

Acute Respiratory Illness in Immunocompetent Patients
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
1. CDC/National Center for Health Statistics. National Hospital Ambulatory Medical Care Survey: 2013 Emergency Department Summary Tables. Available at: https://www.cdc.gov/nchs/data/ahcd/nhamcs_emergency/2013_ed_web_tables.pdf .	Review/Other-Dx	N/A	To summarize the 2013 National Hospital Ambulatory Medical Care Survey.	No results stated in abstract.	4
2. CDC/National Center for Health Statistics. National Vital Statistics Reports. Deaths: Final Data for 2014. Available at: https://www.cdc.gov/nchs/data/nvsr/nvsr65/nvsr65_04.pdf .	Review/Other-Dx	N/A	To present final 2014 data on U.S. deaths, death rates, life expectancy, infant mortality, and trends, by selected characteristics such as age, sex, Hispanic origin, race, state of residence, and cause of death.	In 2014, a total of 2,626,418 deaths were reported in the United States. The age-adjusted death rate was 724.6 deaths per 100,000 U.S. standard population, a decrease of 1% from the 2013 rate and a record low figure. Life expectancy at birth was 78.8 years, unchanged since 2012. Life expectancy increased for black males, Hispanic males and females, and non-Hispanic black males, while it decreased for non-Hispanic white females from 2013 to 2014. Age-specific death rates decreased in 2014 from 2013 for age groups 1–4, 65–74, 75–84, and 85 and over. Age-specific death rates increased for age groups 25–34, 35–44, and 55–64. The 15 leading causes of death in 2014 remained the same as in 2013. The infant mortality rate decreased 2.3% in 2014 from 2013 to a historically record low value of 5.82 deaths per 1,000 live births.	4
3. American College of Radiology. ACR Appropriateness Criteria®: Acute Respiratory Illness in Immunocompromised Patients. Available at: https://acsearch.acr.org/docs/69447/Narrative/ .	Review/Other-Dx	N/A	Evidence-based guidelines to assist referring physicians and other providers in making the most appropriate imaging or treatment decision for acute respiratory illness in immunocompromised patients.	N/A	4

Acute Respiratory Illness in Immunocompetent Patients
EVIDENCE TABLE

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4. Mandell LA, Wunderink RG, Anzueto A, et al. Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults. Clin Infect Dis. 2007; 44 Suppl 2:S27-72.	Review/Other-Dx	N/A	Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults.	N/A	4
5. Self WH, Courtney DM, McNaughton CD, Wunderink RG, Kline JA. High discordance of chest x-ray and computed tomography for detection of pulmonary opacities in ED patients: implications for diagnosing pneumonia. Am J Emerg Med. 2013;31(2):401-405.	Observational-Dx	3423 patients	To evaluate the diagnostic performance of chest x-ray (CXR) compared to computed tomography (CT) for detection of pulmonary opacities in adult emergency department (ED) patients.	The study cohort included 3423 patients. Shortness of breath, chest pain and cough were the most common complaints, with 96.1% of subjects reporting at least one of these symptoms. Pulmonary opacities were visualized on 309 (9.0%) CXRs and 191 (5.6 %) CT scans. CXR test characteristics for detection of pulmonary opacities included: sensitivity 43.5% (95% CI, 36.4%-50.8%); specificity 93.0% (95% CI, 92.1%-93.9%); positive predictive value 26.9% (95% CI, 22.1%-32.2%); and negative predictive value 96.5% (95% CI, 95.8%-97.1%).	3

