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Background.—Clinicians cite parental misconceptions and requests for antibiotics as reasons for inappropriate prescribing.

Aims.—To identify misconceptions regarding antibiotics and predictors of parental demand for antibiotics and to determine if parental knowledge and attitudes are associated with use.

Methods.—Survey of parents in 16 Massachusetts communities. Domains included antibiotic-related knowledge, attitudes about antibiotics, antibiotic use during a 12-month period, demographics, and access to health information. Bivariate and multivariate analyses evaluated predictors of knowledge and proclivity to demand antibiotics. A multivariate model evaluated the associations of knowledge, demand, and demographic factors with parent-reported antibiotic use.

Results.—A total of 1106 surveys were returned (response rates: 54% and 32% for commercially-insured and Medicaid-insured families). Misconceptions were common regarding bronchitis (92%) and green nasal discharge (78%). Two hundred sixty-five (24%) gave responses suggesting a proclivity to demand antibiotics. Antibiotic knowledge was associated with increased parental age and education, having more than 1 child, white race, and receipt of media information on resistance. Factors associated with a proclivity to demand antibiotics included decreased knowledge, pressure from day-care settings, lack of alternatives offered by clinicians, and lack of access to media information. Among all respondents, reported antibiotic use was associated with younger child age and day-care attendance. Among Medicaid-insured children only, less antibiotic knowledge and tendency to demand antibiotics were associated with higher rates of antibiotic use.

Conclusions.—Misconceptions regarding antibiotic use are widespread and potentially modifiable by clinicians and media sources. Particular attention should be paid to Medicaid-insured patients in whom such misconceptions may contribute to inappropriate prescribing.

KEY WORDS: antibiotic use; parental demand; parental knowledge

Rising rates of antibiotic resistance have focused new attention on patterns of antibiotic prescribing. Children receive more antibiotics than do any other age group,[1] and the treatment of colds, upper respiratory infections (URIs), and bronchitis in one study accounted for over 20% of pediatric antibiotic prescriptions.[2] In Massachusetts, antibiotic use rates as high as 3.2 prescriptions per person per year in children aged 3 months to <36 months, and 1.97 prescriptions per person per year in children aged 36 months to <72 months have been reported.[3] Antibiotic resistance is associated with increased antibiotic use,[4,5] and decreasing inappropriate antibiotic prescribing has reportedly decreased antibiotic resistance,[6] although this has not been shown in studies in the United States.[7] Physicians in focus groups reported that they could safely reduce antibiotic prescriptions by 25%–50%.[8]

Misinformation about the role of antibiotics is believed to contribute substantially to antibiotic overuse.[9–11] Studies of adult patients[12,13] and parents[14,15] across regions and demographic attributes all report misconceptions regarding the appropriate treatment of URIs. In Wisconsin and Minnesota, 41% of parents did not know that antibiotics were indicated for bacterial infections only.[15] The most consistent misconception found across these studies, that discolored nasal discharge indicates the need for antibiotic treatment, is shared even by some physicians.[16]

Although physicians ultimately prescribe antibiotics, patient expectations and inappropriate demand are reported by 53% of physicians to be the greatest contributor to inappropriate antibiotic prescribing.[17] Among patients seeking care for URIs, 65% of adult patients and 50% of parents expected antibiotics before seeing the physician.[18,19] Physicians often feel pressure to prescribe antibiotics,[19] though studies have generally not shown a link between patient satisfaction and receiving an antibiotic.[18,20] No empirical data are available regarding the correlation between antibiotic knowledge and inappropriate parental demand. Given the role that parental misinformation and inappropriate expectation are believed to play in prescribing, it is important to identify common mis-

