

When should a chest x-ray be used to evaluate acute-onset productive cough for adults?

Paul Pisarik, MD, MPH, Cathy Montoya, MLS
Baylor College of Medicine, Houston, Tex

EVIDENCE-BASED ANSWER

Even though the most common reason to order a chest x-ray in the evaluation of an acute-onset, productive cough is to rule out pneumonia, there is no strong evidence to help a physician decide when to order this chest x-ray. However, acute cough patients who have rhinorrhea, sore throat, respiratory rate ≤ 25 breaths per minute,

temperature $< 100^\circ\text{F}$, and the absence of night sweats, myalgia, and all-day sputum production, have minimal to no risk of pneumonia and thus do not need a chest x-ray (strength of recommendation: **A**, based on a clinical decision rule validated in 2 high-quality cohort studies).^{1,2}

CLINICAL COMMENTARY

Decision rule not perfect, but still better than physician's own judgment

This decision rule for when to order a chest x-ray was validated in a study of 1758 adult, nonpregnant, ambulatory patients with acute productive cough of less than 4 weeks. Using a threshold score of ≥ 1 point detected 25 of 46 pneumonias (59%), compared with a detection rate of 33% without the detection rule. All that great stuff we learned in our training about the history and physical exam missed a whopping 67% of pneumonias. The application of the decision rule still missed 41% (21 of 46 pneumonias), but that is a lot better

than usual physician judgment. Surprisingly, the patients in whom pneumonias were missed did not reconsult more frequently, and we are left to believe they all did well. This interesting tidbit begs the question of whether chest x-ray or treatment is required for anyone not sick enough to be in the hospital with an acute respiratory infection. Will using this decision rule in your practice reduce unnecessary x-ray or antibiotics? Maybe. I have already tried this decision rule in my practice and have found no surprises so far.

E. Drew Malloy, MD
University of Arizona, Campus Health Services, Tucson

■ Evidence summary

Even though the chest x-ray is as close to a gold standard as we have for diagnosing pneumonia (**FIGURE**), in practice it is only ordered about 11% of the time.³ Individual clinical findings such as pulse above 100 beats per minute, respiratory rate above 25 breaths per minute, temperature above 99.9°F , local dullness to percussion, rales, asymmetric respirations, pleural rubs, egophony, increased fremitus, and cachexia are weak predictors of pneumonia, being present in 4% to 28% of radiographically proven pneumonia.¹ Individual symptoms such as chills, night sweats, fever, and spu-

tum production are found in 31% to 79% of those with pneumonia, but also in 18% to 62% of those without pneumonia. Therefore prediction rules, using combinations of statistically significant factors, have been developed to help us decide when to order a chest x-ray to diagnose pneumonia.

Unfortunately, almost all studies that have developed prediction rules preselected higher-risk patients—those who had already been selected to get a chest x-ray (based on unknown signs and symptoms).⁴⁻⁶ The signs and symptoms that predict pneumonia for patients already selected for a chest x-ray may be different than

FIGURE When to order chest x-ray?



Clinical decision rules detected 59% of pneumonias, vs just 33% with physician judgment.

TABLE 1

Signs and symptoms significant for pneumonia

FACTOR	SCORE
Rhinorrhea	-2
Sore throat	-1
Night sweats	1
Myalgias	1
All-day sputum production	1
Respiratory rate >25/min	2
Temperature $\geq 100^\circ$ F	2

Adapted from Diehr et al, *J Chronic Dis* 1984.¹

FAST TRACK

Patients with infection changes on x-ray did not reconsult more than those without, implying at least some outpatient pneumonias are self-limiting

for unselected patients. These studies also assume that physician judgment in ordering a chest x-ray is 100% sensitive and thus that all patients with pneumonia have been correctly identified.

Only 2 studies have done chest x-rays on all nonpregnant adults with a first visit for a cough of less than 4 weeks duration and no other exclusion criteria.¹⁷ Physicians indicated that they would have wanted to order chest x-rays in 12% to 15% of those

patients (similar to national statistics), but they would have detected only one third of all the pneumonias. One of these studies looked at signs and symptoms and did a stepwise discriminant analysis with those factors that were significant for pneumonia and then assigned point values to them (TABLE 1 AND 2).¹ By limiting chest x-rays to those patients with a clinical score of 1 or greater, 13% of patients would have a chest x-ray with 59% of pneumonias detected—almost twice as many as detected without the prediction rule.

One problem with the application of prediction rules is that they are always associated with missed pneumonias. Not much is known about the pneumonias that would be missed by applying the prediction rule or, for that matter, those that are missed using physician judgment. In the above study, before seeing the results of the x-rays, only 50% of the pneumonia patients would have been prescribed antibiotics. In another study where patients with lower respiratory tract infection all received radiographs but the treating physicians did not see the x-ray results, only half of the patients with radiographic changes consistent with pneumonia were given antibiotics.⁸ Surprisingly, those patients with infection changes on chest x-ray were no more likely to reconsult than those without those changes, implying that a certain percentage of outpatient pneumonias are self-limiting.⁷

Recommendations from others

The Infectious Disease Society of America, the American Thoracic Society, the Canadian Infectious Disease Society and the Canadian Thoracic Society, and the Centers for Disease Control and Prevention all recommend a chest x-ray for patients for whom signs and symptoms suggest a pneumonia, but they do not give any guidance as to which signs and symptoms are significant.⁹⁻¹² The British Thoracic Society does not recommend radiography for patients with suspected pneumonia among outpatients.¹³ The European Respiratory Society only recommends a chest x-ray for those patients with

TABLE 2

Distribution of point scores for pneumonia and non-pneumonia groups

POINT SCORE	NUMBER WITH PNEUMONIA	NUMBER WITHOUT PNEUMONIA	PERCENTAGE WITH PNEUMONIA	CUMULATIVE SENSITIVITY	CUMULATIVE SPECIFICITY
-3	0	140	0	100	8
-2	4	552	0.7	91	40
-1	8	504	1.6	74	70
0	7	316	2.2	59	88
1	12	124	8.8	33	96
2	6	52	10.3	20	99
3	4	12	25.0	11	99
4	3	8	27.3	4	100
5	1	4	20.0	2	100
6	1	0	100.0	0	100
Total	46	1712	2.6		

Adapted from Diehr et al, *J Chronic Dis* 1984.¹

failure of first-time empirical therapy or focal chest signs; a chest x-ray may also be indicated for those who are aged ≥ 65 years, are institutionalized, are alcoholics, have possibly aspirated, have been hospitalized within the previous year for pneumonia, or have significant comorbidities.¹⁴

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FAST TRACK

Reserving x-rays for patients with a prediction rule score of 1 or greater (as in Table 2) should reduce unnecessary chest films