Acute Respiratory Illness in Immunocompetent Patients
EVIDENCE TABLE

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6. Haga T, Fukuoka M, Morita M, Cho K, Tatsumi K. Computed Tomography for the Diagnosis and Evaluation of the Severity of Community-acquired Pneumonia in the Elderly. <i>Intern Med.</i> 2016;55(5):437-441.	Observational-Dx	142 patients	To assess the utility of computed tomography (CT) for the diagnosis and ascertainment of the severity of community-acquired pneumonia (CAP) in the elderly.	One hundred and forty-two patients, 65 years of age or older, were surveyed upon hospital admission for suspected CAP. Of the 142 patients included, 127 (89.4%) had pneumonic infiltration diagnosed by CT, however, chest radiography (CR) could not recognize pneumonic infiltration in 9.4% (12/127) of these patients. In 127 CAP-positive patients, bilateral pneumonic infiltration was more frequently detected by CT in non-survivors than survivors (79.0% vs. 53.7%; $p < 0.05$). By a multivariable analysis to determine the prognostic factors related to mortality from CAP, oxygen desaturation showed the greatest odds ratio among the other predictive factors, followed by comorbid neoplastic disease, blood urea nitrogen ≥ 21 mg/dL, male gender, and bilateral pneumonic infiltration diagnosed by CT.	2
7. Claessens YE, Debray MP, Tubach F, et al. Early Chest Computed Tomography Scan to Assist Diagnosis and Guide Treatment Decision for Suspected Community-acquired Pneumonia. <i>Am J Respir Crit Care Med.</i> 2015;192(8):974-982.	Observational-Dx	333 patients.	To assess whether early multidetector chest computed tomography (CT) scan affects diagnosis and management of patients visiting the emergency department with suspected community-acquired pneumonia (CAP).	Chest radiograph revealed a parenchymal infiltrate in 188 patients. CAP was initially classified as definite in 143 patients (44.8%), probable or possible in 172 (53.8%), and excluded in 4 (1.2%). CT scan revealed a parenchymal infiltrate in 40 (33%) of the patients without infiltrate on chest radiograph and excluded CAP in 56 (29.8%) of the 188 with parenchymal infiltrate on radiograph. CT scan modified classification in 187 (58.6%; 95% confidence interval, 53.2-64.0), leading to 50.8% definite CAP and 28.8% excluded CAP, and 80% of modifications were in accordance with adjudication committee classification. Because of CT scan, antibiotics were initiated in 51 (16%) and discontinued in 29 (9%), and hospitalization was decided in 22 and discharge in 23.	3

Acute Respiratory Illness in Immunocompetent Patients
EVIDENCE TABLE

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8. Bourcier JE, Paquet J, Seinger M, et al. Performance comparison of lung ultrasound and chest x-ray for the diagnosis of pneumonia in the ED. American Journal of Emergency Medicine. 32(2):115-8, 2014 Feb.	Observational-Dx	144 patients	To assess the potential of bedside lung ultrasound examination by the attending emergency physician in the diagnosis of acute pneumonia.	We found a sensitivity of 0.95 for the ultrasound examination against 0.6 for radiography (P < .05). The negative predictive value was 0.67 against 0.25 for radiography (P < .05).	3
9. Cortellaro F, Colombo S, Coen D, Duca PG. Lung ultrasound is an accurate diagnostic tool for the diagnosis of pneumonia in the emergency department. Emergency Medicine Journal. 29(1):19-23, 2012 Jan.	Observational-Dx	120 patients	To evaluate the diagnostic accuracy of bedside lung ultrasound and chest radiography (CXR) in patients with suspected pneumonia compared with computed tomography (CT) scan and final diagnosis at discharge.	120 patients entered the study. A discharge diagnosis of pneumonia was confirmed in 81 (67.5%). The first CXR was positive in 54/81 patients (sensitivity 67%; 95% CI 56.4% to 76.9%) and negative in 33/39 (specificity 85%; 95% CI 73.3% to 95.9%), whereas lung ultrasound was positive in 80/81 (sensitivity 98%; 95% CI 93.3% to 99.9%) and negative in 37/39 (specificity 95%; 95% CI 82.7% to 99.4%). A CT scan was performed in 30 patients (26 of which were positive for pneumonia); in this subgroup the first CXR was diagnostic for pneumonia in 18/26 cases (sensitivity 69%), whereas ultrasound was positive in 25/26 (sensitivity 96%). The feasibility of ultrasound was 100% and the examination was always performed in less than 5 min.	2

Acute Respiratory Illness in Immunocompetent Patients
EVIDENCE TABLE

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10. Nazerian P, Volpicelli G, Vanni S, et al. Accuracy of lung ultrasound for the diagnosis of consolidations when compared to chest computed tomography. <i>American Journal of Emergency Medicine</i> . 33(5):620-5, 2015 May.	Observational-Dx	285 patients	To assess the accuracy of lung ultrasound (LUS) for the diagnosis of lung consolidations when compared to chest computed tomography (CT).	We analyzed 285 patients. CT was positive for at least one consolidation in 87 patients. LUS was feasible in all patients and in 81 showed at least one consolidation, with a good inter-observer agreement ($k = 0.83$), sensitivity 82.8% (95% CI 73.2%-90%) and specificity 95.5% (95% CI 91.5%-97.9%). Sensitivity raised to 91.7% (95% CI 61.5%-98.6%) and specificity to 97.4% (95% CI 86.5%-99.6%) in patients complaining of pleuritic chest pain. In a subgroup of 190 patients who underwent also chest radiography (CXR), the sensitivity of LUS (81.4%, 95% CI 70.7%-89.7%) was significantly superior to CXR (64.3%, 95% CI 51.9%-75.4%) ($P < .05$), whereas specificity remained similar (94.2%, 95% CI 88.4%-97.6% vs. 90%, 95% CI 83.2%-94.7%).	2

