

Diagnosis of Acute Bronchitis in Adults: A National Survey of Family Physicians

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BACKGROUND. The purpose of this study was to determine how family physicians in the United States diagnose acute bronchitis in otherwise healthy adults.

METHODS. A 33-item questionnaire on the diagnosis and treatment of acute bronchitis was mailed to a random sample of 500 physicians who are members of the American Board of Family Practice.

RESULTS. Two hundred sixty-five physicians responded. Of those who did not respond, 32 could not be located. Of those who did respond, 10 were either retired or were practicing in another specialty. The net response rate was 56% (255/458). Responding physicians stated that character of cough and sputum production are the most important items used in diagnosing acute bronchitis. Fifty-eight percent indicated that the cough should be productive, and 60% stated that the sputum should be purulent. Seventy-two percent of respondents did not feel that wheezing or rhonchi need to be present. Younger physicians and those who selected antibiotics as their first treatment choice were more likely to define acute bronchitis as the presence of a productive cough with purulent sputum ($P < .05$). Physicians from an academic setting were more likely to define acute bronchitis as a productive cough ($P < .05$). Thirty-six percent of physicians from practices serving populations with $\geq 60\%$ managed care patients included wheezing or rhonchi in the definition of acute bronchitis, compared with 26% of all others ($P < .05$).

CONCLUSIONS. Variations in the diagnosis of acute bronchitis in otherwise healthy adults can be attributed to physician age, treatment choice, and practice setting. A significant number of family physicians did not require a productive cough as part of the diagnostic criteria for acute bronchitis. This finding needs to be considered in studies evaluating treatment. Additional qualitative studies are necessary to identify other factors involved in diagnosing acute bronchitis.

KEY WORDS. Bronchitis; cough; sputum; diagnosis; family practice; physicians, family. (*J Fam Pract* 1997; 45:402-409)

We are overloaded with terms to express the same idea, and of these terms, a great number are so loose and indefinite, as to convey no precise idea, whatsoever; whilst others, on the contrary, cannot fail to excite an erroneous one.

Dr Mason Good (1846)¹

Originally described in 1808 by Dr Badham as an inflammation of the mucous membranes of the bronchi,¹ acute bronchitis is one of the most common yet least understood problems seen in the outpatient setting. Acute bronchitis

ranks in the top 10 most frequent office diagnoses made by physicians in North America at an estimated cost of between \$200 and \$300 million each year.² Patients lose 2 to 3 work days and receive an average of two prescriptions per episode. About one half of patients use over-the-counter medications.

Acute bronchitis is a clinical diagnosis, likely encompassing multiple diseases in a final common pathophysiologic pathway. Infection, generally of viral origin, is considered to trigger this process. Injury of the bronchial epithelium leads to an inflammatory response, resulting in airway hyperresponsiveness and production of mucus. Cough,

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the primary complaint, is often accompanied by a low-grade fever and chest discomfort. Symptoms frequently persist with the cough often lasting up to a month.

Treatment of acute bronchitis is controversial. Erythromycin, trimethoprim/sulfamethoxazole, or doxycycline may provide marginal benefit in the relief of symptoms,^{2,5} but the rapid emergence of antibiotic resistance necessitates evaluation of other therapies for conditions in which antibiotics are not clearly proven to be beneficial.^{6,8} Although initial reports of the potential role of β_2 -agonist bronchodilators are promising,^{9,11} additional studies of bronchodilators and other treatment modalities are needed.

An essential component in the study of acute bronchitis is an acceptable definition. In 1934, the *Merck Manual* described acute bronchitis as a cough that is at first unproductive, dry and rough with paroxysmal racking and distressing; later looser and less annoying.¹² The sputum is described as initially dry and scanty, viscid and difficult to expel; later becoming mucopurulent or purulent. This description emphasizes the variation in the quality and character of the cough. Current textbooks of primary care and respiratory disease provide varying definitions of acute bronchitis, with respect to the character, severity, and duration of the cough; quality of the sputum; and associated clinical findings.¹³⁻¹⁸ In randomized clinical trials, acute bronchitis has generally been defined as a productive cough, either purulent or nonpurulent.^{2,4,9,10,19-21} Other studies have also included patients with a nonproductive cough^{11,22} or only patients with a purulent, productive cough.²

The purpose of this study was to determine how family physicians in the United States define and treat acute bronchitis in the otherwise healthy adult. Once the definition of acute bronchitis is obtained, it could be used in the design of future studies to evaluate treatments. Only the results related to the diagnosis of acute bronchitis are included in this article; results and discussion of treatment will be provided in a separate paper.

