

# Minimal Radiographic Mucosal Thickness or Opacification Criterion for Sinus-Specific Endoscopic Sinus Surgery for Chronic Rhinosinusitis

Zoe A Walters, MD<sup>1</sup>; Katie M Phillips, MD<sup>1</sup>; Melissa J Previterra<sup>2</sup>; Stacey T Gray, MD<sup>3</sup>; Ahmad R Sedaghat, MD, PhD<sup>1</sup>

<sup>1</sup> Department of Otolaryngology-Head and Neck Surgery, University of Cincinnati College of Medicine, Cincinnati, Ohio, USA.

<sup>2</sup> Health Sciences Library, University of Cincinnati College of Medicine, Cincinnati, Ohio, USA.

<sup>3</sup> Department of Otolaryngology-Head and Neck Surgery, Massachusetts Eye and Ear, Harvard Medical School, Boston, Massachusetts, USA.

## ABSTRACT

**Objective:** Primary chronic rhinosinusitis (CRS) is typically a diffuse process and the extent of endoscopic sinus surgery (ESS) performed for medically recalcitrant CRS is impacted by many factors. However, some third-party payors have implemented policies to authorize coverage for ESS in a sinus-by-sinus manner based on a minimal measurement of millimeters of mucosal thickening or sinus opacification in the corresponding sinus that is being surgically addressed. Our objective was to determine whether such policies are based on scientific evidence that in patients with medically recalcitrant CRS, a minimum measurement of mucosal thickening or sinus opacification is a predictor of CRS in that sinus or improved outcomes after ESS on a sinus-by-sinus basis.

**Data sources:** Medline, Embase, Scopus, and Web of Science databases, from inception through May 2022.

**Review methods:** A systematic review was performed. The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines were followed.

**Results:** We identified 6070 abstracts which were screened and from which 112 studies ultimately underwent a full-text review. From these studies, we found that none investigated (or provided evidence of) whether any minimal degree of radiographic mucosal thickening or sinus opacification predicted CRS or better outcomes after ESS in a sinus-specific manner.

**Conclusion:** We were unable to find evidence supporting a minimum millimeter measurement of mucosal thickening or sinus opacification as predictors of CRS or better post-ESS outcomes in a sinus-specific manner in patients with medically recalcitrant CRS. The extent of ESS for CRS should be determined through personalized medical decision-making that considers all patient-specific factors.

## CONTACT

Ahmad R. Sedaghat, MD, PhD  
Department of Otolaryngology-Head and Neck Surgery, University of Cincinnati College of Medicine  
Email: ahmad.sedaghat@uc.edu

## INTRODUCTION

Primary chronic rhinosinusitis (CRS) is an inflammatory condition of the paranasal sinuses that affects up to 5% of the population worldwide<sup>1</sup> and is defined by clinical consensus criteria that consist of both the presence of symptoms as well as objective evidence of paranasal sinus inflammation.<sup>2-4</sup> Radiography in the form of computed tomography (CT) provides a convenient objective assessment of CRS disease burden in all paranasal sinuses, especially in patients without prior endoscopic sinus surgery (ESS). Radiographic findings in the setting of CRS have been used for manifold purposes—from inferring details about the pathophysiology of a patient's CRS to directly informing treatment decisions.<sup>5,6</sup> As an extension of the latter, third-party payors frequently implement policies that rely on sinus CT scan findings to determine whether ESS is approved for patients. Some third-party payors have adopted policies that determine coverage of ESS on each specific sinus based on a minimal radiographic finding, such as minimal millimeters of mucosal thickening, in that corresponding sinus. It is unclear whether such third-party payor requirements are evidence-based. In this study, we performed a systematic review of the existing scientific literature to determine whether there exists any evidence to support that in patients with medically recalcitrant CRS (1) a minimum mucosal thickness or sinus opacification on sinus CT scan is a predictor of CRS affecting the corresponding sinus or (2) a minimum of mucosal thickening or sinus opacification in a particular sinus is a predictor of better post-ESS outcomes.

## METHODS AND MATERIALS

This study is a systematic review that was conducted according to the 2020 Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) standard guidelines. A systematic literature search was performed from inception through May 2022 of the following databases: Medline, Embase, Scopus, and Web of Science. The following search terms were used: sinusitis, paranasal sinus disease, CRS, inflammation, mucosal thickening, paranasal sinus mucosa, sinus disorder, ethmoid sinus, maxillary sinus, MRI imaging, CT imaging, and cone beam CT. Abstracts were reviewed independently by 1 author (Z.A.W.). Full-text articles were evaluated by 2 authors (Z.A.W. and A.R.S.) to determine eligibility for inclusion. Articles identified by our search strategy were sought to answer 2 questions: whether in patients who have medically recalcitrant CRS, a minimal measurement of mucosal thickness or opacification in a specific sinus was predictive of either (1) having CRS in that particular sinus or (2) better outcomes after ESS.

