternative diagnosis is suspected. Recommends that clinician obtain CT of the paranasal sinuses in diagnosing or evaluating a patient with CRS or recurrent acute rhinosinusitis.	4
37. Tahamiler R, Canakcioglu S, Ogreden S, Acioglu E. The accuracy of symptom-based definition of chronic rhinosinusitis. *Allergy.* 2007;62(9):1029-1032.	Observational-Dx	768 patients	To study, verify and evaluate the accuracy of the symptom-based definition of chronic sinusitis and compare this with objective tests.	73.15% of the non-allergic patients with symptom-based diagnosed chronic sinusitis and 65.34% of the allergic patients with symptom-based diagnosed chronic sinusitis had no CT and endoscopic pathology (Endoscopic score 0 + CT score 0).	3
38. Zinreich SJ. Imaging for staging of rhinosinusitis. *Ann Otol Rhinol Laryngol Suppl.* 2004;193:19-23.	Review/Other-Dx	N/A	To review rhinosinusitis staging systems utilizing CT techniques.	MRI is good for displaying soft tissue resolution and is superior in demonstrating the presence of neoplasia and fungal sinusitis, but has limited advantages over CT scanning in demonstrating the regional anatomy (bony structure) and in the diagnosis of CRS. CT provides greater detailed information about the paranasal sinuses than radiographs.	4
39. Shpilberg KA, Daniel SC, Doshi AH, Lawson W, Som PM. CT of Anatomic Variants of the Paranasal Sinuses and Nasal Cavity: Poor Correlation With Radiologically Significant Rhinosinusitis but Importance in Surgical Planning. *AJR Am J Roentgenol.* 2015;204(6):1255-1260.	Review/Other-Dx	192 sinus CT examinations	To determine the incidence of sinonasal anatomic variants and to assess their relation to sinonasal mucosal disease.	The most common normal variants were nasal septal deviation, Agger nasi cells, and extension of the sphenoid sinuses into the posterior nasal septum. We found no statistically significant difference in the prevalence of any of the studied anatomic variants between patients with minimal and those with clinically significant paranasal sinus or nasal cavity disease.	4
40. Leiva-Salinas C, Flors L, Gras P, et al. Dental flat panel conebeam CT in the evaluation of patients with inflammatory sinonasal disease: Diagnostic efficacy and radiation dose savings. *AJNR Am J Neuroradiol.* 2014;35(11):2052-2057.	Observational-Dx	40 patients	To assess the diagnostic validity, image quality, and radiation-dose savings of dental CBCT in the evaluation of patients with suspected inflammatory disorders of the paranasal sinuses.	All dental CBCT scans were judged of diagnostic quality. Compared with CT, the CBCT image noise was 37.3% higher (P<.001) and the signal to noise ratio of the bone was 75% lower (P<.001). The effective dose of our CBCT protocol was 23 muSv. Compared with CT, the absorbed radiation dose to the lenses and parotid and thyroid glands with CBCT was 4%, 7.8%, and 7.3% of the dose delivered to the same organs by conventional CT (P<.001).	3

