

Supplemental materials for:

Ebell MH, McKay B, Dale A, Guilbault R, Ermias Y. Accuracy of Signs and Symptoms for the Diagnosis of Acute Rhinosinusitis and Acute Bacterial Rhinosinusitis. *Ann Fam Med*. 2019;17:164-172.

Supplemental Appendix, Tables 1 – 4, Figure 1

Table 1. Search strategies for PubMed and Embase

Database	Search strategy
PubMed	(rhinosinusitis[Title/Abstract] OR sinusitis[Title/Abstract] OR sinus infection[Title/Abstract] OR sinusitis[MeSH Terms] OR "Paranasal Sinus Diseases"[MeSH Terms]) AND ("medical history taking"[MeSH Terms] OR "physical examination"[MeSH Terms] OR "signs and symptoms"[Title/Abstract] OR "symptoms and signs"[Title/Abstract] OR symptom[Title/Abstract] OR "history and physical" OR "physical examination" OR "physical exam"[Title/Abstract] OR "clinical examination"[Title/Abstract] OR ultrasound[Title/Abstract] OR "computed tomogram"[Title/Abstract] OR "computed tomographic"[Title/Abstract] OR "radiograph"[Title/Abstract] OR "radiographic"[Title/Abstract] OR "x-ray"[Title/Abstract] OR "computed tomography"[Title/Abstract] OR "radiological"[Title/Abstract] OR "CRP"[Title/Abstract] OR "C-reactive protein"[Title/Abstract] OR "white blood cell count"[Title/Abstract] OR "white cell count"[Title/Abstract] OR "leukocytosis"[Title/Abstract] OR "leukocyte count"[Title/Abstract] OR "Westergren"[Title/Abstract] OR "sed rate"[Title/Abstract] OR "sedimentation rate") NOT ("carotid sinus" OR "sinus rhythm" OR "sinus arrest" OR "aortic sinus" OR "aortic sinuses" OR "cavernous sinus" OR "sinus tachycardia" OR "sinus arrhythmia" OR "cavernous sinuses" OR "sinus tract" OR "sinus tracts" OR "coronary sinus" OR "renal sinus" OR "sinus node" OR "sinusoidal" OR "non-sinus" OR "petrosal sinus" OR "sinus rate" OR "sinus rhythm" OR "sinus cardiac rhythm" OR "sinus cyst" OR "sinusoid") NOT (chronic[Title/Abstract] OR surgery[Title] OR surgical[Title] OR lymphoma OR mycosis OR "sphenoid" OR Wegener's OR sarcoidosis OR cancer OR post-operative OR myositis OR HIV OR tuberculosis OR fasciitis OR periodontitis OR "dental implant").
Embase	('physical examination'/exp OR 'anamnesis'/exp OR 'professional competence'/exp OR 'sensitivity and specificity'/exp OR 'reproducibility'/exp OR 'observer variation'/exp OR 'diagnostic test'/exp OR 'decision support system'/exp OR 'sensitivity and specificity':ab,ti OR 'physical exam':ab,ti OR 'physical examination':ab,ti AND [embase]/lim NOT [medline]/lim) AND ('rhinosinusitis':ab,ti OR 'sinusitis':ab,ti OR 'sinus infection':ab,ti OR 'paranasal sinus diseases'/exp OR 'paranasal sinus diseases')

