

Physician Responses to a Community-Level Trial Promoting Judicious Antibiotic Use

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ABSTRACT

PURPOSE In an environment of multiple campaigns promoting judicious antibiotic use in children, identification of effective strategies is important. We assessed physician responses to a community-level intervention with respect to antibiotic prescribing, related practices, and perceived effectiveness.

METHODS This study was a mixed qualitative and quantitative evaluation of a randomized controlled community-wide educational intervention in 16 Massachusetts communities. Physicians in intervention communities received locally endorsed guidelines, group educational sessions, and biweekly newsletters. Parents simultaneously received materials in physicians' offices and by mail. After the intervention, we conducted a mailed physician survey and individual interviews to assess the impact of the intervention. We compared survey responses for intervention and control physicians, and we analyzed interview transcripts to provide in-depth information about selected topics.

RESULTS Among survey respondents ($n = 168$), 91% of intervention and 4% of control physicians reported receiving intervention materials. Physicians received information from multiple other sources. More intervention than control physicians reported decreased antibiotic prescribing from 2000-2003 (75% vs 58%, $P = .03$), but there were no differences between groups in knowledge, attitudes, or behaviors favoring judicious antibiotic use. Both groups were concerned about antibiotic resistance and reported room to reduce their own prescribing. Interviewed physicians suggested frequent repetition of messages, brief written materials on specific topics for themselves and patients, and promotion in the mass media as the most effective strategies to reduce prescribing.

CONCLUSIONS In multiple communities an intervention in physician offices to promote judicious antibiotic prescribing reached its intended audience, but physicians' self-reported attitudes and practices were similar in intervention and control communities. Campaigns that repeat brief, consistent reminders to multiple stakeholder groups may be most effective at assuring judicious antibiotic use.

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INTRODUCTION

Antibiotic use rates for US children remain high compared with rates for children in other countries,^{1,2} although US rates have decreased during the past 10 years.^{2,3} Although the Centers for Disease Control and Prevention (CDC) and others⁴⁻⁶ have developed prescribing recommendations, and recent campaigns have been undertaken to reduce inappropriate antibiotic prescribing, the initial reduction in antibiotic use rates predates most of these efforts. Interventions have been conducted at the state,⁷ community,^{8,9} and practice^{10,11} level, with reductions in prescribing reported in most, but not all studies.⁷

Most campaigns have targeted both physicians and patients, and many have used multiple strategies to attempt to change attitudes and practices. It is often not known which strategies help to reduce antibiotic prescribing. Evidence suggests that many traditional methods of education, such

as providing continuing medical education and giving patients informational handouts without other interventions, do little to effect physician or patient behavior change.¹²⁻¹⁵ More intensive methods that use multiple components, such as opinion leaders and academic detailing (personal visits to physician offices to promote specific practices),¹⁶⁻¹⁸ are often more successful. To best use resources in efforts to continue to improve judicious prescribing, and to generalize these efforts to other conditions, it is essential to know which campaign components and messages are most useful for practitioners, which prescribing attitudes and behaviors may be changed most as a result, and what other sources of information on the topic shape physicians' practices.

We undertook a randomized, controlled, community-level intervention trial in 8 intervention and 8 control communities in Massachusetts to promote judicious antibiotic use in pediatric outpatients. Effects of the intervention on the primary outcome of community-level antibiotic-prescribing rates among children aged 3 months to 6 years are reported elsewhere¹⁹; we observed a modest overall intervention effect on rates of antibiotic prescribing in some age-groups, and a more significant decrease among children with Medicaid insurance, but not among the study population as a whole. Here we report qualitative and survey data to assess physician perspectives on the intervention's impact. We sought to determine (1) whether intervention physicians were more likely than control physicians to report knowledge, attitudes, and prescribing behaviors consistent with judicious antibiotic use, and (2) which messages and strategies used as part of the intervention were perceived to have the most impact.