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
41. Nunes CA, Guedes OA, Alencar AH, Peters OA, Estrela CR, Estrela C. Evaluation of Periapical Lesions and Their Association with Maxillary Sinus Abnormalities on Cone-beam Computed Tomographic Images. *J Endod.* 2016;42(1):42-46.	Review/Other-Dx	143 patients	To evaluate the association between the clinical characteristics of periapical lesions (presence, size, and distance) in maxillary posterior teeth and the presence of sinus abnormalities by evaluating CBCT images obtained from an archived collection.	Most sinus abnormalities were associated with at least 1 maxillary posterior tooth with a periapical lesion (P>.05). The most frequent sinus abnormality in the presence of a periapical lesion was mucosal thickening. All teeth with a CBCT periapical index score of 5 were associated with sinus abnormalities. The highest frequency of abnormalities was found when the radiolucent area was subjacent to the sinus floor.	4
42. Fraczek M, Guzinski M, Morawska-Kochman M, Nelke KH, Krecicki T. Nasal endoscopy: an adjunct to patient selection for preoperative low-dose CT examination in chronic rhinosinusitis. *Dentomaxillofac Radiol.* 2016;45(8):20160173.	Experimental-Dx	134 patients. Note: A cadaver head was used to discover institutional minimum acceptable CT image quality and scanning settings.	To assess the usefulness of nasal endoscopy in the selection of patients under preoperative care for low-dose CT examination.	Image quality was similar in low-dose and standard dose groups in patients without polyps. The quality of 13% of scans from patients with polyps from the low-dose group and 4% from the standard dose group was in the range from moderate to poor. The quality of scans obtained with low milliamperes second values worsened in patients with polyps in the middle meatus, but the difference was particularly pronounced compared with standard dose among subjects with Lildholdt's score above 2 (P<0.001). Correlation with LKES revealed that changes other than polyps (ie, discharge, oedema, scaring or crusting) in the nasal cavity alone do not affect the image quality. Interobserver agreement in both groups was very high.	1
43. Dillon WP, Som PM, Fullerton GD. Hypointense MR signal in chronically inspissated sinonasal secretions. *Radiology.* 1990;174(1):73-78.	Review/Other-Dx	6 Patients	To examine chronically obstructed sinuses with CT and MRI prior to surgical decompression.	In all 6 patients, hypointense signal was present on all MR sequences despite CT evidence of the presence of high-attenuation material filling the sinus. At surgery, all specimens were viscid or pastelike with no evidence of hemorrhagic products as a cause for the MR findings.	4

Sinonasal Disease
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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
44. Lin HW, Bhattacharyya N. Diagnostic and staging accuracy of magnetic resonance imaging for the assessment of sinonasal disease. *Am J Rhinol Allergy.* 2009;23(1):36-39.	Observational-Dx	89 patients	Randomized blinded study to determine the correlation between CT- and MRI-based staging and diagnosis of CRS.	The mean Lund scores were 2.3 +/- 0.6 (95% CI) for CT-based staging and 2.1 +/- 0.5 for MRI-based staging with a median time interval between scans of 3 days. The difference means was not statistically significant (P=0.444, paired t-test). Correlation analysis revealed a significant association between CT- and MRI-based scores (Pearson's r = 0.837, P<0.001). Disease classification agreement analysis using published Lund score cutoffs (3 vs 4) for the likelihood of true sinus disease revealed that CT- and MRI-based scoring agreed on 76 cases (85.4%). Disagreement occurred in 13 cases (kappa: 0.557, P<0.001). Sensitivity, specificity, PPV, and NPV were 66.7%, 90.1%, 63.2%, and 91.4%, respectively. Lund-Mackay staging of sinus disease by MRI is closely correlated to corresponding staging based on CT. MRI does not significantly overstage or overclassify patients with sinus disease.	2
45. Saylam G, Gorgulu O, Korkmaz H, Dursun E, Ortapamuk H, Eryilmaz A. Do single-photon emission computerized tomography findings predict severity of chronic rhinosinusitis: a pilot study. *Am J Rhinol Allergy.* 2009;23(2):172-176.	Observational-Dx	24 patients	Prospective case control study was performed to evaluate whether SPECT findings predict severity of chronic sinusitis and subjective response to medical treatment in patients with CRS.	SPECT uptakes were positive in 79.2% (19/24) and negative in 20.8% (5/24) of the patients. SPECT was positive in 4/8 of the patients with limited disease and 15/16 of the patients with extensive disease. In subjective assessment of medical treatment 5/8 of the limited disease vs 1/16 the extensive disease patients had good response; whereas 5/5 of SPECT(-) patients vs 1/19 of SPECT(+) patients had good response. Bone SPECT results were found to be correlated with the stage of CRS. Poorer subjective response was observed in patients with positive SPECT.	3