Figure 1. PRISMA flow diagram

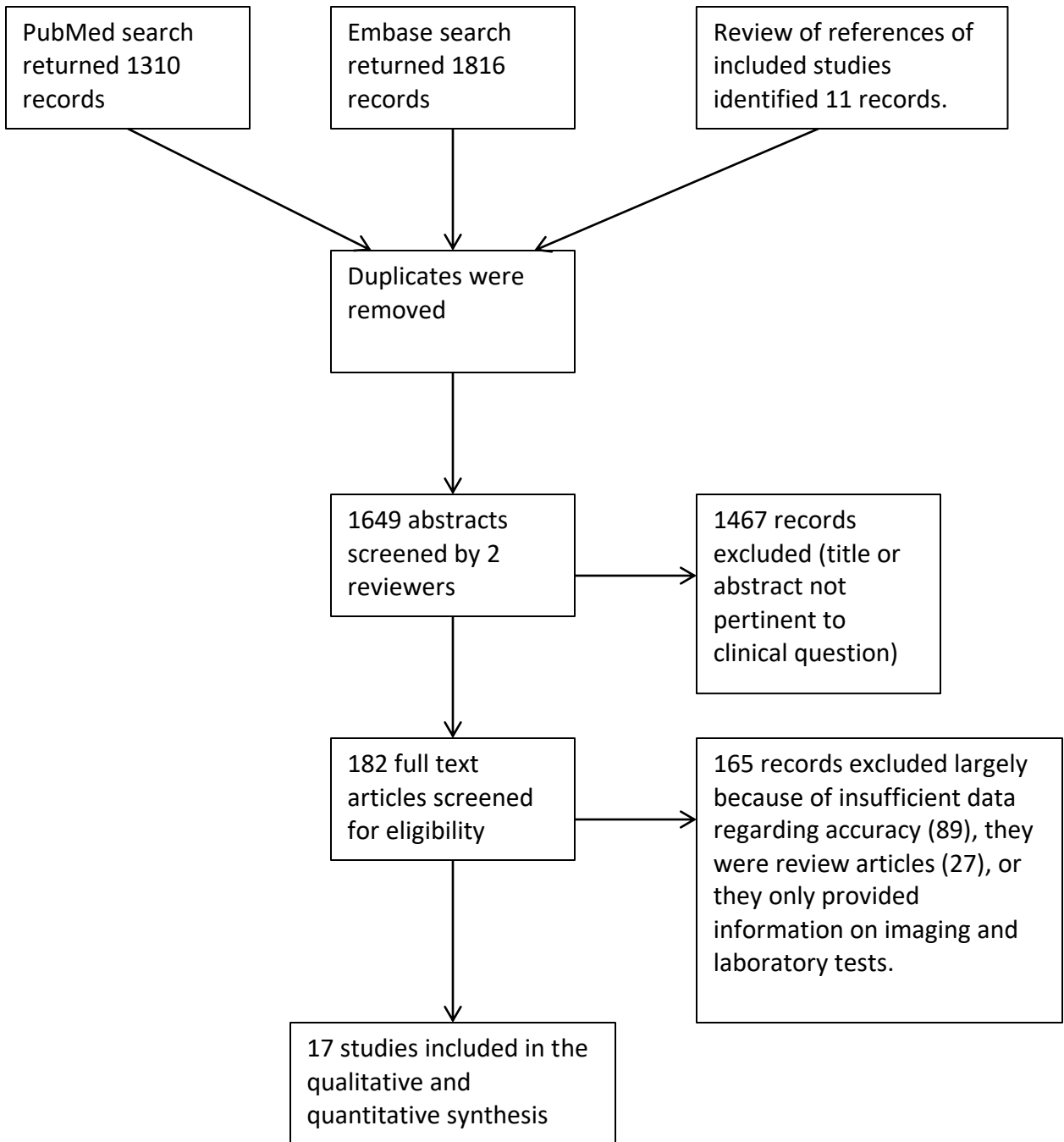


Table 2. QUADAS-2 instrument, adapted for systematic review of the accuracy of signs and symptoms for the diagnosis of acute sinusitis. See below for definition of questions 1-16.

Study, year	QUADAS-2 Study Design Questions (see below for definitions)																	Overall
	Patient selection					Index test				Reference std				Flow & timing				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
	Consecutive	Not case-control	Exclusion criteria	Risk of bias	Applicability	Index blinded	Threshold pre-specified	Risk of bias	Applicability	Antral puncture used	Reference blinded	Risk of bias	Applicability	All got reference std	All had same ref std	All accounted for	Risk of bias	L = 0, M = 1, and H = 2+ with high likelihood of bias
Van Buchem, 1995	Y	Y	Y	L	L	Y	U	L	L	Y	Y	L	L	Y	Y	Y	L	L
Hansen, 1995	Y	Y	Y	L	L	Y	U	L	L	Y	U	L	L	Y	Y	Y	L	L
Laine, 1998	Y	Y	Y	L	L	Y	Y	L	L	Y	Y	L	L	Y	Y	Y	L	L
Autio, 2015	Y	Y	Y	L	L	Y	Y	L	L	Y	U	L	L	Y	Y	Y	L	L
Axelsson, 1976	Y	Y	Y	L	L	Y	Y	L	L	N	U	H	L	Y	Y	Y	L	M
Berg, 1985	U	Y	Y	H	L	Y	Y	L	L	Y	U	L	L	Y	Y	Y	L	M
Berg 1988	Y	Y	Y	L	L	Y	Y	L	L	Y	N	H	L	Y	Y	Y	L	M
Williams, 1992	Y	Y	Y	L	L	Y	Y	L	L	N	Y	H	L	Y	Y	Y	L	M
Van Duijn, 1992	Y	Y	Y	L	L	Y	Y	L	L	N	N	H	L	Y	Y	Y	L	M
Shaikh, 2013	Y	Y	Y	L	L	Y	Y	L	L	N	Y	H	L	Y	Y	Y	L	M
Thomas, 2006	Y	Y	Y	L	L	Y	Y	L	L	N	Y	H	L	Y	Y	Y	L	M
McNeill, 1963	N	Y	Y	H	L	Y	Y	L	L	Y/ N ⁴	N	H	L	Y	Y	N	H	H
Berg, 1981	N	Y	Y	H	L	U	Y	H	L	Y	Y	L	L	Y	Y	Y	L	H
Visca, 1995	N	Y	U	H	U	Y	U	L	N	Y	U	H	L	Y	Y	Y	L	H
Lindbaek, 1996	U	Y	Y	H	L	Y	Y	L	L	N	U	H	L	Y	Y	Y	L	H
Huang, 2008	Y	Y	Y	L	L	Y	N	H	L	N	U	H	L	Y	Y	Y	L	H
Varonen, 2003	N	Y	Y	H	L	Y	Y	L	L	N	Y	H	L	Y	Y	Y	L	H

Note: Overall risk of bias was low (L) if all domains were at low risk of bias; moderate (M) if one domain was at high risk of bias; and high (H) if two or more domains were at high risk of bias. Y = yes, N = no, U = uncertain.

Patient selection

1. Was a consecutive or random sample of patients enrolled?

Y: Study enrolled consecutive patients or a random sample of consecutive patients from a primary care, urgent care, or ED setting.

N: A convenience sample or other non-consecutive or non-random sample was used, or it only included patients referred for diagnostic imaging or to an ENT clinic (this does not address exclusion criteria, handled in #3 below).