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<p>11. Reissig A, Copetti R, Mathis G, et al. Lung ultrasound in the diagnosis and follow-up of community-acquired pneumonia: a prospective, multicenter, diagnostic accuracy study. <i>Chest</i>. 142(4):965-972, 2012 Oct.</p>	<p>Observational-Dx</p>	<p>229 patients</p>	<p>To define the accuracy of lung ultrasound (LUS) in the diagnosis of community-acquired pneumonia (CAP).</p>	<p>CAP was confirmed in 229 patients (63.3%). LUS revealed a sensitivity of 93.4% (95% CI, 89.2%-96.3%), specificity of 97.7% (95% CI, 93.4%-99.6%), and likelihood ratios (LRs) of 40.5 (95% CI, 13.2-123.9) for positive and 0.07 (95% CI, 0.04-0.11) for negative results. A combination of auscultation and LUS increased the positive LR to 42.9 (95% CI, 10.8-170.0) and decreased the negative LR to 0.04 (95% CI, 0.02-0.09). We found 97.6% (205 of 211) of patients with CAP showed breath-dependent motion of infiltrates, 86.7% (183 of 211) an air bronchogram, 76.5% (156 of 204) blurred margins, and 54.4% (105 of 193) a basal pleural effusion. During follow-up, median C-reactive protein levels decreased from 137 mg/dL to 6.3 mg/dL at days 13 to 16 as did signs of CAP; median area of lesions decreased from 15.3 cm² to 0.2 cm² and pleural effusion from 50 mL to 0 mL.</p>	<p>3</p>

Acute Respiratory Illness in Immunocompetent Patients
EVIDENCE TABLE

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12. Sperandeo M, Carnevale V, Muscarella S, et al. Clinical application of transthoracic ultrasonography in inpatients with pneumonia. <i>European Journal of Clinical Investigation</i> . 41(1):1-7, 2011 Jan.	Observational-Dx	391 patients	To investigate the clinical applicability of transthoracic ultrasound (TUS) in the diagnosis and follow-up of community acquired pneumonia (CAP).	Concerning the reproducibility of TUS method, no reader's bias was present (P=0.18), overall variability and between-subject variability (inter-reader agreement) did not show any difference between readers (P = 0.62 and P = 0.32 respectively), and estimated within-subject variabilities (intra-reader agreement) suggested a very high repeatability of the method (P approximately 1). Of 342 patients with Rx diagnosis of CAP, in 314 patients (92% of cases) a pulmonary consolidation was also detected using TUS, whose ultrasonographic patterns were studied. Pleural effusion was detected in 120/342 (35%) patients using ultrasound and in 111/342 (32%) patients using chest radiography. Overall dimensional changes of the lung consolidated areas assessed with TUS method showed highly significant results. (1st day mean +/- SD: 66.34 +/- 19.25; 4th day: 39.92 +/- 14.61; 8-10th day: 7.41 +/- 1.50; P < 0.0001).	2
13. Bouhemad B, Zhang M, Lu Q, Rouby JJ. Clinical review: Bedside lung ultrasound in critical care practice. [Review] [61 refs]. <i>Critical Care</i> (London, England). 11(1):205, 2007.	Review/Other-Dx	N/A	To review the performance of bedside lung ultrasound for diagnosing pleural effusion, pneumothorax, alveolar-interstitial syndrome, lung consolidation, pulmonary abscess and lung recruitment/derecruitment in critically ill patients with acute lung injury.	No results stated in abstract.	4

Acute Respiratory Illness in Immunocompetent Patients
EVIDENCE TABLE

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14. Syrjala H, Broas M, Ohtonen P, Jartti A, Paakko E. Chest magnetic resonance imaging for pneumonia diagnosis in outpatients with lower respiratory tract infection. <i>Eur Respir J.</i> 2017;49(1).	Experiment al-Dx	77 patients	To assess whether magnetic resonance imaging (MRI) is applicable for diagnosing pneumonia among adult outpatients with lower respiratory tract infection.	MRI missed two HRCT-identified pneumonia cases due to motion artefacts. Chest radiography resulted in four false-positive pneumonia findings and MRI resulted in none. When HRCT was used as a reference, MRI had a sensitivity of 0.938 (95% CI 0.799-0.983) and specificity of 0.978 (95% CI 0.884-0.996) for the diagnosis of pneumonia, whereas the sensitivity and specificity for chest radiography were 0.719 (95% CI 0.546-0.844) and 0.911 (95% CI 0.793-0.965), respectively.	1
15. Attenberger UI, Morelli JN, Henzler T, et al. 3 Tesla proton MRI for the diagnosis of pneumonia/lung infiltrates in neutropenic patients with acute myeloid leukemia: initial results in comparison to HRCT. <i>Eur J Radiol.</i> 83(1):e61-6, 2014 Jan.	Experiment al-Dx	19 patients	To evaluate the diagnostic accuracy of 3 Tesla proton MRI for the assessment of pneumonia/lung infiltrates in neutropenic patients with acute myeloid leukemia.	Pulmonary abnormalities were characterized by 3 Tesla MRI with a sensitivity of 82.3% and a specificity of 78.6%, resulting in an overall accuracy of 88% (NPV/PPV 66.7%/89.5%). In 51 lobes (19 of 19 patients), pulmonary abnormalities visualized by MR were judged to be concordant in their location and in the lesion type identified by both readers. In 22 lobes (11 of 19 patients), no abnormalities were present on either MR or HRCT (true negative). In 6 lobes (5 of 19 patients), ground glass opacity areas were detected on MRI but were not visible on HRCT (false positives). In 11 lobes (7 of 19 patients), MRI failed to detect ground glass opacity areas identified by HRCT. However, since the abnormalities were disseminated in these patients, accurate treatment decisions were possible in every case based on MRI. In one case MRI showed a central area of cavitation, which was not visualized by HRCT.	1