METHODS

STUDY POPULATION AND SURVEY METHOD

A survey instrument regarding the diagnosis and treatment of acute bronchitis was mailed to 500 family physicians in January 1996. The list of physi-

cians was generated by randomly sampling the 1995 *Directory of the American Board of Family Practice*.²³ Before the first mailing, the survey instrument was pilot-tested for clarity, usefulness, and face validity. A cover letter explaining the study and a prestamped return envelope were included with the questionnaire. Second and third mailings were sent to nonresponders.

SURVEY INSTRUMENT

The survey consisted of a 33-item questionnaire, including 6 demographic questions, 13 questions related to diagnosis, and 14 questions about treatment of acute bronchitis in the otherwise healthy adult. The demographic questions included information about age, sex, years in practice, practice type and location, and the percentage of managed care patients in the practice. A brief vignette described a healthy nonsmoking adult with acute bronchitis who did not have systemic or sinusitis symptoms. Six questions concerning the quality, character, and duration of the cough and associated clinical findings followed the vignette. Physicians were asked to rank the items in order of their relative importance in diagnosing acute bronchitis. Respondents were also asked if the smoking status of the patient affects the diagnosis and to rank order the same items for the patient who smokes. The final questions addressed the frequency with which chest radiographs and spirometry are ordered for both the smoking and nonsmoking patient.

SAMPLE SIZE

For this study, a difference of .10 between two proportions was considered to be clinically significant. This size difference translates into an effect size of $h = .20$ for the Difference in Proportions Test (DIP).^{24,25} A sample size of 350 would provide a power of .84. Since most of the variables were categorical, the chi-square test was expected to be the most frequently used statistical test. For chi-square tests of 9 degrees of freedom (df), a sample size of 180 provides a power of .82 to detect a medium effect size, $w = .30$.²⁵ Based on this information, a sample size of 500 was selected.

ANALYSIS

Descriptive statistics on the demographic variables consisted of counts and percentages for the nominal and ordinal variables. Years of practice was a

TABLE 1

Demographics of Responding Family Physicians

Category	Responding Physicians n (%)*
Age, y	
≤35	28 (11)
36-45	140 (55)
46-55	59 (23)
≥56	26 (10)
Practice type	
Solo	28 (11)
Small single specialty (2-4 physicians)	83 (33)
Large single specialty (≥5 physicians)	51 (20)
Multispecialty	44 (17)
Academic	30 (12)
Other	17 (7)
HMO patients in practice	
<20%	103 (41)
20-40%	67 (27)
41-60%	53 (21)
61-80%	13 (5)
>80%	14 (6)

*Since not all responders answered all questions, the number varies by category. Percentages are based on the number responding to a given category.

HMO denotes health maintenance organization. reference group.

continuous variable, and the standard measures of central tendency and dispersion were computed.

The demographic variables were most often used as grouping variables. Responses with either nominal or ordinal variables were compared with chi-square tests. Other tests used in this situation were the DIP and the Gradient in Proportions Test (GIP).²⁶ In all cases, the *P* value was adjusted for multiple comparisons by the conservative Bonferroni method.

Some responses were continuous variables, but there was no statistical evidence that these variables were normally distributed. Descriptive correlation coefficients were obtained for certain pairs of variables.

RESULTS

Two hundred sixty-five physicians responded. Of the nonrespondents, 32 could not be located. Data from 10 physicians who were either retired or practicing in another specialty were not included in the analy-

sis. The remaining 255 responses were analyzed, for a net response rate of 56% (255/458). Since not all physicians responded to each question, the number varies by question.