U: Uncertain

2. Was the study designed to avoid a case-control design (Y/N/U)?

Y: The study population was drawn from a cohort that included patients with a spectrum of disease.

N: The study population consisted of patients with known disease and healthy controls

U: Uncertain

3. Did the study design avoid inappropriate exclusion criteria (Y/N/U)?

Y: There were no inappropriate exclusion criteria, such as excluding those with uncertain findings.

N: The study used inappropriate exclusion criteria.

U: Uncertain

4. **Patient Selection Risk of Bias:** What is likelihood that patient selection could have introduced bias (L/H/U)?

L: Low likelihood of bias due to patient selection or enrollment ("Yes" to 1, 2 and 3)

H: High likelihood of bias due to patient selection ("No" to 1, 2 or 3)

U: Unable to judge degree of bias.

5. **Concerns About Patient Selection Applicability:** Are there concerns that included patients and setting do not match the review question?

L: Low risk of bias, the patients or settings are from the outpatient setting and have clinically suspected acute sinusitis or acute respiratory tract infection.

H: High risk of bias, the patients or settings do not match the review question, for example a group of patients hospitalized or from a specialized population, or patients with subacute or chronic sinusitis.

U: Uncertain

Index Test

6. Were index test results interpreted without knowledge of reference standard?

Y: Yes.

N: No (including when index and reference std were performed by same observer, although blinding was not addressed)

U: Uncertain

7. If a threshold was used for the index test, was it pre-specified?

Y: The threshold was pre-specified or there was no threshold mentioned

N: The threshold was established post-hoc

U: A threshold was used but it is not clear when it was specified

8. **Index Test Risk of Bias:** What is the likelihood that conduct of the index test could have introduced bias (L, H, U)?

L: High likelihood of bias due to (“Yes” to 6 and “Yes” or “Uncertain” to 7)

H: High likelihood of bias due to failure to mask to reference standard (“No” to 6 or 7)

U: Uncertain

9. **Concerns Regarding Index Test Applicability:** Are there concerns that the index test differs from those specified in the review question?

L: Low likelihood: the index test in this study is a lab or imaging test

H: High likelihood: that index test in this study may not be a lab or imaging test

U: Uncertain

Reference Standard Test

10. Is the reference standard likely to correctly classify patients as having acute sinusitis?

Y: Yes, used antral puncture.

N: No, used another reference standard

U: Uncertain

11. Was the reference standard interpreted without knowledge of the index test?

Y: Yes, reference standard interpretation masked to index test results

N: No, reference standard interpretation not masked to index test results

U: Uncertain

12. **Reference Standard Risk of Bias:** Could conduct or interpretation of the reference standard could have introduced bias?

L: Low likelihood of bias due to the reference standard (“Yes” to 9, “Yes” or “Uncertain” to 10)

H: High likelihood of bias due to inadequate reference standard (“No” to 9 or 10)

U: Uncertain

13. Concerns Regarding Applicability of the Reference Standard: are there concerns that the target conditions defined by the reference standard do not match the review question?

L: Low likelihood of bias, i.e. the reference standard was intended to detect acute sinusitis

H: High likelihood of bias, i.e. the reference standard was not intended to detect acute sinusitis

U: Uncertain

Patient Flow and Timing

14. Did all patients receive a reference standard?

Y: Yes, all patients received some sort of reference standard (no partial verification bias)

N: No, some patients did not receive any reference standard (partial verification bias)

U: Uncertain

15. Did all patients receive the same reference standard?

Y: Yes, all used the same reference standard (no differential verification bias)

N: No, the reference standard varied depending on the results of the index test (differential verification bias)

U: Uncertain

16. Were all patients included in the analysis?

Y: All patients were properly accounted for in the analysis

N: Some patients were not accounted for or dropped for unclear reasons

U: Uncertain

17. Patient Flow Risk of Bias: Could patient flow have introduced bias?

L: Low likelihood of bias based on absence of partial verification bias and good follow-up (“Y” on 14 and 15, “Yes” or “Uncertain” for 16)

H: High likelihood of bias based on partial verification bias or poor follow-up (“No” to 14 or 15, or significant number of patients lost to follow-up in 16)

U: Uncertain

Table 3. Accuracy of signs and symptoms by individual study, when reported by 3 or more studies. Bold face indicates a likelihood ratio significantly greater or less than 1.0.