Table 1. Parental Responses to Antibiotic-Related Knowledge Items*

Question	Acceptable Responses†	% Acceptable (N)‡
How often are antibiotics needed for *middle ear fluid?*	sometimes or almost never	42 (443)
How often are antibiotics needed for *deep cough or bronchitis?*	almost never	8 (87)
How often are antibiotics needed for *colds or flu?*	almost never	68 (721)
How often are antibiotics needed for *runny nose or green nasal drainage?*	almost never	22 (236)
How often are antibiotics needed for *sore throat?*	sometimes or almost never	88 (934)
How often are antibiotics needed for *strep throat?*	almost always	88 (948)
How often are antibiotics needed for *ear infection?*	almost always or sometimes	96 (1035)
Are antibiotics helpful in treating bacterial infections, viral infections, or both?	bacterial	66 (709)
If my child does not receive an antibiotic for cold, cough, and flu symptoms, will he (she) be sick for a longer time?	disagree or strongly disagree	66 (714)
Are most cold, cough, and flu illnesses caused by bacteria or viruses?	viruses	76 (823)

*Mean (SD) number of correct responses: 6.2 (1.9), based on 990 respondents with answers to all items. Cronbach $\alpha = 0.63$.
†Acceptable responses adopted from CDC/AAP Principles of Judicious Antibiotic Use.[22]
‡Numbers vary because of nonresponse to individual items.

conceptions and risk factors for knowledge deficits and inappropriate demand. Our goals were to 1) identify the most common misconceptions regarding appropriate antibiotic use and patient characteristics associated with these beliefs, 2) assess the role of such misunderstandings in generating inappropriate demand for antibiotics, and 3) determine whether misconceptions and inappropriate demand are associated with self-reported antibiotic use.

METHODS

Setting and Design

We conducted a survey of parents in 16 Massachusetts communities. These communities were chosen as noncontiguous towns and cities for a community-level trial of antibiotic education. They included both moderate-sized urban centers, as well as smaller suburban towns. Their populations ranged from 30 000 to 139 000 (median 49 000), and the median family income ranged from $32 000 to $93 000 (median $49 000).[21] Two commercial health insurance plans and the state Medicaid program supplied addresses of all families with a child <6 years old. We performed a pilot study to refine the survey and determine the likely response rate for each community and by insurer. On the basis of this information and our goal (50 responses from commercially insured and 20 responses from Medicaid-insured families in each community), we mailed 2666 surveys to randomly selected families (1008 to Medicaid-insured and 1658 to commercially insured families). Parents were offered a children's book as an incentive for completion of the 46-item survey. The survey was mailed in October 2000, with a second mailing 2 weeks later to households not responding initially.

Outcome Measures

Knowledge was assessed by level of agreement with 7 statements about the role of antibiotics in specific conditions and 3 general statements regarding the effectiveness of antibiotics in treating viral illness (Table 1). These questions were adapted from a previously published study,[15] and acceptability of responses was based on national guidelines.[22] Cronbach α was calculated to assess the measure of association among the questions. Vignettes were constructed to assess expectations for antibiotic use for specific symptoms given a 3- to 5-day duration (chosen to be consistent with an uncomplicated acute URI). Antibiotic knowledge was summarized as the number of correct responses for these 10 items. Proclivity to demand antibiotics was assessed by agreement with any of 3 items suggesting that the parents would be substantially dissatisfied if their expectation for an antibiotic prescription was not met (Table 2). Respondents reported the total number of antibiotics in the preceding 12 months and the total number of URI clinician visits in the preceding 12 months for respiratory illnesses including cough, cold, flu, bronchitis, sore throat, sinus infection, pneumonia, and ear infection.

Potential Predictors

Pressure from school or day care to seek antibiotics was assessed for those who attended. Parents were asked about

Table 2. Parental Attitudes Toward Unnecessary Antibiotic Prescribing

Statement	Affirmative Responses	% Affirmative Responses* (N)
If I expect an antibiotic, I am less satisfied with the doctor visit if I do not receive one.	strongly agree or agree	14 (151)
I would rather give my child an antibiotic that may not be needed than wait to see if he/she gets better without it.	strongly agree or agree	8 (89)
If a doctor does not prescribe an antibiotic when I think one is needed, I will take my child to another doctor.	strongly agree or agree	10 (105)

*Positive response to any of these items: 24% (265).

prior receipt of information regarding antibiotic resistance. We distinguished information from media sources (including print, television or radio, and the Internet) and information received at a doctor's office or the child's school or day care. Other potential predictor variables included parental age, parental education, race/ethnicity, number of children, child age, insurance status, daycare attendance, perceived child health, and aspects of clinician communication, including whether alternative treatments were discussed when antibiotics were not prescribed.