Responding physicians had been in practice an average of 12.9 years (SD±1.1). Sixteen percent of respondents were female, 68% male, and 16% did not answer the question. Fifty-one percent of respondents reported that they practiced in an urban setting (respondent's definition), and 44% said they practiced in a rural location. Demographics of respondents, including age, practice type, and percentage of physician's practice composed of health maintenance organization (HMO) patients, are displayed in Table 1.

To make a diagnosis of acute bronchitis, 58% of physicians responded that the cough should be productive, and 60% responded that the sputum should be purulent. Seventy-two percent of physicians felt

TABLE 2

Physician Responses to Questions About the Definition of Acute Bronchitis

Category	Response	Responding Physicians n (%)*
Cough should be	Productive	148 (58)
	Nonproductive	7 (3)
	DNM	99 (39)
Character of sputum, if any, should be	Purulent	154 (60)
	Clear, thin	10 (4)
	DNM	91 (36)
Severity of cough should be	Mild/moderate	90 (35)
	Severe	33 (13)
	DNM	131 (52)
Duration of cough should be	At least 2 days	134 (53)
	At least 7 days	50 (20)
	DNM	69 (27)
Fever should be	Present	45 (18)
	Absent	19 (8)
	DNM	191 (75)
Wheezing or rhonchi need to be present	Yes	71 (28)
	No	183 (72)

*Since not all responders answered all questions, the number varies by category. Percentages are based on the number responding to a given category.

DNM denotes "does not matter."

TABLE 3

Physician Responses to the Diagnostic Usefulness of Productive Cough and Purulent Sputum

Presence of Symptoms	% of All Respondents	Antibiotics 1st Choice of Treatment (%)	Other as 1st Choice of Treatment (%)
Productive cough/purulent sputum	49	57	35
Productive cough/no purulent sputum†	9	7	13
No productive cough*/purulent sputum	12	15	6
No productive cough/no purulent sputum†	30	21	46

* No productive cough includes physician responses for nonproductive and "does not matter."

† No purulent sputum includes responses for clear sputum and "does not matter."

patient affects the diagnosis of acute bronchitis. In patients who smoke, sputum production is ranked as the most important item, with character of cough and associated clinical findings ranked as next important.

Younger physicians were more likely to define acute bronchitis as a productive cough with a purulent sputum (Table 4). Practitioners from academic settings were more likely to define acute bronchitis as a productive cough (70% academic; 57% others; DIP: $P < .05$). There was no difference between academic physicians and all others with respect to the presence of purulent sputum. Thirty-six percent of physicians from settings with $\geq 60\%$ HMO patients include wheezing or rhonchi in their definition of acute bronchitis, compared

that wheezing or rhonchi need not be present (Table 2). Eighty-four percent (124/148) of physicians who responded that the cough should be productive also indicated that the sputum should be purulent. The responses to questions about the quality of the cough and character of the sputum are shown in Table 3.

When asked to rank order items, physicians named character of cough and sputum production as the most important factors in making a diagnosis (Figure 1). Associated clinical findings, such as rhonchi or wheezing, were also viewed as important. Eighty-two percent of physicians replied that the smoking status of the