METHODS

Setting

In the autumn of 2000, we began a 3-year randomized controlled effectiveness trial called REACH Mass (REducing Antibiotics in CHildren) to promote judicious antibiotic use for respiratory tract infections in cities and towns in Massachusetts. Sixteen geographically distinct communities from across the state were selected, and pairs matched by demographic characteristics were randomized by computer to intervention or control status.¹⁹ Towns were selected to be demographically diverse and, using health plan claims data, to be communities in which most children received primary care within the community.

Intervention

We sent physicians in the intervention communities locally developed guidelines, invitations to case-based interactive dinner sessions providing local data in the

first and third years, biweekly e-mail or facsimile newsletters addressing prescribing and resistance during the winter respiratory illness seasons ("REACH notes"), and several types of parent educational materials for their offices. Content included trends in bacterial resistance statewide and within each community; evidence regarding the benefit of antibiotics for otitis media and other respiratory tract infections; advantages and disadvantages of initial observation without antibiotic treatment, or watchful waiting, for otitis media; and strategies for addressing parent misconceptions about antibiotics. Patients in intervention communities simultaneously received educational materials in the office, by direct mail twice each winter, and at pharmacies. Child care staff in intervention communities were also educated at community-wide sessions in year 3. Control communities received no intervention or materials.

Participants and Data Collection

During the 6 months after the close of the intervention, we mailed questionnaires with a cover letter and a stamped return envelope to 292 physicians (123 control and 169 intervention). All general pediatricians and family physicians practicing in these communities according to state registration files were included. We mailed up to 2 more questionnaires to nonrespondents at 4-week intervals. Respondents were mailed a \$5 gift card for coffee.

To understand the reasons behind physicians' answers to the questionnaire, a survey research firm conducted semistructured 15- to 30-minute telephone interviews of a convenience sample of the same physicians. Invitations were mailed to each physician's practice and followed up with telephone calls. Recruitment continued until additional interviews produced no new themes. Interviews were tape-recorded if participants agreed; otherwise, notes were taken by hand (for 2 physicians). Physicians were compensated \$75.

Survey Content

The survey questionnaire focused on physicians' knowledge, attitudes, and practices regarding antibiotic use, with particular attention to REACH intervention topics. We piloted the questionnaire with 10 pediatricians. The final 4-page, 32-item questionnaire took 10 minutes to complete, and addressed physicians' awareness of REACH, other sources of information about antibiotic use and resistance, views about antibiotic resistance and prescribing practices, attitudes about watchful waiting for acute otitis media, and (for physicians who recalled the REACH intervention) the usefulness of different components of the intervention. Most items used 4- or 5-point Likert scale response formats, with 1 open-ended question asking the percent-

age that physicians could further reduce prescribing without harming patients.

Telephone interviews explored physicians' reasoning behind prescribing behaviors, experiences with the intervention, strategies they believed might improve judicious prescribing, and ways in which interventions could be more effective. We used an interview guide (Supplemental Appendix, available at <http://www.annfammed.org/cgi/content/full/6/3/206/DC1>);



6 topic areas reflected those in the questionnaire with such questions as, "What educational strategies have been/would be most useful to you in helping you change your prescribing behavior, and why?"

Analysis

For data analysis, we identified differences between physicians in intervention and control communities, using χ^2 or Fisher's exact tests for categorical variables, and *t* tests for continuous variables. Variables from Likert scales were collapsed into 2 or 3 categories for reporting after examination of univariate distributions and before analysis of intervention effect. Bivariate and multivariate regression models were constructed to identify independent factors associated with a decrease in self-reported antibiotic prescribing (vs staying the same or increasing). In all regression models, we accounted for clustering of observations within communities. Variables that had an association with the outcome at a level of $P < .10$ in bivariate models were entered into multivariate models. Odds ratios (OR) and 95% confidence intervals (CI) are reported.

Interviews were transcribed verbatim, and responses were sorted by topic area. Two academic general pediatricians read all physician responses and independently summarized themes (codes) for each question, gathering codes into broad categories. Categories were derived post hoc, allowing themes to suggest new categories where appropriate. Disagreements were reconciled at a face-to-face meeting, after which we generated a written summary with codes gathered into broad categories.