Acute Respiratory Illness in Immunocompetent Patients
EVIDENCE TABLE

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16. Ekinci A, Yucel Ucarkus T, Okur A, Ozturk M, Dogan S. MRI of pneumonia in immunocompromised patients: comparison with CT. <i>Diagn Interv Radiol.</i> 23(1):22-28, 2017 Jan-Feb.	Experimental-Dx	40 patients	To investigate the utility of magnetic resonance imaging (MRI) in the diagnosis and surveillance of immunocompromised patients with pneumonia.	Infection was determined in 36 patients (90%), while the causative organism remained unknown in four patients (10%). In all the patients, the CT findings were consistent with infection, although three patients showed no abnormal findings on MRI. CT was superior to MRI in the detection of the tree-in-bud nodules, centrilobular nodules, and halo sign ($P < 0.001$, for all). A significant difference was observed between the MRI sequences and CT in terms of the number of detected nodules ($P < 0.001$). The nodule detection rate of MRI significantly increased in proportion to the size of the nodule ($P < 0.001$). All MRI sequences had almost perfect agreement with CT for the detection of consolidation (small ka, Cyrillic=0.950, $P < 0.001$), patchy increased density (small ka, Cyrillic=1, $P < 0.001$), pleural effusion (small ka, Cyrillic=0.870, $P < 0.001$), pericardial effusion (small ka, Cyrillic=1, $P < 0.001$), reverse halo sign, (small ka, Cyrillic=1 $P < 0.001$), 10-20 mm, nodules (small ka, Cyrillic=0.896, $P < 0.001$ for CT and B-FFE; small ka, Cyrillic=0.948, $P < 0.001$ for CT and T1- or T2-weighted imaging) 10-20 mm, >20 mm nodules (small ka, Cyrillic=0.844, $P < 0.001$).	2
17. Peltola V, Ruuskanen O, Svedstrom E. Magnetic resonance imaging of lung infections in children. <i>Pediatr Radiol.</i> 2008;38(11):1225-1231.	Review/Other-Dx	N/A	To illustrate MRI findings in children with pneumonia caused by <i>Mycoplasma pneumoniae</i> , <i>Streptococcus pneumoniae</i> , and other pathogens.	No results stated in abstract.	4

Acute Respiratory Illness in Immunocompetent Patients
EVIDENCE TABLE

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18. Rieger C, Herzog P, Eibel R, Fiegl M, Ostermann H. Pulmonary MRI--a new approach for the evaluation of febrile neutropenic patients with malignancies. <i>Support Care Cancer</i> . 16(6):599-606, 2008 Jun.	Observational-Dx	50 patients	To determine the feasibility and sensitivity of magnetic resonance imaging (MRI) of the lung compared to HR-CT in immunocompromised patients with persistent fever in neutropenia and suspected pneumonia.	Of 50 patients, 35 had pulmonary infiltration according to HR-CT; these were examined with MRI of the lungs. MRI showed a high correlation (91%) with the findings in HR-CT. Both HR-CT and MRI were feasible in 94% of the examined patients. In 12 of 35 patients, fungal pathogens were identified in microbiological testing.	2
19. Sodhi KS, Khandelwal N, Saxena AK, et al. Rapid lung MRI in children with pulmonary infections: Time to change our diagnostic algorithms. <i>J Magn Reson Imaging</i> . 2016;43(5):1196-1206.	Experimental-Dx	75 patients	To determine the diagnostic utility of a new rapid MRI protocol, as compared with computed tomography (CT) for the detection of various pulmonary and mediastinal abnormalities in children with suspected pulmonary infections.	MRI with a new rapid MRI protocol demonstrated sensitivity, specificity, PPV, and NPV of 100% for detecting pulmonary consolidation, nodules (>3 mm), cyst/cavity, hyperinflation, pleural effusion, and lymph nodes. The kappa-test showed almost perfect agreement between MRI and multidetector CT (MDCT) in detecting thoracic abnormalities (k = 0.9). No statistically significant difference was observed between MRI and MDCT for detecting thoracic abnormalities by the McNemar test (P = 0.125).	2
20. Yikilmaz A, Koc A, Coskun A, Ozturk MK, Mulkern RV, Lee EY. Evaluation of pneumonia in children: comparison of MRI with fast imaging sequences at 1.5T with chest radiographs. <i>Acta Radiol</i> . 2011;52(8):914-919.	Observational-Dx	40 patients	To investigate the efficacy of chest MRI with fast imaging sequences at 1.5T for evaluating pneumonia in children by comparing MRI findings with those of chest radiographs.	All consolidation, lung necrosis/abscess, bronchiectasis, and pleural effusion detected with chest radiographs were also detected with MRI. There was statistically substantial agreement between chest radiographs and MRI in detecting consolidation (k = 0.78) and bronchiectasis (k = 0.72) in children with pneumonia. The agreement between chest radiographs and MRI was moderate for detecting necrosis/abscess (k = 0.49) and fair for detecting pleural effusion (k = 0.30).	3