Demographic characteristics were compared for respondents with commercial and Medicaid insurance. Because selection of families was stratified by commercial versus Medicaid insurance, insurance source was accounted for in all multivariate models, whether or not it was statistically significant. Race/ethnicity was dichotomized as white non-Hispanic and nonwhite because of low proportions of specific ethnic or racial minority groups. Bivariate associations of summary antibiotic knowledge score (which had a roughly normal distribution) with potential predictor variables were analyzed by Student's *t* test. Variables significantly associated with parental knowledge were entered into a multivariate linear regression model. Finally, we sequentially eliminated variables that lacked statistical significance, retaining only those significant at $P < .05$ (in addition to insurance status).

Proclivity to demand antibiotics was analyzed as a dichotomous variable, using chi-square tests for bivariate associations followed by entry into a multivariate logistic regression model. Again, after the backward selection process, the final model included insurance status in addition to other variables that remained significant at $P < .05$. Finally, the self-reported number of antibiotic prescriptions received in the previous year was analyzed assuming a Poisson distribution. Bivariate associations were assessed by single predictor Poisson regression analysis, as is common for count data.[23] A multivariate Poisson regression model was constructed to determine the impact of knowledge and proclivity to demand antibiotics; therefore, these 2 variables were included in the final model regardless of statistical significance. Self-reported health status was not included in modeling for antibiotic use, because perception of health status may be a result of frequent antibiotic use. Again, variables significant only at the level of $P < .05$ were retained. Interactions of key variables were tested and, if significant, were addressed by construction of stratified models. A confirmatory analysis was performed to assess the impact of clustering of responses within communities by generalized estimating equations.[24] All analyses were conducted with the SAS statistical package (Version 8.1, SAS Inc, Cary, NC). The study was conducted with the approval of the associated health plans and the Harvard Pilgrim Health Care institutional review board.

RESULTS

Of the 2666 questionnaires sent, 1220 were returned for an overall response rate of 46% (commercial: 54%, Medicaid: 32%, $P < .001$). Of these, 1106 met the child-age eligibility criterion of <72 months. Demographic and other key variables are reported and compared for Medicaid-insured and commercially insured respondents in Table 3. The mean child age was 3.3 years (SD = 1.59 years). The distribution of child age did not differ between commercial insurance and Medicaid insurance by Student's *t* test. Medicaid respondents were generally younger, had less formal education, and were more likely to be of minority race/ethnicity. Privately insured respondents were more likely to work outside the home compared with respondents insured by Medicaid (73% vs 56%, $P < .001$), but there was no difference in the proportion of their children attending day care (66% vs 61%, $P = .10$). Privately insured respondents were more likely to rate their child's health as excellent (63% vs 49%, $P < .001$).

Medicaid respondents reported more antibiotic prescriptions received in the previous 12 months (1.6 vs 1.3, $P < .001$) and were more likely to report receiving antibiotic prescriptions by phone (7% vs 3%, $P < .01$). Of all respondents, 69% reported receiving some information about antibiotic resistance (37% received information from the doctor's office, school, or day care; 62% received information from media sources). Commercially insured respondents were more likely to report receipt of media-based information (67% vs 47%, $P < .001$), though the groups did not differ in receipt of information from the clinician's office, school, or day care. Only 8% of respondents reported pressure from day care or school to obtain antibiotics for their child.

Table 1 shows acceptable responses for each knowledge item. The most frequent misconceptions included appropriateness of antibiotics for green nasal discharge (22% correct) and bronchitis (8% correct). Many respondents did not know that antibiotics are helpful only in bacterial infections (34%) and that viruses cause most colds, coughs, and flu (24%). The mean number of total acceptable responses for parental antibiotic knowledge was 6.2 (SD = 1.9). Table 2 shows responses to the items suggestive of a tendency to demand antibiotics. A total of 24% of respondents answered at least one of these items affirmatively, including 10% who said they would change physicians if they did not receive an expected antibiotic.