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
46. Dankbaar JW, van Bemmel AJ, Pameijer FA. Imaging findings of the orbital and intracranial complications of acute bacterial rhinosinusitis. *Insights Imaging.* 2015;6(5):509-518.	Review/Other-Dx	N/A	To illustrate the anatomic relationship between the paranasal sinuses and the orbital and intracranial compartments.	ABRS can cause severe orbital and intracranial complications. If orbital or intracranial complications are suspected, cross-sectional imaging is mandatory. Infection can spread from the ethmoid sinus to the orbit through the lamina papyracea. Frontal sinusitis can spread intracranially through dehiscences or osteomyelitis. Radiologists must recognize imaging findings of complications of ABRS.	4
47. Al Abduwani J, ZilinSkiene L, Colley S, Ahmed S. Cone beam CT paranasal sinuses versus standard multidetector and low dose multidetector CT studies. *Am J Otolaryngol.* 2016;37(1):59-64.	Observational-Dx	21 patients	To compare the absorbed dose of radiation from CBCT and conventional CT, and to compare the clarity and image quality for important structures in sinus anatomy in patients with sinus disease meriting CT scan imaging.	The mean effective dose of 21 consecutive CBCTs of paranasal sinuses performed in our institution over a 1 year period was 0.27 mSv (range 0.05-0.48 mSv). The dose was approximately 40% lower when compared to a similar cohort of standard MDCT examinations and 30% lower when compared to low dose sinus CT scans. The visualization of high-contrast bone morphology on CBCT was comparable to standard sinus CT, allowing clear delineation of the principal surgically relevant osseous structures. Soft tissue visibility was however limited.	3
48. Momeni AK, Roberts CC, Chew FS. Imaging of chronic and exotic sinonasal disease: review. *AJR Am J Roentgenol.* 2007;189(6 Suppl):S35-45.	Review/Other-Dx	N/A	To describe the anatomy, pathophysiology, microbiology, and diagnosis of sinonasal disease (chronic and fungal sinusitis, juvenile nasopharyngeal angiofibroma, inverted papilloma, and chondrosarcoma).	CT and MRI are the 2 primary diagnostic imaging methods for evaluating paranasal sinuses. CT is recommended in both adult and pediatric patients.	4
49. Rao VM, el-Noueam KI. Sinonasal imaging. Anatomy and pathology. *Radiol Clin North Am.* 1998;36(5):921-939, vi.	Review/Other-Dx	N/A	To review anatomy and pathology of sinonasal inflammatory diseases and rationale behind endoscopic surgery. Emphasis on role of CT and MRI in evaluation of inflammatory and neoplastic lesions.	High-resolution CT is recommended for the evaluation of sinus inflammatory diseases. MRI is important in the evaluation of sinonasal tumors because of its ability to differentiate neoplasm from surrounding inflammatory changes, edema, and retained secretions.	4