## RESULTS

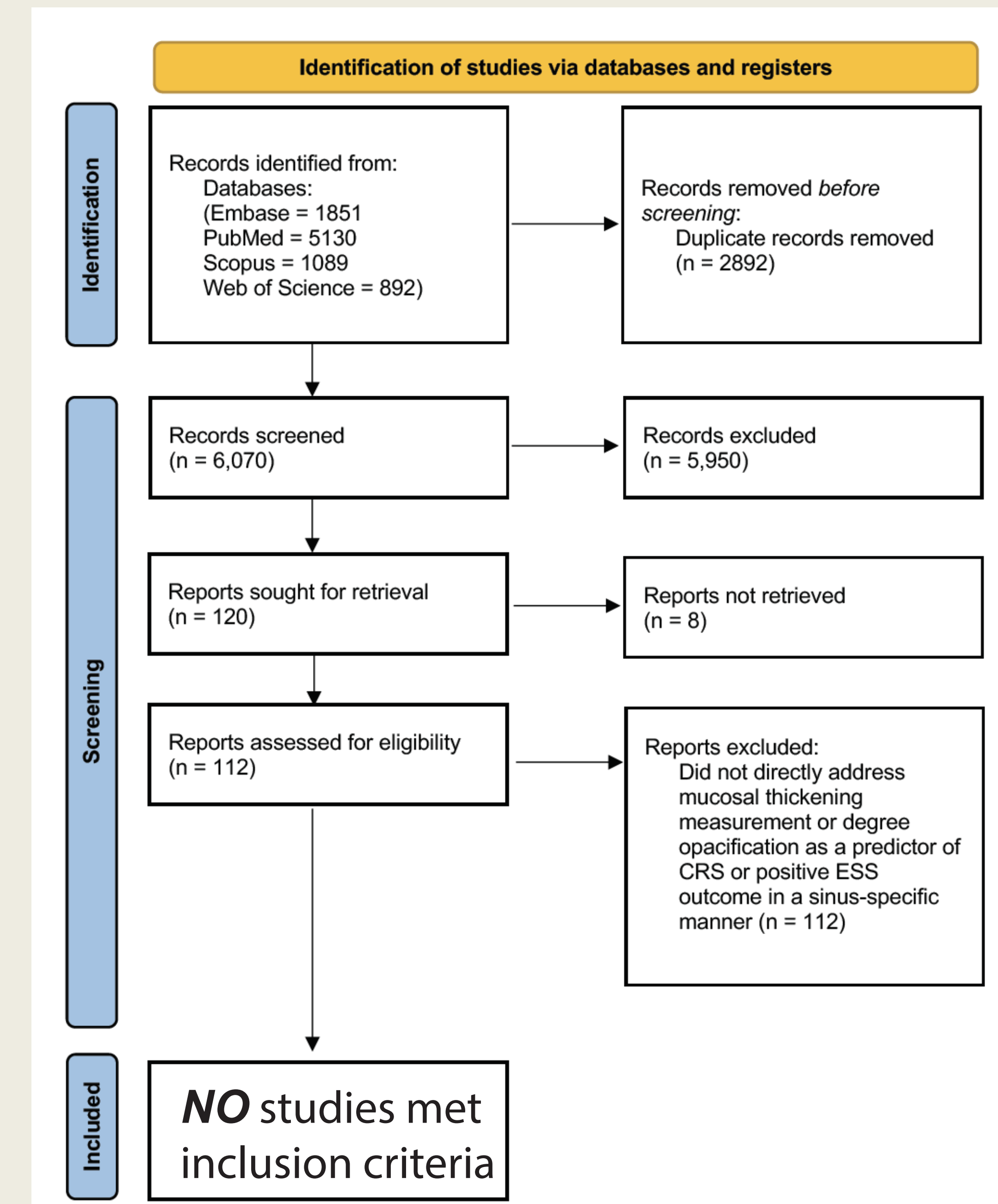


Figure 1. Preferred Reporting Items for Systematic Reviews Meta-analyses (PRISMA) diagram for the systemic literature search.

## DISCUSSION

Clinical consensus guidelines by otolaryngology and rhinology societies from around the world have not recommended that any sinus-specific radiographic criteria (such as minimum mucosal thickness or opacification) be used in the provision of treatment for CRS, including ESS.<sup>3,4</sup> In addition, expert recommendations for the appropriateness of ESS have not included criteria related to sinus-specific radiographic findings.<sup>7</sup> Nevertheless, some third-party payors have required a minimum measurement of mucosal thickness (e.g., minimum millimeters of thickness) or minimum sinus opacification in a paranasal sinus before approving ESS for the corresponding sinus in patients with medically recalcitrant CRS.