Sign or symptom	Reference standard	Population	Sensitivity	Specificity	LR+	LR-	AUC
Medical history							
Allergies							
Laine, 1998	PS	A	0.20	0.79	0.95	1.0	
Lindbaek, 1996	CT	A	0.17	0.82	0.99	1.0	
Shaikh, 2013	Rad	C	0.21	0.75	0.84	1.1	
Summary			0.19 (0.16 – 0.24)	0.79 (0.72 - 0.85)	0.96 (0.64 – 1.4)	1.0 (0.93 – 1.1)	0.39
Preceding respiratory infection							
Axelsson, 1976	Rad	A	0.88	0.33	1.3	0.38	
Hansen, 1995	BC	A	0.90	0.19	1.1	0.54	
Lindbaek, 1996	CT	A	0.99	0.08	1.1	0.10	
van Duijn, 1992	USN	A	0.85	0.28	1.2	0.54	
Williams, 1992	Rad	A	0.50	0.61	1.3	0.82	
Summary			0.87 (0.66-0.96)	0.27 (0.13-0.48)	1.2 (1.1 - 1.3)	0.48 (0.30-0.72)	0.58
Previous sinusitis episodes							
Axelsson, 1976	Rad	A	0.52	0.33	0.78	1.4	
Hansen, 1995	BC	A	0.61	0.24	0.80	1.6	
Laine, 1998	PS	A	0.70	0.16	0.83	1.9	
Lindbaek, 1996	CT	A	0.57	0.38	0.92	1.1	
Summary			0.59 (0.52-0.65)	0.27 (0.18-0.39)	0.81 (0.71-0.93)	1.6 (1.1 - 2.2)	0.49
Symptoms							
Cacosmia							
Axelsson, 1976	Rad	A	0.23	0.67	0.69	1.6	
Berg 1988	PS	A	0.16	0.99	14	0.85	
Hansen, 1995	BC	A	0.39	0.63	1.0	0.98	
Laine, 1998	PS	A	0.10	0.95	1.9	0.95	
Lindbaek, 1996	CT	A	0.24	0.68	0.73	1.1	
Summary			0.23 (0.15-0.33)	0.84 (0.58-0.95)	1.5 (0.63-3.7)	0.96 (0.83-1.2)	0.35
Cough							
Autio, 2015	BC	A	0.88	0.11	0.99	1.1	
Axelsson, 1976	Rad	A	0.70	0.58	1.68	0.51	
Hansen, 1995	BC	A	0.63	0.33	0.94	1.1	
Laine, 1998	PS	A	0.45	0.47	0.86	1.2	
Lindbaek, 1996	CT	A	0.50	0.58	1.2	0.87	

Varonen, 2003	Rad	A	0.85	0.21	1.1	0.73	
Williams, 1992	Rad	A	0.70	0.44	1.3	0.69	
Summary			0.69 (0.57-0.80)	0.40 (0.27-0.55)	1.3 (1.0-1.7)	0.78 (0.60-0.98)	0.58
Cough (nocturnal)							
Thomas, 2006	CT	A	0.81	0.09	0.90	2.0	
Shaikh, 2013	Rad	C	0.92	0.13	1.1	0.64	
Visca, 1995	CT	C	0.88	0.08	0.96	1.5	
Summary			0.89 (0.80 – 0.94)	0.11 (0.06 – 0.19)	0.99 (0.87 – 1.1)	1.2 (0.43 – 2.6)	0.27
Double-sickening							
Autio, 2015	BC	A	1.0	0.11	1.1	0.00	
Lindbaek, 1996	CT	A	0.72	0.65	2.1	0.42	
Varonen, 2003	Rad	A	0.38	0.53	0.81	1.2	
Summary			0.74 (0.32-0.95)	0.41 (0.13-0.77)	1.3 (0.77-2.4)	0.69 (0.20-1.5)	0.60
Fatigue or malaise							
Autio, 2015	BC	A	0.63	0.31	0.91	1.2	
Axelsson, 1976	Rad	A	0.58	0.58	1.4	0.73	
Lindbaek, 1996	CT	A	0.54	0.59	1.3	0.77	
Varonen, 2003	Rad	A	0.31	0.53	0.65	1.3	
Williams, 1992	Rad	A	0.56	0.47	1.1	0.95	
Shaikh, 2013	Rad	C	0.78	0.22	1.0	0.97	
Summary			0.62 (0.51-0.71)	0.45 (0.32-0.59)	1.1 (0.99-1.3)	0.86 (0.72-1.0)	0.56
Headache							
Autio, 2015	BC	A	0.50	0.74	1.9	0.67	
van Buchem, 1995	PS	A	0.62	0.44	1.10	0.86	
Varonen, 2003	Rad	A	0.69	0.00	0.69	--	
Williams, 1992	Rad	A	0.68	0.30	0.98	1.04	
Visca, 1995	CT	C	0.18	0.92	2.3	0.89	
Shaikh, 2013	Rad	C	0.41	0.46	0.76	1.28	
Summary			0.50 (0.32-0.67)	0.50 (0.27-0.73)	1.0 (0.71-1.3)	1.0 (0.79-1.4)	0.49
Hyposmia or anosmia							
Axelsson, 1976	Rad	A	0.69	0.60	1.7	0.51	
Hansen, 1995	BC	A	0.62	0.40	1.0	0.96	
Laine, 1998	PS	A	0.40	0.79	1.9	0.76	
Lindbaek, 1996	CT	A	0.80	0.43	1.4	0.47	
Thomas, 2006	CT	A	0.52	0.45	0.95	1.1	
van Duijn, 1992	USN	A	0.55	0.55	1.2	0.82	
Varonen, 2003	Rad	A	0.62	0.42	1.1	0.91	
Williams, 1992	Rad	A	0.56	0.64	1.5	0.69	