Several demographic factors, parental perception of overall child health, and receipt of antibiotic resistance information were associated with higher antibiotic knowledge in bivariate analyses (Table 4). Respondents with a proclivity to demand antibiotics answered fewer questions correctly (55% vs 65%, $P < .001$). Also, respondents who gave leftover antibiotics to their child in the preceding 12 months had worse knowledge than respondents who did not (47% vs 63%, $P < .001$), as did respondents who reported receiving one or more prescriptions by telephone in the prior 12 months (51% vs 63%, $P < .01$). In bivariate analyses (Table 4), several demographic variables were associated with higher likelihood to ''demand'' antibiotics, as were reports of pressure by school or day care for antibiotics (42% vs 23%, $P < .01$), and antibiotic knowledge ($P < .001$).

Table 3. Characteristics of Antibiotic Survey Respondents by Insurance Status

	Private Insurance (N = 812) n (%)	Medicaid Insurance (N = 294) n (%)	*P* Value
Respondent = mother	706 (89)	265 (92)	NS
Parental age (y)			
<20	2 (0)	22 (8)	
21–30	185 (23)	136 (47)	<.001
31–40	499 (62)	98 (34)	
41–50	108 (14)	24 (8)	
50	5 (1)	10 (3)	
Ethnicity			
Caucasian	703 (90)	217 (80)	
African American	4 (1)	10 (4)	<.001
Hispanic	18 (2)	15 (6)	
Asian	27 (3)	4 (1)	
Other†	26 (3)	25 (9)	
Education			
College graduate	512 (64)	59 (21)	
High school graduate/some college	274 (34)	194 (68)	<.001
Less than high school	10 (1)	34 (12)	
Parent works outside the home	578 (73)	162 (56)	<.001
Child age (y): mean (SD)	3.3 (1.6)	3.3 (1.7)	NS
Child attends day care	530 (66)	175 (61)	NS
Child health			
Excellent	501 (63)	140 (49)	
Very good	232 (29)	99 (35)	<.001
Good	54 (7)	38 (13)	
Fair	10 (1)	10 (4)	
Poor	2 (0)	0 (0)	
Heard or read about antibiotic resistance from media sources (Internet, radio, television, magazine, newspaper)	546 (67)	138 (47)	<.001
Heard or read about antibiotic resistance from someone within the physician's office or from child's school or day care	293 (36)	113 (47)	NS
History of giving left-over antibiotic at least once in past year	17 (2)	9 (3)	NS
Was prescribed antibiotic via phone at least once in past year	27 (3)	20 (7)	<.01
	Mean (SD)	Mean (SD)	*P*
Antibiotics received in past 12 mo	1.3 (1.5)	1.6 (2.0)	<.001
URI* visits in past 12 mo	1.8 (1.9)	2.2 (2.6)	<.01

*URI indicates upper respiratory infection.
†Native American, Cape Verdean, and more than 1 race/ethnicity chosen.

In a multivariate linear regression model of parental antibiotic knowledge (Table 5A), receipt of antibiotic resistance information from media sources (but not clinicians' offices), college education, parental age >40 years, having more than one child, and white race were associated with higher levels of antibiotic-related knowledge. College graduation was associated with an effect of 1.4 (confidence interval [CI] = 0.8, 2.0) additional questions answered correctly compared with respondents with less than a high school education. Having received antibiotic resistance information from media sources was associated with an effect of 0.94 (CI = 0.70, 1.17) additional question answered correctly compared with no exposure to such information. Other variables associated with lower knowledge included parental age <30 years (0.37 questions, CI = 0, 0.75) and nonwhite race (0.89 questions, CI = 0.55, 1.24). No independent effect was seen for perceived health of the child, attendance in day care, child's age, or receipt of information on resistance from a doctor's office or school. In a multivariate model (Table 5B), proclivity to demand was independently associated with lower parental antibiotic knowledge (odds ratio [OR] = 0.8; CI = 0.7, 0.9 for each question increase in knowledge) and report of perceived pressure from day care or school to obtain antibiotics (OR = 1.9; CI = 0.99, 3.8). Media information on resistance (OR = 0.7; CI = 0.5, 1.0) and alternative treatment options given by clinicians (OR = 0.6; CI = 0.4, 0.9) were protective.