FIGURE 1

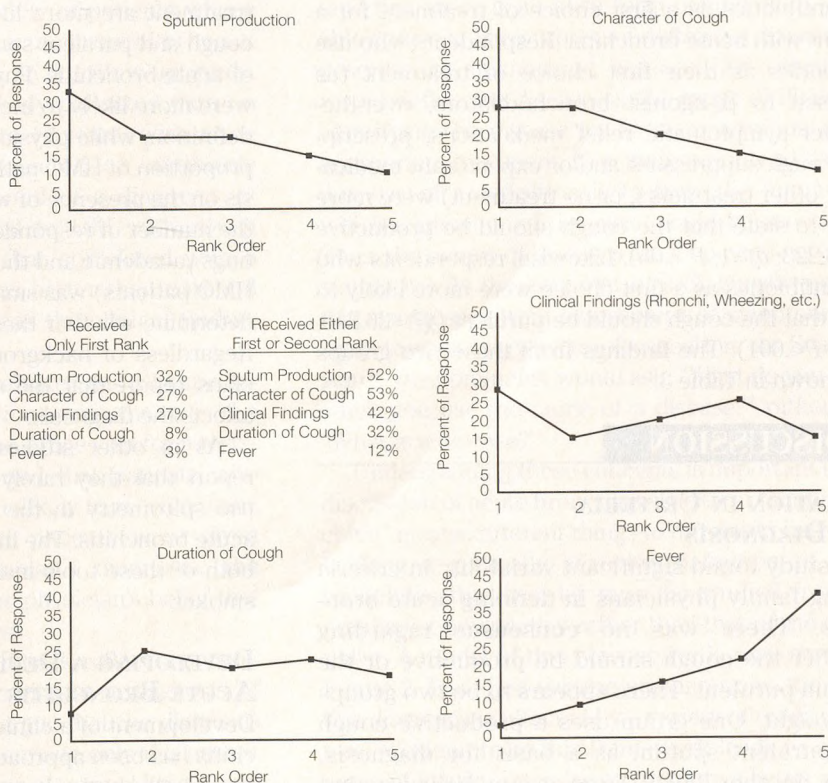
Responding Physicians' Rank Order of Items in Making the Diagnosis of Acute Bronchitis.


TABLE 4

Physician Responses to Questions about the Quality of Cough and Character of Sputum in the Diagnosis of Acute Bronchitis, by Physician Age

Question	Response	% of Respondents in Each Age Group				P Value*
		≤35	36-45	46-55	≥56	
Cough should be	Productive	64	64	47	42	< .01
Character of sputum should be	Purulent	71	65	53	35	< .01

*Gradient in Proportions Test.

with 26% of all others (DIP: $P < .05$).

In surveyed physicians, 2% reported that they perform spirometry or measure peak flow rates and 6% order chest radiographs for nonsmoking patients with acute bronchitis. For patients who smoke, however, physicians more often perform spirometry or determine peak flow rates (14%) and more frequently order chest radiographs (25%) than for their nonsmoking patients (Friedman Test Statistic=75.473; $df=1$; $P < .001$).

Sixty-three percent of physicians state that they use antibiotics as a first choice of treatment for a patient with acute bronchitis. Respondents who use antibiotics as their first choice of treatment (as opposed to β_2 -agonist bronchodilators, over-the-counter symptomatic relief medications, prescription cough suppressant and/or expectorant medications, other treatments, or no treatment) were more likely to state that the cough should be productive ($\chi^2=5.223$; $df=1$; $P < .05$). Likewise, respondents who use antibiotics as a first choice were more likely to state that the cough should be purulent ($\chi^2=26.246$; $df=1$; $P < .001$). The findings from these two groups are shown in Table 3.

DISCUSSION

VARIATION IN CRITERIA FOR DIAGNOSIS

This study found significant variability in criteria among family physicians in defining acute bronchitis. There was no consensus regarding whether the cough should be productive or the sputum purulent. There appears to be two groups of thought. One group uses a productive cough and purulent sputum as a basis for diagnosis, while another fairly large group believes that

these two symptoms are irrelevant. In contrast with the former group, physicians who view the quality of the cough and the character of sputum as irrelevant are more likely to choose a first-line treatment other than antibiotics.

Most responding physicians placed little emphasis on the severity and duration of the cough and the presence of fever or associated clinical findings. Subgroups of physicians placed different degrees of emphasis on certain items. Younger physicians and those who use antibiotics as their first choice of treatment are more likely to include a productive cough and purulent sputum as part of the definition of acute bronchitis. Physicians in academic settings were more likely to include productive cough in the definition, while physicians in settings with a higher proportion of HMO patients placed a greater emphasis on the presence of wheezing or rhonchi. Because the number of respondents in each of these two settings (academic and those with a high percentage of HMO patients) was small, further study is needed to determine whether these findings are reproducible. Regardless of background or age, however, physicians report that the smoking status of a patient affects the diagnosis.