Summary			0.61 (0.52-0.70)	0.54 (0.46-0.61)	1.3 (1.1-1.5)	0.72 (0.59-0.87)	0.59
Maxillary pain (location not specified)							
Hansen, 1995	BC	A	0.54	0.60	1.4	0.76	
Lindbaek, 1996	CT	A	0.67	0.31	0.97	1.1	
Thomas, 2006	CT	A	0.48	0.18	0.59	2.9	
van Buchem, 1995	PS	A	0.34	0.65	0.97	1.0	
Varonen, 2003	Rad	A	0.77	0.11	0.86	2.2	
Summary			0.70 (0.42-0.88)	0.2 (0.05-0.51)	0.88 (0.73-1.0)	1.6 (0.95-2.8)	0.45
Maxillary or frontal pain							
Autio, 2015	BC	A	0.50	0.66	1.5	0.76	
Laine, 1998	PS	A	0.80	0.16	0.95	1.3	
Shaikh, 2013	Rad	C	0.20	0.93	2.7	0.87	
Summary			0.49 (0.15-0.83)	0.63 (0.14-0.95)	1.5 (0.86-3.5)	0.89 (0.61-1.4)	0.55
Maxillary pain (unilateral)							
Shaikh, 2013	Rad	C	0.07	0.98	3.7	0.95	
van Duijn, 1992	USN	A	0.34	0.80	1.7	0.83	
Varonen, 2003	Rad	A	0.62	0.47	1.2	0.81	
Berg, 1988	PS	A	0.35	0.62	0.93	1.0	
Laine, 1998	PS	A	0.30	0.79	1.4	0.89	
Summary			0.30 (0.14-0.52)	0.80 (0.51-0.94)	1.5 (0.96-2.6)	0.90 (0.79-1.0)	0.51
Nasal congestion or obstruction							
Autio, 2015	BC	A	1.0	0.11	1.1	0.00	
Hansen, 1995	BC	A	0.73	0.18	0.89	1.50	
Laine, 1998	PS	A	0.80	0.16	0.95	1.3	
Lindbaek, 1996	CT	A	0.89	0.14	1.0	0.82	
Thomas, 2006	CT	A	0.74	0.24	0.98	1.1	
van Buchem, 1995	PS	A	0.55	0.63	1.5	0.72	
Varonen, 2003	Rad	A	0.92	0.11	1.0	0.73	
Visca, 1995	CT	C	0.82	0.46	1.5	0.38	
Shaikh, 2013	Rad	C	0.93	0.15	1.1	0.46	
Summary			0.83 (0.74-0.89)	0.24 (0.14-0.36)	1.1 (1.0-1.2)	0.73 (0.56-0.93)	0.59
Nasal discharge (any)							
Autio, 2015	BC	A	0.88	0.66	2.6	0.19	
Axelsson, 1976	Rad	A	0.90	0.35	1.4	0.27	
van Buchem, 1995	PS	A	0.59	0.59	1.5	0.69	
Varonen, 2003 **	Rad	A	1.0	0.00	1.0	NA	
Summary			0.75 (0.57-0.91)	0.49 (0.35-0.68)	1.5 (1.3-1.8)	0.49 (0.24-0.82)	0.63

Nasal speech								
Axelsson, 1976	Rad	A	0.20	0.95	4.0	0.84		
Lindbaek, 1996	CT	A	0.84	0.41	1.4	0.39		
Williams, 1992	Rad	A	0.45	0.73	1.7	0.75		
Summary			0.51 (0.15-0.85)	0.73 (0.35-0.93)	1.9 (1.3-2.7)	0.67 (0.37-0.91)	0.67	
Overall clinical impression								
Williams, 1992	Rad	A	0.76	0.64	2.1	0.38		
Berg, 1988	PS	A	0.71	0.61	1.8	0.48		
Berg, 1985	PS	A	0.75	0.77	3.2	0.33		
Berg, 1981	PS	A	0.84	0.92	10	0.17		
Summary			0.77 (0.69-0.83)	0.72 (0.57-0.84)	2.8 (1.6-4.9)	0.34 (0.21-0.51)	0.80	
Pain bending forward								
Hansen, 1995	BC	A	0.76	0.24	1.01	0.98		
Laine, 1998	PS	A	0.45	0.58	1.1	0.95		
Lindbaek, 1996	CT	A	0.90	0.22	1.2	0.47		
van Buchem, 1995	PS	A	0.66	0.38	1.1	0.89		
van Duijn, 1992	USN	A	0.67	0.58	1.6	0.57		
Summary			0.72 (0.57-0.84)	0.39 (0.24-0.57)	1.2 (1.0-1.5)	0.71 (0.51-0.94)	0.59	
Pain in teeth								
Autio, 2015	BC	A	0.13	0.97	4.4	0.90		
Hansen, 1995	BC	A	0.72	0.46	1.3	0.62		
Laine, 1998	PS	A	0.35	0.79	1.7	0.82		
Lindbaek, 1996	CT	A	0.50	0.50	0.99	1.0		
Shaikh, 2013	Rad	C	0.16	0.91	1.8	0.92		
van Duijn, 1992	USN	A	0.36	0.83	2.1	0.77		
Varonen, 2003	Rad	A	0.54	0.63	1.5	0.73		
Williams, 1992	Rad	A	0.18	0.93	2.5	0.89		
Summary			0.34 (0.21-0.51)	0.80 (0.63-0.90)	1.7 (1.2-2.5)	0.83 (0.73-0.91)	0.57	
Postnasal drip								
Autio, 2015	BC	A	0.63	0.37	0.99	1.0		
Thomas, 2006	CT	A	0.71	0.18	0.91	1.4		
Varonen, 2003	Rad	A	0.85	0.05	0.89	2.9		
Summary			0.74 (0.55-0.87)	0.19 (0.07-0.45)	0.94 (0.73-1.3)	1.5 (0.64-3.4)	0.56	
Purulent nasal discharge								
Autio, 2015	BC	A	0.88	0.37	1.4	0.34		
Axelsson, 1976	Rad	A	0.71	0.57	1.6	0.51		
Berg 1988	PS	A	0.54	0.57	1.3	0.79		