On average, children reportedly received 1.35 antibiotics in the preceding year, and 16% reportedly received 3 or more. The number of antibiotics reported varied significantly by demographic variables, perceived child health, day-care attendance, pressure from school or day care, parental proclivity to demand, and antibiotic knowl-

Table 4. Factors Associated With Parental Antibiotic-Related Knowledge, Proclivity to Demand Antibiotics, or Parental Report of the Number of Antibiotics Received in the Past Year*

	Parental Antibiotic Knowledge		Proclivity to Demand Antibiotics		No. of Antibiotics in Past Year	
	% Correct Responses	*P* Value	% Demanders	*P* Value	Mean (SD)	*P* Value
Insurance						
Private	65	<.001	23	NS	1.3 (1.5)	<.001
Medicaid	55		27		1.6 (2.0)	
Ethnicity						
Caucasian	64	<.001	23	<.001	1.3 (1.6)	<.05
Non-Caucasian	51		37		1.6 (2.3)	
Child's age (y)						
0–1	56	<.01	27	NS	0.60 (1.1)	<.001
1–2	59		23		1.60 (1.8)	
2–3	62		23		1.6 (1.8)	
3–4	64		28		1.4 (1.7)	
4–5	64		22		1.2 (1.7)	
5–6	65		24		1.30 (1.5)	
Number of children						
1	58	<.001	23	NS	1.3 (1.7)	NS
>1	64		25		1.4 (1.7)	
Day care attendance						
Yes	64	<.001	24	NS	1.5 (1.7)	<.001
No	60		25		1.0 (1.4)	
Child's health						
Excellent	64	<.05	20	<.05	0.9 (1.1)	<.001*
Very good	60		28		1.7 (1.6)	
Good	57		31		3.0 (2.4)	
Fair	64		35		3.7 (3.9)	
Poor	70		50		2.5 (2.1)	
Parent education						
College graduate	68	<.001	22	<.001	1.3 (1.6)	<.001
High school graduate/some college	57		24		1.4 (1.6)	
Less than high school	47		52		2.0 (2.9)	
Parental age (y)						
>40	66	<.001	20	<.01	1.3 (1.7)	<.05
31–40	65		22		1.3 (1.4)	
≤30	56		30		1.5 (1.9)	
Receipt of bacterial resistance information from physician's office or day care						
Yes	64	<.01	23	NS	1.6 (1.7)	<.001*
No	61		25		1.2 (1.6)	
Receipt of bacterial resistance information from the media						
Yes	67	<.001	20	<.001	1.3 (1.5)	NS
No	54		32		1.4 (1.9)	
Doctor offers alternatives if no antibiotic prescribed						
Yes	. . .*		22	<.01	1.4 (1.7)	NS
No			34		1.2 (1.5)	
Antibiotic knowledge (scaled 0–10)†						
9–10	. . .		11	<.001	1.3 (1.8)	<.01
7–8			17		1.3 (1.5)	
4–6			31		1.4 (1.7)	
0–3			39		1.5 (2.1)	
Proclivity to demand antibiotics						
Yes	55	<.001*	. . .		1.5 (1.8)	<.05
No	65				1.3 (1.6)	
Perceived school or day care pressure for child's doctor to prescribe an antibiotic						
Yes	. . .*		42	<.01	2.0 (1.7)	<.01
No			23		1.5 (1.7)	

*Variable not tested as a potential predictor in multivariate models for this outcome.
†Tested for significance as a continuous variable, presented here as categories for ease of interpretation.