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EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
50. Yousem DM. Imaging of sinonasal inflammatory disease. *Radiology.* 1993;188(2):303-314.	Review/Other-Dx	N/A	To review anatomy of the sinonasal cavity, imaging of uncomplicated and complicated sinusitis, and analyze the current role of each imaging modality.	Changes in imaging sinonasal inflammatory disease have paralleled changes in the treatment of chronic sinusitis. As functional ESS has become a more widespread technique, coronal CT has become the primary imaging modality, replacing plain radiography. Knowledge of the plethora of sinonasal anatomic variations and the inherent surgical implications is critical to the interpretation of the CT scans and to the safe performance of endoscopic surgery. Currently, the role of MRI is restricted to the evaluation of complicated sinusitis, intraorbital and intracranial manifestations of aggressive sinusitis, and sinonasal neoplasms.	4
51. NCCN Clinical Practice Guidelines in Oncology. Head and Neck Cancers. Version 2.2016. 2016; Available at: https://www.nccn.org/professionals/physician_gls/pdf/head-and-neck.pdf.	Review/Other-Dx	N/A	To provide clinical practice guidelines on head and neck cancers.	No abstract available.	4
52. Lai V, Wong YC, Lam WY, Tsui WC, Luk SH. Inflammatory myofibroblastic tumor of the nasal cavity. *AJNR Am J Neuroradiol.* 2007;28(1):135-137.	Review/Other-Dx	1 patient	Examine a case of inflammatory myofibroblastic tumor in the left nasal cavity of a 13-year-old girl.	MRI revealed T1-weighted hypointense and T2-weighted intermediate-signal-intensity changes with homogeneous contrast enhancement. Angiography revealed the hypervascular nature of the tumor, with blood supplied by mildly hypertrophied terminal branches of the left internal maxillary artery.	4
53. Palacios E, Restrepo S, Mastrogiovanni L, Lorusso GD, Rojas R. Sinonasal hemangiopericytomas: clinicopathologic and imaging findings. *Ear Nose Throat J.* 2005;84(2):99-102.	Review/Other-Dx	7 patients	Retrospective review of imaging characteristics, clinical and pathologic findings in patients with sinonasal hemangiopericytoma.	Hemangiopericytomas can occur in any part of the body. They are mesenchymal tumors that account for 3% to 5% of all soft-tissue sarcomas and 1% of all vascular tumors. They originate in extravascular cells (pericytes). Some 15%-30% of all hemangiopericytomas occur in the head and neck; of these, approximately 5% occur in the sinonasal area.	4
54. Serrano E, Coste A, Percodani J, Herve S, Brugel L. Endoscopic sinus surgery for sinonasal haemangiopericytomas. *J Laryngol Otol.* 2002;116(11):951-954.	Review/Other-Tx	5 patients	To examine cases of hemangiopericytomas treated by a strict endonasal endoscopic approach.	Study suggests that when tumor is purely intranasal or strictly located in the ethmoid or sphenoid sinus, it can be removed via an endonasal approach under endoscopic guidance.	4

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EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
55. Adelson RT, Marple BF. Fungal rhinosinusitis: state-of-the-art diagnosis and treatment. *J Otolaryngol.* 2005;34 Suppl 1:S18-23.	Review/Other-Dx	N/A	To review the classification of the various forms of fungal rhinosinusitis and their clinical presentations, radiologic findings, and treatment options.	No results stated in abstract.	4
56. Younis RT, Anand VK, Davidson B. The role of computed tomography and magnetic resonance imaging in patients with sinusitis with complications. *Laryngoscope.* 2002;112(2):224-229.	Observational-Dx	82 adult and pediatric patients	Retrospective study to compare role of CT with MRI and clinical assessment in the diagnosis and surgical management of patients with sinusitis with complications.	For patients with orbital complications, the diagnostic accuracy was 82% for clinical assessment compared with 91% for CT. For patients with intracranial complications, meningitis was common diagnosis and MRI was more accurate (97%) in determining diagnoses than CT (87%) or clinical findings (82%).	3
57. American College of Radiology. ACR Appropriateness Criteria® Radiation Dose Assessment Introduction. Available at: http://www.acr.org/~/media/ACR/Documents/AppCriteria/RadiationDoseAssessmentIntro.pdf. Accessed March 1, 2017.	Review/Other-Dx	N/A	Guidance document on exposure of patients to ionizing radiation.	N/A	4

Evidence Table Key

Study Quality Category Definitions

- *Category 1* The study is well-designed and accounts for common biases.
- *Category 2* The study is moderately well-designed and accounts for most common biases.
- *Category 3* There are important study design limitations.
- *Category 4* The study is not useful as primary evidence. The article may not be a clinical study or the study design is invalid, or conclusions are based on expert consensus. For example:
  a) the study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description);
  b) the study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence;
  c) the study is an expert opinion or consensus document.
- M = Meta-analysis

Dx = Diagnostic

Tx = Treatment

Abbreviations Key

ABRS = Acute bacterial rhinosinusitis

CBCT = Conebeam computed tomography

CI = Confidence interval

CRS = Chronic rhinosinusitis

CT = Computed tomography

ESS = Endoscopic sinus surgery

MRI = Magnetic resonance imaging

NPV = Negative predictive value

PPV = Positive predictive value

SPECT = Single-photon emission tomography