Thomas, 2006	CT	A	0.67	0.55	1.5	0.61	
Williams, 1992	Rad	A	0.72	0.52	1.5	0.55	
Laine, 1998	PS	A	0.60	0.53	1.3	0.76	
Lindbaek, 1996	CT	A	0.89	0.42	1.5	0.26	
van Duijn, 1992	USN	A	0.62	0.67	1.9	0.57	
Shaikh, 2013	Rad	C	0.72	0.56	1.6	0.51	
Visca, 1995	CT	C	0.53	0.46	0.98	1.0	
Summary			0.71 (0.63-0.78)	0.54 (0.48-0.61)	1.6 (1.4-1.7)	0.54 (0.44-0.65)	
Sneezing							
Thomas, 2006	CT	A	0.44	0.45	0.81	1.2	
Williams, 1992	Rad	A	0.70	0.34	1.1	0.88	
Shaikh, 2013	Rad	C	0.66	0.41	1.1	0.83	
Summary			0.63 (0.49-0.74)	0.39 (0.31-0.48)	1.0 (0.86-1.2)	0.96 (0.71-1.2)	0.46
Physical examination							
Fever (temperature > 38 C)							
Axelsson, 1976	Rad	A	0.22	0.98	13	0.79	
Hansen, 1995	BC	A	0.12	0.89	1.1	0.99	
Laine, 1998	PS	A	0.00	0.74	0.00	1.4	
Lindbaek, 1996	CT	A	0.13	0.89	1.2	0.98	
Varonen, 2003	Rad	A	0.08	0.74	0.29	1.2	
Williams, 1992	Rad	A	0.16	0.83	0.92	1.0	
Shaikh, 2013	Rad	C	0.03	0.96	0.93	1.0	
Summary			0.11 (0.07-0.19)	0.87 (0.79-0.92)	0.94 (0.42-1.9)	1.0 (0.91 - 1.1)	0.47
Frontal sinus tender							
Lindbaek, 1996	CT	A	0.50	0.51	1.0	0.98	
van Buchem, 1995	PS	A	0.25	0.75	1.0	1.00	
Shaikh, 2013 *	Rad	C	0.10	0.91	1.1	0.99	
Summary			0.25 (0.09-0.54)	0.75 (0.47-0.91)	1.1 (0.76-1.4)	0.99 (0.86-1.1)	0.50
Maxillary tenderness							
Autio, 2015	BC	A	0.38	0.80	1.9	0.78	
Berg 1988	PS	A	0.04	0.26	0.06	3.6	
Hansen, 1995	BC	A	0.56	0.67	1.7	0.66	
Laine, 1998	PS	A	0.45	0.53	0.95	1.1	
Lindbaek, 1996	CT	A	0.63	0.32	0.93	1.1	
Thomas, 2006	CT	A	0.26	0.39	0.43	1.9	
van Buchem, 1995	PS	A	0.32	0.59	0.79	1.1	
van Duijn, 1992	USN	A	0.52	0.60	1.3	0.80	
Williams, 1992	Rad	A	0.48	0.65	1.4	0.79	

Varonen, 2003	Rad	A	0.69	0.21	0.88	1.5	
Visca, 1995	CT	C	0.82	0.15	0.97	1.2	
Shaikh, 2013	Rad	C	0.13	0.91	1.4	0.96	
Summary			0.44 (0.28-0.61)	0.49 (0.34-0.64)	0.88 (0.57-1.3)	1.2 (0.80-1.6)	0.45
Nasal or mucosal thickening or edema							
Autio, 2015	BC	A	0.63	0.46	1.2	0.82	
Laine, 1998	PS	A	0.55	0.26	0.75	1.7	
Lindbaek, 1996	CT	A	0.98	0.16	1.2	0.1	
Summary			0.82 (0.27-0.98)	0.30 (0.15-0.51)	1.1 (0.49-1.4)	0.68 (0.09-1.6)	0.41
Purulent secretions: pharyngeal or post-nasal							
Hansen, 1995	BC	A	0.20	0.80	1.0	1.0	
Laine, 1998	PS	A	0.00	0.95	0.00	1.1	
Lindbaek, 1996	CT	A	0.03	1.00	3.0	0.97	
van Duijn, 1992	USN	A	0.03	1.00	6.4	0.98	
Varonen, 2003	Rad	A	0.38	0.74	1.5	0.84	
Shaikh, 2013	Rad	C	0.29	0.78	1.3	0.91	
Summary			0.14 (0.06-0.30)	0.92 (0.77-0.97)	1.8 (1.1-2.8)	0.93 (0.87-0.98)	0.52
Purulent secretions: any nasal							
Autrio, 2015	BC	A	0.88	0.43	1.5	0.29	
Berg 1988	PS	A	0.16	0.39	0.27	2.14	
Laine, 1998	PS	A	0.30	0.84	1.9	0.83	
Lindbaek, 1996	CT	A	0.60	0.89	5.5	0.45	
Varonen, 2003	Rad	A	0.54	0.53	1.1	0.88	
Williams, 1992	Rad	A	0.51	0.76	2.1	0.65	
Axelsson, 1976	Rad	A	0.41	0.82	2.3	0.72	
Hansen, 1995	BC	A	0.34	0.77	1.5	0.86	
Thomas, 2006	CT	A	0.22	0.82	1.2	0.95	
van Buchem, 1995	PS	A	0.30	0.78	1.4	0.90	
van Duijn, 1992	USN	A	0.17	0.90	1.7	0.92	
Shaikh, 2013	Rad	C	0.63	0.61	1.6	0.61	
Summary			0.39 (0.28-0.50)	0.74 (0.64-0.82)	1.5 (1.0-2.2)	0.84 (0.67-1.0)	0.54
Purulent secretions: middle meatus							
Autio, 2015	BC	A	0.50	0.94	8.8	0.53	
Axelsson, 1976	Rad	A	0.20	0.97	6.1	0.83	
Lindbaek, 1996	CT	A	0.05	1.00	95	0.95	