Table 5. Independent Predictors of Parent Knowledge and Proclivity to Demand Antibiotics

A. Factors Associated With Parental Antibiotic Knowledge by Multiple Linear Regression (N = 935)*

Independent Variables	Adjusted Mean Difference	95% Confidence Interval
Receipt of bacterial resistance information (from television, radio, newspapers, magazines, Internet)		
No	. . .	
Yes	0.94	(0.70, 1.17)
Parental education		
College graduate	. . .	
High school graduate/some college	−0.78	(−1.02, −0.53)
Less than high school	−1.41	(−2.02, −0.79)
Parental age (y)		
>40	. . .	
31–40	−0.07	(−0.41, 0.27)
≤30	−0.37	(−0.75, 0.00)
Race/ethnicity		
Caucasian	. . .	
Non-Caucasian	−0.89	(−1.24, −0.55)
Number of children		
1	. . .	
>1	0.55	(0.32, 0.79)
Overall regression: $R^2 = .22$; F = 31.9; $P = <.0001$		

B. Factors Associated With Proclivity to Demand Antibiotics by Multiple Logistic Regression (N = 979)*

Independent Variables	Adjusted Odds Ratio	95% Confidence Interval
Receipt of bacterial resistance information (from television, radio, newspapers, magazines, Internet)		
No	. . .	
Yes	0.72	(0.52, 1.0)
Doctor offers alternatives if no antibiotic prescribed		
No	. . .	
Yes	0.60	(0.39, 0.93)
Perceived school or day care pressure†		
No	. . .	
Yes	1.9	(0.99, 3.8)
Antibiotic knowledge	0.80	(0.74, 0.87)

*Insurance status included in model.

†Children who do not attend school or day care categorized as other.

Table 6. Factors Independently Associated With the Number of Antibiotics over 12 Months, Stratified by Insurance Status

Independent Variables	Proportional Increase	95% Confidence Interval
Medicaid Insurance		
Child's age (y)		
0–1	. . .	
1–2	3.07	(1.81, 5.20)
2–3	1.90	(1.08, 3.33)
3–4	1.60	(0.90, 2.75)
4–5	1.42	(0.80, 2.54)
5–6	1.25	(0.71, 2.21)
Day care		
No	. . .	
Yes	1.97	(1.50, 2.59)
Antibiotic knowledge	0.94	(0.89, 0.99)
Parental demand		
No	. . .	
Yes	1.33	(1.06, 1.66)
Private Insurance		
Child's age (y)		
0–1	. . .	
1–2	2.10	(1.40, 3.17)
2–3	2.53	(1.69, 3.78)
3–4	1.75	(1.16, 2.63)
4–5	1.29	(0.85, 1.96)
5–6	1.46	(0.97, 2.21)
Day care		
No	. . .	
Yes	1.69	(1.43, 1.99)
Antibiotic knowledge	1.00	(0.97, 1.04)
Parental demand		
No	. . .	
Yes	1.02	(0.88, 1.20)

edge (Table 4). Initial multivariate Poisson regression models revealed a strong interaction effect between knowledge and insurance status and between patient demand and insurance status. Therefore, we constructed separate models for patients with private and Medicaid insurance (Table 6). Among those privately insured, only child age and day-care attendance were independently associated with more frequent receipt of antibiotics. Among Medicaid enrollees, however, both antibiotic knowledge and proclivity to demand antibiotics were significantly associated with more frequent antibiotic use in a model that also included child age and day-care attendance. Controlling for other variables in this model, parents reported 6% more prescriptions for each additional knowledge item answered incorrectly. Having a proclivity to demand antibiotics was associated with 33% more antibiotics reported. A confirmatory analysis, undertaken to assess the potential nonindependence (ie, clustering) of responses within communities, showed parameter estimates to be essentially unchanged from those reported. Also, as a secondary analysis, we created a model to determine factors independently associated with care seeking for URIs in the preceding 12 months and, not surprisingly, found similar predictors to those for reported antibiotics received.

DISCUSSION

In this multi-community study, we found that antibiotic misconceptions were common among parents. One third incorrectly believed antibiotics could be helpful for viral illnesses, and more than three quarters believed antibiotics were needed for treatment of green nasal discharge in the absence of fever or other signs of illness. Not surprisingly, lower parental education, fewer children, and less exposure to information in the media regarding resistance were associated with lower parental knowledge. Almost one quarter of parents revealed a tendency to request unnecessary antibiotics. Such a tendency was more common among those with less knowledge. Both knowledge and the tendency to request unnecessary antibiotics were independently associated with increased prescribing among Medicaid-insured parents but not among those who were privately insured.