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EVIDENCE TABLE

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21. Benacerraf BR, McLoud TC, Rhea JT, Tritschler V, Libby P. An assessment of the contribution of chest radiography in outpatients with acute chest complaints: a prospective study. <i>Radiology</i> . 1981; 138(2):293-299.	Review/Other-Dx	1,102 consecutive patients	To assess the value of CXR in patients with chest complaints to identify selective indications for CXR in this population with relation to the patient's age, the symptoms, and the results of physical examination.	Although in patients over 40 years old, chest symptoms are a sufficient indication for CXR, 96% of the patients below age 40 had a normal physical examination of the chest, no hemoptysis, and no acute radiographic abnormalities. If CXRs in the below-40 group had been limited to patients with abnormal physical examinations and/or hemoptysis, 58% of the patients in that group would have been spared the examination. Under these conditions, 2.3% of the acute radiographic abnormalities in the entire population of patients under 40 would have gone undetected.	4
22. Heckerling PS. The need for chest roentgenograms in adults with acute respiratory illness. Clinical predictors. <i>Arch Intern Med</i> . 1986; 146(7):1321-1324.	Observational-Dx	464 patients	To study the predictive values of several clinical variables for the presence or absence of pneumonia in adults with acute respiratory complaints.	Of 464 patients who received a CXR, 129 (27.8%) had pneumonia. None of the symptoms, signs, or laboratory findings evaluated could reliably predict the presence of pneumonia. The absence of abnormal auscultatory findings on lung examination, however, excluded pneumonia with >95% certainty. Among the 106 patients who presented with acute asthma, only 2 (1.9%) had pneumonia. Among the 33 patients with underlying organic brain syndrome, 25 (75.8%) had pneumonia. Incorporating these findings into a diagnostic strategy for ordering CXRs could have reduced the number obtained by 54% and spared 72% of patients without pneumonia unnecessary radiation exposure.	3

Acute Respiratory Illness in Immunocompetent Patients
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23. Okimoto N, Yamato K, Kurihara T, et al. Clinical predictors for the detection of community-acquired pneumonia in adults as a guide to ordering chest radiographs. <i>Respirology</i> . 2006; 11(3):322-324.	Observational-Dx	79 outpatients	To identify sensitive clinical predictors for the detection of community-acquired pneumonia in adults as a guide to when to order a CXR.	A total of 24 patients (30.4%) had radiological evidence of pneumonia. In total, 22 presented with 4 clinical signs: fever, cough, sputum and coarse crackles. The sensitivity and the specificity of detecting pneumonia based on these 4 clinical signs mentioned was 91.7% and 92.7%, respectively.	4
24. O'Brien WT, Sr., Rohweder DA, Lattin GE, Jr., et al. Clinical indicators of radiographic findings in patients with suspected community-acquired pneumonia: who needs a chest x-ray? <i>J Am Coll Radiol</i> . 2006; 3(9):703-706.	Observational-Dx	350 patients	To develop a prediction rule for the use of CXRs in evaluating for CAP based on presenting signs and symptoms.	The data show that vital sign and physical examination findings are useful screening parameters for CAP, demonstrating a sensitivity of 95%, a specificity of 56%, and an OR of 24.9 [corrected] in the presence of vital sign or physical examination abnormalities. In light of these results, the authors developed a prediction rule for low-risk patients with reliable follow-up, which states that CXRs are unnecessary in the presence of normal vital signs and physical examination findings.	2
25. Ebrahimzadeh A, Mohammadifard M, Naseh G, Mirgholami A. Clinical and Laboratory Findings in Patients With Acute Respiratory Symptoms That Suggest the Necessity of Chest X-ray for Community-Acquired Pneumonia. <i>Iran J Radiol</i> . 2015;12(1):e13547.	Observational-Dx	420 patients.	To derive practical criteria for performing chest radiographs for the evaluation of community-acquired pneumonia (CAP).	The data showed that vital signs and physical examination findings are useful screening parameters for predicting chest radiograph findings in outpatient settings. Therefore, by implementing a prediction rule, we would be able to determine which patients would benefit from a chest X-Ray (sensitivity, 94% and specificity, 57%).	2
26. Meltzer MI. Increased hospitalizations of elderly patients. <i>Emerg Infect Dis</i> . 2008;14(5):847-848.	Review/Other-Dx	N/A	To report that there is increase in Emerging Infectious Diseases among those >65 years of age.	No results stated in abstract.	4