van Duijn, 1992	USN	A	0.07	0.98	3.2	0.95	
Shaikh, 2013	Rad	C	0.21	0.83	1.2	0.95	
Summary			0.15 (0.07-0.28)	0.95 (0.87-0.98)	3.2 (1.4-6.6)	0.90 (0.78-0.97)	0.45
Transillumination abnormal							
Thomas, 2006	CT	A	0.63	0.67	1.9	0.56	
Williams, 1992	Rad	A	0.73	0.54	1.6	0.51	
McNeill, 1963	Rad	B	0.68	0.57	1.6	0.56	
Summary			0.69 (0.63-0.75)	0.56 (0.50-0.62)	1.6 (1.4-1.9)	0.55 (0.44-0.67)	0.67

* Allergy symptoms: Shaikh, 2013 reported data separately for itchy eyes, itchy nose, and sneezing; to avoid double-counting of participants, only sneezing was included. Frontal sinus tenderness on exam: Shaikh, 2013 reported data separately for tenderness to pressure (LR+ 0.41, LR- 1.23) and tenderness to percussion (LR+ 1.11, LR- 0.99). Only tenderness to percussion was included to avoid double-counting of participants.

** Varonen, 2003 excluded from summary accuracy calculation to avoid incorporation bias, as all patients in this study had nasal discharge.

Population: A = adult, C = child, B = both

Reference standard: PS = purulent secretion from antral puncture, BC = bacterial culture positive from antral puncture fluid, CT = computed tomogram, Rad = radiographs, MRI = magnetic resonance imaging, USN = ultrasound.

AUC = area under ROC curve

Table 4. Accuracy of signs and symptoms by individual study, for studies using purulent antral puncture fluid or positive bacterial culture of antral puncture fluid as the reference standard.

Sign or symptom	Reference standard	Pop'n	Sensitivity	Specificity	LR+	LR-
Medical history						
Allergies						
Laine, 1998	PS	A	0.20	0.79	0.95	1.0
Preceding respiratory infection						
Hansen, 1995	BC	A	0.90	0.19	1.1	0.54
Previous sinusitis episodes						
Hansen, 1995	BC	A	0.61	0.24	0.80	1.6
Laine, 1998	PS	A	0.70	0.16	0.83	1.9
Summary			0.62 – 0.70	0.16 – 0.20	0.77 – 0.83	1.9 – 2.0
Symptoms						
Cacosmia						
Berg 1988	PS	A	0.16	0.99	14	0.85
Hansen, 1995	BC	A	0.39	0.63	1.0	0.98
Laine, 1998	PS	A	0.10	0.95	1.9	0.95
Summary			0.23 (0.11 – 0.42)	0.93 (0.59 – 0.99)	4.3 (0.94 – 14)	0.86 (0.76-0.99)
Cough						
Autio, 2015	BC	A	0.88	0.11	0.99	1.1
Hansen, 1995	BC	A	0.63	0.33	0.94	1.1
Laine, 1998	PS	A	0.45	0.47	0.86	1.16
Summary			0.66 (0.34 – 0.86)	0.29 (0.12-0.55)	0.93 (0.70 – 1.1)	1.2 (0.79 – 1.7)
Double-sickening						
Autio, 2015	BC	A	1.00	0.11	1.1	0.00
Headache						
Autio, 2015	BC	A	0.50	0.74	1.9	0.67
van Buchem, 1995	PS	A	0.62	0.44	1.1	0.86
Summary			0.50 – 0.62	0.44 – 0.74	1.1 – 1.9	0.67 – 0.86
Hyposmia or anosmia						
Hansen, 1995	BC	A	0.62	0.40	1.0	0.96
Laine, 1998	PS	A	0.40	0.79	1.9	0.76
Summary			0.40 – 0.62	0.43 – 0.79	1.0 – 1.9	0.76 – 0.96
Maxillary pain (location not specified)						