Questionnaires and interview transcripts were coded to protect the identity of study participants. The study was approved by the Human Subjects Committee at Harvard Pilgrim Health Care, which granted a waiver of informed consent for study participants.

RESULTS

Mail Survey

Of 292 questionnaires mailed, 16 were undeliverable and 1 respondent who treated patients fewer than 8 hours per week was excluded. Of the 275 eligible physicians, 168 (61%) responded to the survey questionnaire. Demographics are shown in Table 1. Many respondents reported multiple sources of information about antibiotic prescribing or resistance (Table 2). Profes-

Table 1. Demographic Characteristics of Respondents

Characteristic	Total	Intervention	Control	P Value
Number responding	168	98	70	
Specialty, No. (%)				.05 ^a
Pediatrics	123 (74)	66 (67)	57 (81)	
Family medicine	41 (25)	30 (31)	11 (16)	
Other	2 (1)	1 (1)	1 (1)	
Male	106 (63)	68 (69)	38 (55)	.06
Direct patient care, hours per week (≥ 25), No. (%)	151 (92)	87 (91)	64 (93)	.63
Percentage of patients ensured by Medicaid, No. (%)				.93 ^a
0%–20%	71 (43)	44 (46)	27 (40)	
21%–40%	68 (41)	37 (39)	31 (46)	
41%–60%	19 (12)	11 (11)	8 (12)	
61%–80%	3 (2)	2 (2)	1 (1)	
81%–100%	3 (2)	2 (2)	1 (1)	
Years in practice, mean (SD)	18 (10)	18 (11)	17 (10)	.60

Note: Numbers and percentages vary between items due to differing numbers of missing values.

^a Fisher's exact test.

Table 2. Physician-Reported Sources of Information About Judicious Antibiotic Prescribing

Source	Total No (%)	Intervention No (%)	Control No (%)	P Value
REACH Mass	92 (55)	89 (91)	3 (4)	<.0001
Professional journals	154 (92)	89 (92)	65 (93)	.64
CDC	93 (55)	49 (50)	44 (63)	.10
AAP	125 (74)	67 (68)	58 (83)	.03
Other organizations (primarily AAFP)	23 (14)	15 (15)	8 (11)	.47
Lay press	64 (38)	34 (35)	30 (43)	.28
Pharmaceutical companies	45 (27)	25 (26)	20 (29)	.66
Professional meetings	106 (63)	63 (64)	43 (61)	.71

AAFP = American Academy of Family Physicians; AAP = American Academy of Pediatrics; CDC = Centers for Disease Control and Prevention; Mass = Massachusetts; REACH = REDucing Antibiotics in CHildren.

Note: Numbers and percentages vary between items due to differing numbers of missing values.

Table 3. Reported Attitudes About Bacterial Antibiotic Resistance and Prescribing

Question	Total	Intervention	Control	P Value
Is bacterial antibiotic resistance a significant problem for children in your community? No. (%)	95 (57)	58 (60)	37 (54)	.43
Does antibiotic resistance currently have an impact on your own prescribing choices or patient outcomes? No. (%)	109 (66)	63 (65)	46 (68)	.72
Is parental demand for antibiotics a significant issue in your practice? No. (%)	76 (46)	42 (43)	34 (50)	.40
Do you believe antibiotics are overused in primary care practice for children? No. (%)	144 (87)	84 (88)	60 (87)	.92
How much, as a percentage, do you believe you could decrease your antibiotic prescribing without changing the outcome? Mean % (SD)	19 (12)	18 (9)	20 (15)	.38

Note: All figures are numbers (percentages) of responses of "moderately" or "a lot" on a 4-point scale, except where noted in the last row. Numbers and percentages vary between items due to differing numbers of missing values.

sional organizations were a major source. Almost no respondents in the control group reported receipt of information from the REACH program.