Parents had high rates of acceptable answers regarding illnesses in which antibiotics are indicated (eg, strep throat and acute otitis media) but were not as good at identifying illnesses for which antibiotics are not needed. The specific misconceptions that antibiotics are needed for bronchitis and for illnesses with green nasal drainage were particularly widespread, confirming the results of several other studies.[12,14,16] The percentage of parents answering particular knowledge questions incorrectly were similar among this population and parents in Wisconsin and Minnesota,[15] suggesting that these misconceptions are not limited to a single region. Certainly, such misconceptions are reinforced by prescribing patterns for both adults and children. One study reported 88% of children with bronchitis were given an antibiotic,[25] another reported that 53% of pediatricians would give an antibiotic to a 10-month-old child who had 1 day of green nasal discharge,[26] and a third reported 30% of pediatricians routinely prescribed an antibiotic for colds.[27] Seventy-seven percent of clinical pharmacists surveyed would recommend antibiotics for bronchitis with discolored sputum,[28] and 28% of a physician sample would prescribe antibiotics for discolored nasal discharge.[16]

The multivariate analyses suggest that parental knowledge is associated with parental age, number of children, race/ethnicity, educational attainment, and access to media sources of information on the topic. In the Wisconsin and Minnesota sample, exposure to 3 or more information sources on the topic of resistance was associated with greater parental knowledge.[15] We interpret this both as an opportunity for more education at the site of care and as a reinforcement of the utility of media sources for health education. Success has been reported in use of the media to promote infant immunization, proper infant sleep position, adolescent condom use, and designated driver programs.[29–32] The Bureau of the US Census reports that in 2000 48% of US families had Internet access at home, making this an increasingly useful source of health information.[33] Clinicians may want to make recommendations of specific sources with trustworthy information about appropriate antibiotic prescribing. Though clinicians infrequently refer parents to Web sites, one study reported that 92% of patients would visit a Web site referred to them by their clinician.[34]

In one survey of pediatricians, 54% reported that parent demand was the greatest contributor to inappropriate antibiotic prescribing, followed by lack of time and fear of liability (19% and 12%, respectively).[17] Although careful studies of parental demand suggest that physicians overestimate parental demand for antibiotics,[20] better understanding of this phenomenon is needed. For this study, we used a set of 3 survey items designed to identify parents with a tendency to demand antibiotics on the basis of statements that they would be less satisfied, seek care elsewhere, or would give their child an antibiotic that may not be needed rather than ‘‘wait and see.’’ We found that these attitudes were correlated with actual prescribing only among Medicaid-insured patients. Medicaid-insured patients differed in several ways from privately insured patients and had, on average, less antibiotic knowledge. The model controlled simultaneously for both knowledge and demand and additional confounding variables. It is possible that unmeasured confounders explain the differential effect of demand on prescribing, that providers respond differently to parental demand from low-income patients, or that providers treating these patients are less judicious prescribers. Previous work has suggested that older physicians and nonpediatricians may prescribe more unnecessary antibiotics for children.[35]

A limitation of this study is the total response rate of 46% (commercial: 54%, Medicaid: 32%) despite 2 mailings, oversampling of the Medicaid population, and a small incentive. No demographic information is available to allow comparisons of responders and nonresponders. In addition, although the vast majority of respondents were mothers, we have no information about who else in the household (eg, grandparents) may influence beliefs regarding antibiotic use.

As with most survey research, we have no independent verification of parental reports. In this anonymous survey, the likelihood of parents giving responses they believe are ‘‘desired’’ by study staff is minimized. Certainly, recollection of the number of antibiotics prescribed in the prior year is subject to errors in recall.

These data reinforce the need for parent education on issues of appropriate treatment for URIs, specifically bronchitis and green nasal discharge. Medicaid-insured respondents, in particular, were more likely to report pressure from schools or day care to obtain antibiotics, more overall prescriptions, and receipt of less antibiotic resistance information from the media, and they had lower antibiotic knowledge. These findings all point to the need for additional work in health education for underserved communities. Although the final decision to prescribe rests squarely with clinicians, enhanced education for specific at-risk populations may well contribute to more judicious prescribing for children.

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