As in other studies, physicians in our survey report that they rarely order chest radiographs or use spirometry in the evaluation of patients with acute bronchitis. The likelihood of a physician using both of these tools increases when the patient is a smoker.

DEVELOPING A DEFINITION OF ACUTE BRONCHITIS

Development of a clinical definition for acute bronchitis has been approached in a variety of manners. In a small, single-site study, Dunlay and Reinhardt²⁷

retrospectively reviewed medical records to determine which features family physician faculty use to discriminate between patients with acute bronchitis and those with upper respiratory infection (URI). Based on statistically significant differences between groups, their study suggested that acute bronchitis should be defined as a productive cough with rhonchi. In the Netherlands, Verheij and colleagues²⁸ surveyed 800 general physicians regarding clinical features distinguishing acute bronchitis from URI and pneumonia. Their findings did not confirm that general physicians distinguish between acute bronchitis and URI on the basis of coughing up purulent sputum or presence of auscultatory findings. Rather, they concluded that the more signs present, the more likely a diagnosis of acute bronchitis.

Vinson²⁹ reported a two-step method for developing a definition of acute bronchitis in children. In a study design similar to that of Dunlay and Reinhardt,²⁷ Vinson retrospectively reviewed the medical records of children aged 1 to 12 years. A diagnosis of bronchitis was more likely when the presence of productive sputum and rhonchi were indicated in the chart. Only 56% of patients whose condition was diagnosed as acute bronchitis had at least one of these findings. In a follow-up study, Vinson and Lutz³⁰ prospectively collected data on 1398 patients (age, infancy to 14 years) with acute bronchitis. If a parent expected an antibiotic before the visit, the likelihood of a diagnosis of acute bronchitis as opposed to URI with cough doubled. The only finding that correlated with a diagnosis of acute bronchitis better than parental expectation of antibiotics was the clinical finding of rales on examination.

Hamm and colleagues³¹ evaluated patient expectations and physician perceptions with the use of a questionnaire at the time of an office visit for a respiratory infection. They reported that patients who wanted antibiotics were more likely to receive them. Factors influencing whether patients were given antibiotics were the physician's diagnosis, the patient's expectation, and the physician's belief that the patient wanted antibiotics.

These studies and our findings reflect the complexity of the process of arriving at a diagnosis of acute bronchitis. Some will argue that the diagnosis of acute bronchitis should be made only if a patient has a productive cough with an abnormal lung exam-

ination. Others could argue that patients who present with a harsh, nonproductive cough without a URI should be included. Still another group might take the position that the more signs and symptoms seen, the more likely the diagnosis, and this third group might recommend that an arbitrary number of criteria should be met prior to making the diagnosis of acute bronchitis. Is one group right, the others wrong? Or should this variation be expected in a clinical syndrome in which various pathogens can cause an inflammatory response in bronchi that can manifest differently from patient to patient? The complexity of these issues is further magnified by our recognition that patient expectations and physicians' perceptions of those expectations not only affect treatment decisions but also influence whether the label "acute bronchitis" is given for a patient's illness. An understanding of how we make a diagnosis is essential in the study of acute bronchitis.