Physicians' attitudes (Table 3) generally reflected concern about antibiotic overuse and resistance. Most reported moderate or greater concern about antibiotic resistance in their community and the impact of resistance on their own prescribing. Physicians reported, on average, that they could further reduce their own antibiotic prescribing by 19% without changing patient outcomes. Intervention and control physicians did not differ in any attitudes in the primary analysis or after stratification by specialty. Further, physicians' self-reported practices in both groups (Table 4) were generally consistent with judicious antibiotic use. More intervention than control physicians, however, reported a decrease in their own antibiotic prescribing during the prior 3 years. When analyses were stratified by specialty, no new significant differences emerged.

Using multivariate analyses (Table 5), we adjusted for clustering by community and examined the association of physician and practice characteristics and intervention group with reported decreases in antibiotic prescribing (compared with no change or increased use). Only intervention group (OR = 2.4; 95% CI, 1.2-4.9) and increasing years in practice (OR = 1.04 for each additional year; 95% CI, 1.00-1.08) were positively associated with reported decreases in use during the study period.

Of those intervention physicians who reported

Table 4. Reported Practices Related to Judicious Antibiotic Prescribing

Practice	Total No. (%)	Intervention No. (%)	Control No. (%)	P Value
During the past 3 years, has antibiotic use in your practice				.03 ^a
Decreased	113 (68)	73 (75)	40 (58)	
Remained the same	49 (30)	23 (24)	26 (38)	
Increased	4 (2)	1 (1)	3 (4)	
During the past 3 years, has parental demand for inappropriate antibiotics in your practice ^a				.19
Decreased	94 (57)	61 (63)	33 (49)	
Remained the same	59 (36)	30 (31)	29 (43)	
Increased	12 (7)	6 (6)	6 (9)	
Use watchful waiting for uncomplicated AOM in children 2 years old or greater "occasionally" or more	100 (63)	64 (67)	36 (56)	.18
Use high-dose amoxicillin (75-90 mg/kg/d) for initial antibiotic treatment of AOM among otherwise healthy children under 2 years old ("most of the time" or "always")	68 (41)	40 (41)	28 (41)	.99 ^a
Prescribe antibiotics for pharyngitis before test results known ≤10% of the time	148 (90)	89 (93)	59 (87)	.21
Days of symptoms before prescribing antibiotics for sinusitis in a 3-year-old child with cough but no fever ≥14 or "never"	96 (58)	56 (58)	40 (57)	.88

AOM = acute otitis media.

Note: Numbers and percentages vary between items due to differing numbers of missing values.

^a Fisher's exact test.

exposure to the REACH program (n = 88), the materials most frequently reported as received were the biweekly "REACH notes" and parent educational materials (Table 6). More physicians reported that the intervention was more effective at educating themselves (84%) than their patients (59%).

Physician Interviews

We interviewed 20 physicians from intervention communities and 16 from control communities, representing all but 1 community. When physicians were asked what had caused them to change their own antibiotic

Table 5. Bivariate and Multivariate Analyses Examining the Relationship of Physician Characteristics and Intervention Group to the Outcome of Self-Reported Decrease in Antibiotic Prescribing

Characteristic	Bivariate		Multivariate	
	OR (95% CI)	P Value	OR (95% CI)	P Value
Female	0.60 (0.30-1.17)	.13		
Years in practice	1.04 (1.00-1.07)	.04	1.04 (1.00-1.08)	.04
Specialty				
Pediatrics (reference group)	—			
Family medicine/other	1.9 (0.80-4.4)	.15		
Medicaid patients				
0%–20%	1.8 (0.85-3.8)	.12		
>20% (reference group)	—			
Intervention vs control (reference group)	2.4 (1.1-5.1)	.03	2.4 (1.2-4.9)	.02

Note: All variables with bivariate $P < .10$ were included in the multivariate model. All P values were adjusted for clustering within communities using generalized linear mixed models.