Acute Respiratory Illness in Immunocompetent Patients
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27. Trotter CL, Stuart JM, George R, Miller E. Increasing hospital admissions for pneumonia, England. <i>Emerg Infect Dis.</i> 2008;14(5):727-733.	Review/Other-Dx	N/A	To describe trends in pneumonia hospitalizations, we extracted information on all episodes of pneumonia that occurred from April 1997 through March 2005 recorded in the Hospital Episode Statistics (HES) database by searching for International Classification of Diseases 10th revision codes J12-J18 in any diagnostic field.	The age-standardized incidence of hospitalization with a primary diagnosis of pneumonia increased by 34% from 1.48 to 1.98 per 1,000 population between 1997-98 and 2004-05. The increase was more marked in older adults, in whom the mortality rate was also highest. The proportion of patients with recorded coexisting conditions (defined by using the Charlson Comorbidity Index score) increased over the study period. The rise in pneumonia hospital admissions was not fully explained by demographic change or increasing coexisting conditions.	4
28. Metlay JP, Schulz R, Li YH, et al. Influence of age on symptoms at presentation in patients with community-acquired pneumonia. <i>Arch Intern Med.</i> 1997;157(13):1453-1459.	Review/Other-Dx	1812 patients	To evaluate the association between age and the presenting symptoms in patients with community-acquired pneumonia.	The 1812 eligible study patients were categorized into 4 age groups: 18 through 44 years (43%), 45 through 64 years (25%), 65 through 74 years (17%), and 75 years or older (15%). For 17 of the 18 symptoms, there were significant decreases in reported prevalence with increasing age ($P < .01$). In a linear regression analysis, controlling for patient demographics, comorbidity, and severity of illness at presentation, older age remained associated with lower symptom scores ($P < .001$).	4

Acute Respiratory Illness in Immunocompetent Patients
EVIDENCE TABLE

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<p>29. Aagaard E, Maselli J, Gonzales R. Physician practice patterns: chest x-ray ordering for the evaluation of acute cough illness in adults. <i>Med Decis Making.</i> 2006; 26(6):599-605.</p>	<p>Review/Other-Dx</p>	<p>300 adults</p>	<p>To examine which clinical factors contribute to the clinician suspicion of pneumonia, as well as the relationship between clinical factors, clinician suspicion of pneumonia, and ordering CXR.</p>	<p>Clinician suspicion of pneumonia was low in the majority of patients presenting for evaluation of cough (63%). Higher clinician suspicion of pneumonia was predicted by advanced patient age (OR: 4.6; 95% CI, [1.2-18.1]), shortness of breath (2.4; [1.0-6.0]), fever (5.5; [1.8-17.5]), tachycardia (3.8; [1.1-13.1]), rales (23.8; [5.7-98.7]), and rhonchi (14.6; [5.2-40.5]). CXRs were ordered in 19% of patients presenting with acute cough. Intermediate clinician suspicion of pneumonia (OR: 7.9; 95% CI, [2.8, 22.5]) (vs low suspicion), advanced patient age (≥65 years) (9.2; [2.7, 31.6]) (vs ages 18-44 years), and decreased breath sounds on examination (5.1; [1.8, 14.3]) are independent predictors of ordering a CXR. Among patients with a clinical diagnosis of pneumonia (n=31), CXRs were ordered in only 61%.</p>	<p>4</p>