Hansen, 1995	BC	A	0.54	0.60	1.4	0.76
van Buchem, 1995	PS	A	0.34	0.65	0.97	1.0
Summary			0.34 – 0.54	0.60-0.65	0.97- 1.4	0.76-1.0
Maxillary or frontal pain						
Autio, 2015	BC	A	0.50	0.66	1.5	0.76
Laine, 1998	PS	A	0.80	0.16	0.95	1.3
Summary			0.50 – 0.80	0.16 – 0.66	0.95 – 1.5	0.76 – 1.3
Maxillary pain (unilateral)						
Berg, 1988	PS	A	0.35	0.62	0.93	1.0
Laine, 1998	PS	A	0.30	0.79	1.4	0.89
Summary			0.30 – 0.35	0.62 – 0.79	0.93 – 1.4	0.89 – 1.0
Nasal congestion or obstruction						
Autio, 2015	BC	A	1.00	0.11	1.1	0.00
Hansen, 1995	BC	A	0.73	0.18	0.89	1.50
Laine, 1998	PS	A	0.80	0.16	0.95	1.3
van Buchem, 1995	PS	A	0.55	0.63	1.5	0.72
Summary			0.71 (0.57-0.82)	0.25 (0.10-0.52)	0.98 (0.83-1.3)	1.3 (0.70-2.3)
Nasal discharge						
Autio, 2015	BC	A	0.88	0.66	2.6	0.19
van Buchem, 1995	PS	A	0.59	0.59	1.4	0.69
Summary			0.59 – 0.88	0.59 – 0.66	1.4 – 2.6	0.19 – 0.69
Overall clinical impression						
Berg, 1988	PS	A	0.71	0.61	1.8	0.48
Berg, 1985	PS	A	0.75	0.77	3.2	0.33
Berg, 1981	PS	A	0.84	0.92	10	0.17
Summary			0.74 (0.61-0.84)	0.80 (0.72-0.87)	3.9 (2.4-5.9)	0.33 (0.20-0.50)
Pain bending forward						
Hansen, 1995	BC	A	0.76	0.24	1.01	0.98
Laine, 1998	PS	A	0.45	0.58	1.1	0.95
van Buchem, 1995	PS	A	0.66	0.38	1.1	0.89
Summary			0.64 (0.44 – 0.79)	0.38 (0.20 – 0.60)	1.0 (0.87 – 1.3)	0.95 (0.69 – 1.3)
Pain in teeth						
Autio, 2015	BC	A	0.12	0.97	4.4	0.90
Hansen, 1995	BC	A	0.72	0.46	1.3	0.62
Laine, 1998	PS	A	0.35	0.79	1.7	0.82

Summary			0.38 (0.10-0.78)	0.80 (0.37-0.97)	2.0 (1.1-3.7)	0.77 (0.50-0.96)
Postnasal drip						
Autio, 2015	BC	A	0.63	0.37	0.99	1.0
Purulent nasal discharge						
Autio, 2015	BC	A	0.88	0.37	1.4	0.34
Berg 1988	PS	A	0.54	0.57	1.3	0.79
Laine, 1998	PS	A	0.60	0.53	1.3	0.76
Summary			0.64 (0.45-0.79)	0.50 (0.36-0.63)	1.3 (0.99-1.6)	0.74 (0.47 – 1.0)
Tired or malaise						
Autio, 2015	BC	A	0.63	0.31	0.91	1.2
Physical examination						
Fever (temperature > 38 C)						
Hansen, 1995	BC	A	0.12	0.89	1.1	0.99
Laine, 1998	PS	A	0.00	0.74	0.00	1.4
Summary			0.00 – 0.12	0.74 – 0.89	0.00 – 1.1	0.99 – 1.4
Frontal sinus tender						
van Buchem, 1995	PS	A	0.25	0.75	1.0	1.00
Maxillary tenderness						
Autio, 2015	BC	A	0.38	0.80	1.0	0.78
Berg 1988	PS	A	0.04	0.26	0.06	3.6
Hansen, 1995	BC	A	0.56	0.67	1.7	0.66
Laine, 1998	PS	A	0.45	0.53	0.95	1.05
van Buchem, 1995	PS	A	0.32	0.59	0.79	1.14
Summary			0.33 (0.13 – 0.61)	0.57 (0.40 – 0.73)	0.86 (0.23-2.2)	1.2 (0.55-2.1)
Nasal or mucosal thickening or edema						
Autio, 2015	BC	A	0.63	0.46	1.2	0.82
Laine, 1998	PS	A	0.55	0.26	0.75	1.71
Summary			0.55 – 0.63	0.26 – 0.46	0.75 – 1.2	0.82 – 1.7
Purulent secretions: pharyngeal or post-nasal						
Hansen, 1995	BC	A	0.20	0.80	1.0	1.0
Laine, 1998	PS	A	0.00	0.95	0.00	1.1
Summary			0.00 – 0.22	0.82 – 0.95	0.00 – 1.2	0.96 – 1.1
Purulent secretions: any nasal						
Autrio, 2015	BS	A	0.88	0.43	1.5	0.29

Berg 1988	PS	A	0.16	0.39	0.27	2.1
Laine, 1998	PS	A	0.30	0.84	1.9	0.83
Hansen, 1995	PS	A	0.34	0.77	1.5	0.86
van Buchem, 1995	PS	A	0.30	0.78	1.4	0.90
Summary			0.27 (0.20-0.35)	0.66 (0.45-0.82)	0.88 (0.36-1.9)	1.2 (0.57-1.8)
Purulent secretions: middle meatus						
Autio, 2015	BS	A	0.50	0.94	8.8	0.53

* Allergy symptoms: Shaikh, 2013 reported data separately for itchy eyes, itchy nose, and sneezing; to avoid double-counting of participants, only sneezing was included. Frontal sinus tenderness on exam: Shaikh, 2013 reported data separately for tenderness to pressure (LR+ 0.41, LR- 1.23) and tenderness to percussion (LR+ 1.11, LR- 0.99). Only tenderness to percussion was included to avoid double-counting of participants.

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