Table 6. Exposure to REACH Materials Among 88 REACH Intervention Group Respondents

Material	Reporting Yes No. (%)
Attended dinner meeting	33 (38)
Received "REACH notes"	79 (93)
Among those reporting "yes," those who read them most/all of the time	57 (73)
Received parent educational materials	80 (95)
Among those reporting "yes"	
Displayed in waiting room sometimes/often	63 (80)
Displayed in examination room sometimes/often	53 (67)
Handed to parents by nurse sometimes/often	36 (46)
Handed to parents by physician sometimes/often	48 (61)

REACH = REducing Antibiotics in CHildren.

Note: Percentages may vary because of missing responses for some items.

prescribing, most mentioned messages and methods similar to those in the REACH program, with no one predominant reason. For those exposed to REACH, the REACH program in general was most frequently mentioned. Several mentioned articles in professional journals and guidelines from professional organizations, suggesting that journals remain relevant for practicing primary care physicians in this area.

When physicians who were aware of REACH were asked about which aspects were most useful, 2 emerged. One was the frequent, brief reminders to be careful about antibiotic use, in particular the biweekly "REACH notes," each covering a specific topic on 1 page. The second was patient education materials, specifically brochures and office posters. Several physicians said they used them often to save time and stimulate discussion with parents. Several physicians (Table 7, quote 1) mentioned that these helped decrease

parental pressure to prescribe antibiotics.

Physicians had a number of suggestions for effective interventions in the future, which included several features of the REACH program. One (Table 7, quote 2) was to deliver repeated, consistent, brief reminders to parents and all physicians who prescribe antibiotics to both children and adults, to avoid giving mixed messages to parents. Several physicians suggested that annual repetition of messages before the cold season would be useful. Others mentioned that television, other mass media, and the lay press would be

useful (Table 7, quote 3). Adoption of the principles of academic detailing and direct-to-consumer advertising in promoting the messages of judicious antibiotic use to parents was mentioned (Table 7, quote 4). Finally, some believed education in schools would provide additional impact. Although there were few suggestions for program content, physicians mentioned watchful waiting for initial treatment of otitis media and evolution of bacterial resistance as 2 areas for emphasis.

DISCUSSION

Our goal with this study was to gather information from physicians involved in this 3-year randomized community-level trial about exposure to the program, the effectiveness of its various components, and suggestions for future efforts. As mentioned previously, the trial as a whole showed a slight decrease in antibiotic prescribing in some age-groups only, but no overall effect above an already strong time trend.¹⁹ Prescribing rates were similar to those reported by the most comparable independent study conducted around the same time,⁸ although other interventions in the years just before this study generally reported slight positive effects.^{8,9,11} Recent publications and campaigns from the CDC^{6,20-22} and new practice guidelines by the American Academy of Pediatrics and the American Academy of Family Physicians^{4,5} introduced about the time of the study may have made the impact of this single campaign difficult to detect. Intervention physicians were well aware of the REACH program, but as a group reported only a slight impact on practices and no differences in attitudes as compared with control physicians. Although there was little contamination of physicians in control communities, most physicians reported attitudes and behaviors consistent with recommendations.

We note, however, that physicians on average believed a further 19% decrease in their own prescribing would be possible without harm to their patients.

In contrast to some earlier studies, the physicians studied here generally reported prescribing attitudes and practices consistent with careful use of antibiotics. One survey of pediatricians and family physicians in 1999²³ reported that only 15% would wait 14 days or longer before prescribing antibiotics in a child with cough and colored nasal discharge. The rate of 58% in our sample may reflect geographic differences or change with time. Additionally, although watchful waiting, or initial observation of selected patients with acute otitis media, had not yet been endorsed by the American Academy of Pediatrics at the time of our survey, 63% reported using it occasionally or more frequently. The use of high-dose amoxicillin, another relatively new recommendation,⁵ had been adopted by 41% of respondents, suggesting relatively rapid diffusion of this practice.