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30. Basi SK, Marrie TJ, Huang JQ, Majumdar SR. Patients admitted to hospital with suspected pneumonia and normal chest radiographs: epidemiology, microbiology, and outcomes. <i>Am J Med.</i> 2004; 117(5):305-311.	Review/Other-Dx	2,706 adults	To describe the prevalence of patients admitted to hospital with a diagnosis of community-acquired pneumonia who have normal CXRs; the extent to which patients actually had pneumonia on radiographs; and to compare presentation and outcomes in patients with a lower respiratory tract infection and those whose clinical diagnosis of pneumonia was confirmed by radiography.	One third (n=911) of patients admitted with pneumonia had their initial radiograph reported as “no pneumonia.” Independent review found that only 7% (6/92) of radiographs developed an opacity that confirmed pneumonia. Characteristics were similar among admitted patients irrespective of radiographic findings, although patients without pneumonia on radiograph were older (mean [+/- SD] age, 73 +/- 15 years vs 68 +/- 19 years, P<0.001) and had greater pneumonia-specific severity-of-illness scores (104 +/- 32 vs 99 +/- 37, P=0.004). Patients without radiographic confirmation of pneumonia had similar rates of positive sputum cultures (32% [87/271] vs 30% [208/706], P=0.42) and blood cultures (6% [35/576] vs 8% [100/1241], P=0.13), but microbiology results differed, with a shift away from <i>Streptococcus pneumoniae</i> towards other streptococci species and gram-negative aerobic bacilli. In-hospital mortality was similar for both groups of patients (8% [64/911] in the unconfirmed pneumonia group vs 10% [165/1795] in the confirmed group, adjusted P=0.09).	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
31. Speets AM, Hoes AW, van der Graaf Y, Kalmijn S, Sachs AP, Mali WP. Chest radiography and pneumonia in primary care: diagnostic yield and consequences for patient management. <i>Eur Respir J.</i> 2006; 28(5):933-938.	Observational-Dx	192 patients	To assess the diagnostic yield of CXR in primary-care patients suspected of pneumonia.	Pneumonia was diagnosed by general practitioners in 35 (18%) patients, of whom 27 (14%) patients had a positive CXR, and 8 (4%) patients a negative CXR, but with an assumed high probability of pneumonia by the general practitioner. CXR clearly influenced the diagnosis of pneumonia by the general practitioner in 53% of the patients. CXR ruled out pneumonia in 47% and the probability of pneumonia substantially increased in 6% of the patients. Patient management changed after CXR in 69% of the patients, mainly caused by a reduction in medication prescription (from 43% to 17%) and more frequent reassurance of the patient (from 8% to 35%).	3
32. Hayden GE, Wrenn KW. Chest radiograph vs. computed tomography scan in the evaluation for pneumonia. <i>J Emerg Med.</i> 2009; 36(3):266-270.	Review/Other-Dx	26 patients had either negative CXR or nondiagnostic	To determine, in an emergency department population, the incidence of pneumonia diagnosed on thoracic CT in the setting of negative or nondiagnostic CXRs.	Of the 1,057 patients diagnosed with pneumonia, both CXR and CT were performed in 97 cases. Of this group, there were 26 patients (27%), in whom the CXR was either negative or nondiagnostic, but the CT noted an infiltrate/consolidation consistent with pneumonia. The authors find that in 27% of cases in which both a CXR and a CT scan were performed in the workup of varied chief complaints, pneumonia was demonstrated on CT in the face of a negative or nondiagnostic CXR.	4
33. Maughan BC, Asselin N, Carey JL, Sucof A, Valente JH. False-negative chest radiographs in emergency department diagnosis of pneumonia. <i>R I Med J</i> (2013). 2014;97(8):20-23.	Observational-Dx	428 patients.	To identify patients admitted with pneumonia who were diagnosed by computed tomography (CT) despite nondiagnostic chest x-ray (CXR).	49 patients (11.4%) were diagnosed by CT ($p<0.001$). These patients were younger ($p<0.001$) and more often complained of chest pain ($p<0.001$).	3

Acute Respiratory Illness in Immunocompetent Patients
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
34. Walker JS, Levy G. Kinetics of drug action in disease states. XXXIV. Effect of experimental thyroid disorders on the pharmacodynamics of phenobarbital, ethanol and pentylenetetrazol. J Pharmacol Exp Ther. 1989;249(1):6-10.	Experiment al-Tx	68 rats	To determine the effect of thyroid disorders on the concentration-activity relationship of certain drugs acting on the central nervous system.	The hypnotic dose of ethanol was increased significantly in hyperthyroid rats and decreased in hypothyroid animals; ethanol concentrations in serum, brain and CSF at onset of effect were generally not affected by thyroid dysfunction except for a small but statistically significant increase of serum ethanol concentrations in the hyperthyroid rats. The convulsant dose of pentylenetetrazol was reduced significantly in hypothyroid animals and unaltered in hyperthyroid rats; the concentrations of the convulsant in serum, brain and CSF were not apparently changed by the thyroid dysfunctions.	1
35. Baber CE, Hedlund LW, Oddson TA, Putman CE. Differentiating empyemas and peripheral pulmonary abscesses: the value of computed tomography. Radiology. 1980; 135(3):755-758.	Review/Ot her-Dx	13 patients	To determine the value of CT in differentiating empyemas and peripheral pulmonary abscesses.	After CT, 8 patients were diagnosed as having abscesses and 5 as having empyemas. Abscesses had an irregular shape and a relatively thick wall which was not uniformly wide and did not have a discrete boundary between the lesion and lung parenchyma. In contrast, empyemas had a regularly shaped lumen, a smooth inner surface, and a sharply defined border between the lesion and lung. CT studies can help to distinguish between empyemas and abscesses, and treatment can be started sooner in difficult cases.	4
36. Soni NJ, Franco R, Velez MI, et al. Ultrasound in the diagnosis and management of pleural effusions. [Review]. Journal of Hospital Medicine (Online). 10(12):811-6, 2015 Dec.	Review/Ot her-Dx	N/A	To provide an overview of how point-of-care ultrasound can be utilized by hospitalists in the care of patients with pleural effusions	No results stated in abstract	4