Expert review and consensus guidelines have highlighted that the extent of ESS performed for medically recalcitrant primary CRS is influenced by many factors.<sup>3,4,7-9</sup> Beyond directly treating CRS, one of the main objectives of ESS for medically recalcitrant CRS is to improve access for delivery of topical medications into the paranasal sinuses. Additionally, due to development of increasingly osteitic bone with every surgical intervention,<sup>10,11</sup> consideration must be given that the more completely that primary ESS is performed, the less risk that may be imparted to the patient in any future ESS.

## DISCUSSION CONT'D

Finally, primary CRS by its very nature is a diffuse inflammatory process that is likely to be present throughout the paranasal sinuses but also dynamic in its activity. Diagnostic sinus CT scans are reflective of the state of the paranasal sinuses at one single point in time and are frequently performed after a full course of appropriate medical management.<sup>12</sup> In this context, patient care may be compromised by the predetermined restriction of ESS to only sinuses with a third-party payor policy mandated minimal measurement of mucosal thickening or sinus opacification.

Limitation of ESS coverage for patients with medically recalcitrant primary CRS to only sinuses meeting specific radiographic criteria is not supported by any scientific evidence or consensus guidelines, may lead to undertreatment of CRS patients, and ignores other factors such as the need to improve the delivery of topical medications to the paranasal sinuses and concerns that future revision surgery might prove more challenging with incomplete primary ESS.

## CONCLUSIONS

In our systematic review of the scientific literature, we found no studies to support using a minimum measurement of mucosal thickness or sinus opacification as a criterion for determining the appropriateness of ESS on a sinus-by-sinus basis for patients with an established diagnosis of medically recalcitrant primary CRS. In fact, no studies have been performed that specifically focus on this question. The results of our systematic review highlight that the extent of ESS should be determined in a personalized, patient-specific manner that considers all patient-specific factors.

## REFERENCES

- Sedaghat AR, Kuan EC, Scadding GK. Epidemiology of chronic rhinosinusitis: prevalence and risk factors. *J Allergy Clin Immunol Pract.* 2022;10:1395-1403.
- Rosenfeld RM, Piccirillo JF, Chandrasekhar SS, et al. Clinical practice guideline (update): adult sinusitis. *Otolaryngol Head Neck Surg.* 2015;152:S39.
- Fokkens WJ. EPOS2020: a major step forward. *Rhinology.* 2020;58:1.
- Orlandi RR, Kingdom TT, Smith TL, et al. International consensus statement on allergy and rhinology: rhinosinusitis 2021. *Int Forum Allergy Rhinol.* 2021;11:213-739.
- Killeen DE, Sedaghat AR, Cunnane ME, Gray ST. Objective radiographic density measurements of sinus opacities are not strong predictors of noninvasive fungal disease. *Am J Rhinol Allergy.* 2014;28:483-486.
- Lee SH, Kim HJ, Lee JW, Yoon YH, Kim YM, Rha KS. Categorization and clinicopathological features of chronic rhinosinusitis with eosinophilic mucin in a Korean population. *Clin Exp Otorhinolaryngol.* 2015;8:39-45.
- Rudmik L, Soler ZM, Hopkins C, et al. Defining appropriateness criteria for endoscopic sinus surgery during management of uncomplicated adult chronic rhinosinusitis: a RAND/UCLA appropriateness study. *Int Forum Allergy Rhinol.* 2016;6:557-567.
- Kohanski MA, Toskala E, Kennedy DW. Evolution in the surgical management of chronic rhinosinusitis: current indications and pitfalls. *J Allergy Clin Immunol.* 2018;141:1561-1569.
- Lee JM, Chiu AG. Role of maximal endoscopic sinus surgery techniques in chronic rhinosinusitis. *Otolaryngol Clin North Am.* 2010;43:579-589.
- Georgalas C, Videler W, Freling N, Fokkens W. Global Osteitis Scoring Scale and chronic rhinosinusitis: a marker of revision surgery. *Clin Otolaryngol.* 2010;35:455-461.
- Huang Z, Hajjij A, Li G, Nayak JV, Zhou B, Hwang PH. Clinical predictors of neo-osteogenesis in patients with chronic rhinosinusitis. *Int Forum Allergy Rhinol.* 2015;5:303-309.
- Setzen G, Ferguson BJ, Han JK, et al. Clinical consensus statement: appropriate use of computed tomography for paranasal sinus disease. *Otolaryngol Head Neck Surg.* 2012;147:808-816.