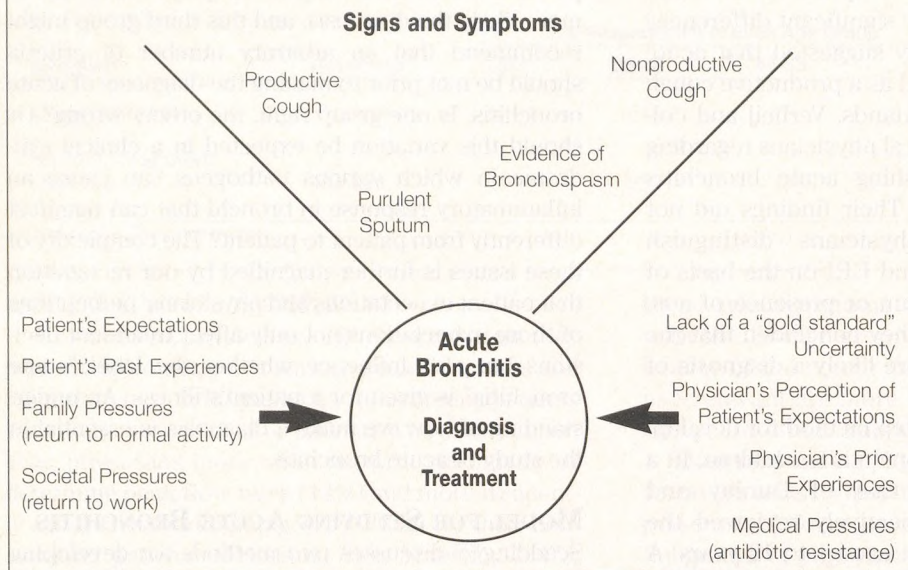
MODEL FOR STUDYING ACUTE BRONCHITIS

Scadding^{32,33} discusses two methods for developing the concept of a clinical diagnosis: essentialism and nominalism. Briefly, essentialists, or realists, contend that there is an ideal form behind every definable concept. The purpose of defining a disease is to describe its unchanging essence. An essentialist would define the disease as the cause of illness; ie, identifying the disease leads to prescription of the appropriate treatment. Nominalists contend that the purpose of a definition is to state the features by which a member of the class could be recognized. Thus, the names of diseases are a convenient way of stating briefly the endpoint of a diagnostic process that progresses from assessment of symptoms and signs toward knowledge of causation. As Scadding states, the nominalist would ask, "What do you mean when you use the name of a disease?" rather than "What is a disease?"

Understanding these concepts is important to this discussion of acute bronchitis. The term "acute bronchitis" means different things to different physicians. Lacking a generally accepted definition of acute bronchitis, the disorder must be studied from the nominalist perspective rather than that of the essentialist. A model of this perspective is represented in Figure 2. Based on varying presentations, the tentative diagnosis is affected by a variety of external factors. Working from this framework leads to several areas of inquiry, intended to promote a better under-

FIGURE 2

Model illustrates various external factors that influence the diagnosis of acute bronchitis.



standing of what we mean by the term “acute bronchitis”:

1. How are signs and symptoms used by physicians in the decision-making process?
2. How do external factors influence the decision process for making the diagnosis and recommending treatment?
3. Can subsets of patients that respond differently to a treatment be identified?

STUDY LIMITATIONS

In evaluating the generalizability of this study, four potential biases or limitations related to the survey methodology should be considered. First, a possible selection bias could have resulted from the inherent differences between nonresponders and responders. Since the demographics of the responders in this study are similar to the demographics of physicians in ABFP and the responders and nonresponders have a similar geographic distribution, we are confident that our sample is representative of the target population. Second, the response rate was lower than the sample size calculation. A larger response rate would likely have improved the power of some of the statistical analyses. Thus, there may be some differences in the population of physicians that were not

detectable in this sample. Third, the survey did not seek information about how physicians differentiate acute bronchitis from other illnesses, since this was not the aim of this survey. Fourth, the literature indicates that in surveys examining physician practice behaviors, physicians tend to overstate their adherence to various clinical and laboratory guidelines in self-reports as compared with medical record notes or patient self-reports. We attempted to avoid the potential for overstating by including a cover letter specifying

that we were conducting a survey to examine common practices in the medical management of acute bronchitis, ie, there were no right or wrong answers. There are also no clearly established guidelines for either diagnosing or treating this illness that should have influenced what physicians reported.

CONCLUSIONS

Family physicians in the United States vary in the criteria used to diagnose acute bronchitis. Furthermore, a significant number of family physicians do not require a productive cough as part of the diagnostic criteria.

Future research should explore differences in definition and further examine why physicians in academic, managed care, or other settings place a greater emphasis on the quality of the cough or other symptoms than do other family physicians. Prior to further quantitative studies concerning the treatment of acute bronchitis, it is necessary to design qualitative studies to better understand how physicians diagnose acute bronchitis, what patient expectations and needs are when experiencing an episode of this illness, and how decisions are made to treat.

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