**Acute Respiratory Illness in Immunocompetent Patients
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
37. Findley LJ, Sahn SA. The value of chest roentgenograms in acute asthma in adults. <i>Chest</i> . 1981; 80(5):535-536.	Review/Other-Dx	90 roentgenograms	To determine the frequency of roentgenographic abnormalities in adults with acute asthma seen in an emergency room and to assess its value in guiding management.	Chest roentgenograms were obtained in 90 episodes of acute asthma in adults coming to an emergency room. of these 90 roentgenograms, 50 (55 percent) were interpreted as normal, 33 (37 percent) showed hyperinflation, and 6 (7 percent) showed minimal interstitial abnormalities unchanged from previous roentgenograms. One (1 percent) showed a new alveolar infiltrate in a patient with allergic aspergillosis. There was no significant correlation between chest roentgenogram interpretation and hospitalization. Our data show that the incidence of specific abnormalities on chest roentgenogram in adults with uncomplicated acute asthma is low and suggests that the information obtained from the roentgenogram is rarely helpful to outpatient management.	4
38. Petheram IS, Kerr IH, Collins JV. Value of chest radiographs in severe acute asthma. <i>Clin Radiol</i> . 1981; 32(3):281-282.	Observational-Dx	117 patients	To assess the value of CXRs in determining the frequency and importance of radiological abnormalities in adults with severe acute asthma.	92 (70%) of the admission	3
39. White CS, Cole RP, Lubetsky HW, Austin JH. Acute asthma. Admission chest radiography in hospitalized adult patients. <i>Chest</i> . 1991; 100(1):14-16.	Review/Other-Dx	54 patients	To examine the effect of admission CXR on immediate management decisions after unsuccessful therapy in the emergency ward	Major radiographic abnormalities were found in 20 (34 percent) of 58 occasions. These abnormalities included focal parenchymal opacities, IIM, enlarged cardiac silhouette, pulmonary vascular congestion, new solitary pulmonary nodule and pneumothorax. Subsequent antibiotic use correlated with radiographic focal opacities or IIM, even in afebrile patients, but did not correlate with elevated blood leukocyte count.	4

**Acute Respiratory Illness in Immunocompetent Patients
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
40. Sherman S, Skoney JA, Ravikrishnan KP. Routine chest radiographs in exacerbations of chronic obstructive pulmonary disease. Diagnostic value. Arch Intern Med. 1989; 149(11):2493-2496.	Review/Other-Dx	54 patients	To review the impact of admission CXR on in-hospital management of patients with acute asthma.	Major radiographic abnormalities were found in 20 (34%) of 58 occasions. These abnormalities included focal parenchymal opacities, increased interstitial markings, enlarged cardiac silhouette, pulmonary vascular congestion, new solitary pulmonary nodule and pneumothorax. Subsequent antibiotic use correlated with radiographic focal opacities or increased interstitial markings, even in afebrile patients, but did not correlate with elevated blood leukocyte count. Based on the evidence of in-hospital alteration of management independent of elevated blood leukocyte count and body temperature, the authors recommend that CXRs be obtained for all adult patients admitted because of acute asthma.	4
41. American College of Radiology. ACR Appropriateness Criteria® Radiation Dose Assessment Introduction. Available at: https://www.acr.org/-/media/ACR/Files/Appropriateness-Criteria/RadiationDoseAssessmentIntro.pdf .	Review/Other-Dx	N/A	Guidance document on exposure of patients to ionizing radiation.	No results stated in abstract.	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.
- Meta-analysis
 - a. *Good quality* – the study design, methods, analysis, and results are valid and the conclusion is supported.
 - b. *Inadequate quality* – the study design, analysis, and results lack the methodological rigor to be considered a good meta-analysis study.

Abbreviations Key

Dx = Diagnostic

Tx = Treatment