Although survey respondents reported recent decreases in parental demand for antibiotic use, almost one-half reported that it remained a considerable problem. Several interviewed physicians mentioned the usefulness of the brief messages provided in parent handouts and of "prescription pads" for viral illnesses; this finding agrees with those of others that explanations of moderate length which emphasize what treatments parents can give are effective in decreasing parent demand for antibiotics.^{24,25} Most believed that the REACH program was effective at educating parents, but several also favored education through the mass media. This potentially effective though expen-

sive strategy²⁶ has been used effectively in Iceland²⁷ for otitis media. A campaign by the CDC, including a mass media component, was launched in late 2003.²⁰

Respondents viewed the REACH program as effective for physician education, with 84% rating it as somewhat or very effective. Reported use of the "REACH notes" sent by facsimile or e-mail was high. These materials were short, covered topics of local importance, and were sent during the winter to enhance relevance. Although the impact of their distribution as part of the larger program is unknown, use of "REACH notes" required far fewer resources, only a few hours of investigator and assistant time per month, than an academic detailing program would.¹⁷

Most physicians in both groups reported changes in their antibiotic prescribing, citing multiple sources of information. Physicians interviewed believed that multiple sources, as well as dissemination among multiple stakeholder groups, are necessary to effect change, and that further decreases in prescribing were possible. This finding fits well with observations regarding adoption of health care innovations.^{28,29} Innovations requiring a change in culture (eg, the idea that antibiotics are not harmless and are not always effective) and coordination across multiple disciplines (eg, pediatrics and family medicine), as well as innovations not driven by an easily visible threat (eg, resistant infections), might be adopted more slowly. Interventions to promote judicious prescribing might better be measured for a longer time than was possible in this study.

This study's methods have unavoidable limitations. Physicians' awareness of the social desirability of careful antibiotic prescribing may have led

to overreporting practices consistent with guidelines,³⁰ especially as there was no change in more-specific behaviors that would have produced an overall decrease in use. Additionally, the lack of a preintervention survey and no available physician-level data on actual antibiotic dispensing patterns make estimation of practice and attitude changes dependent on physician reports and comparisons with previous studies. Finally, although interviews were continued until no new themes emerged, we interviewed only a small sample of physicians, so all opinions among physicians in the community may not have been represented. Nonetheless, physicians' opinions about which messages had the most impact are useful in assessing the intervention's value and to design future interventions on other topics.

Table 7. Representative Quotes From Interviewed Physicians

1. Regarding parent brochures and pressure to prescribe antibiotics	"I find patients reading them, and then I'll walk into the room and they'll actually confront me as if they've just had an epiphany, saying, 'oh, I didn't know that antibiotics weren't useful for [some ear infections]....' Patients grab the pamphlet and they read about it and then I don't feel pressured at the end of the visit."
2. Regarding simultaneous messages to multiple stakeholders	"The best thing is to get in touch [with] pediatricians, family practice doctors, and the ER doctors and the community at the same time. I know that's hard, but that's a good way to do it.... So there should be consistency in the message that we give to the community."
3. Regarding patient education	"Every channel of education has to be sort of initiated so that whoever has a particular preference, their educational interest would be evoked. So it shouldn't just be [patient pamphlets or anticipatory guidance]. It should be an all around effort of having every channel available, because as the awareness increases, then the educational efforts don't need to be that intense."
4. Regarding direct-to-consumer advertising	"I think we should have it in some type of written form that parents can see, even on television.... Why can't we advertise the appropriate use of antibiotic? Why can't we use the same media that they use to tell everyone on television to take [brand-name medications] or whatever else they are advertising?"

ER = emergency department.

In conclusion, a randomized, controlled community-level intervention in physician offices to promote judicious antibiotic prescribing was associated with physician reports of decreased prescribing, but not with differences in related attitudes and practices, and most physicians reported practices consistent with relatively judicious use of antibiotics. The intervention was successful in reaching its intended audience and was welcomed by physicians as a tool for parent education. Physicians in intervention communities believed that frequent repetition of brief, consistent messages to both parents and physicians, brief physician and parent handouts on specific topics, and dissemination by the mass media were effective techniques. Educational campaigns using these techniques may make them more likely to stand out in an environment of competing similar messages.

To read or post commentaries in response to this article, see it online at <http://www.annfammed.org/cgi/content/full/6/3/206>.

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