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Howard Bauchner, Stavroula Osganian, Kevin Smith and Randi Triant

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# Improving Parent Knowledge About Antibiotics: A Video Intervention

Howard Bauchner, MD\*; Stavroula Osganian, MD‡; Kevin Smith, MSS; and Randi Triant, MFA§

**ABSTRACT.** *Objective.* To determine whether an educational video could improve parent knowledge, beliefs, and behaviors about the appropriate use of oral antibiotics.

*Study Design.* A randomized, controlled trial was conducted in an urban primary care clinic and a suburban pediatric practice. Parents were randomly assigned to the intervention or control groups. Parents in the intervention group were asked to view a 20-minute video, specifically developed for this project, over a 2-month period, and given a brochure about antibiotics. Parent knowledge, beliefs, and behaviors were assessed at the time of enrollment and then by telephone 2 months later.

*Results.* A total of 193 (94%) of 206 parents completed the study. The groups were equivalent with respect to all important baseline characteristics. No differences were found for adjusted posttest means between the intervention and control groups for knowledge, beliefs, or behavior. For example, the intervention group scored 8.04 on the knowledge questionnaire (11 true-false questions), compared with 7.82 for the control group. Subgroup analysis, based on site of enrollment, indicated that families in the intervention group from the primary care urban clinic improved their knowledge score (6.03 to 6.92) and were more likely to report that there were problems with children receiving too many antibiotics (intervention 67% vs control 34%).

*Conclusion.* Overall, this video had only a modest effect on parent knowledge, beliefs, and self-reported behaviors regarding oral antibiotics. We believe that any campaign promoting the judicious use of oral antibiotics must use a multifaceted approach and target both parents and physicians. *Pediatrics* 2001;108:845-850; *antibiotics, antimicrobial agents, parent education, video intervention.*

Promoting the judicious use of antibiotics is one of the most important public health issues of the decade. The National Foundation for Infectious Diseases has identified antimicrobial resistance and emerging infections as the most crucial problem in infectious disease control.<sup>1</sup> Although bacterial resistance to antibiotics has continued to rise, there is some evidence that when antibiotics are used appropriately, patterns of resistance can be favorably al-

tered.<sup>2-4</sup> In addition, although it is difficult to reverse patterns of resistance, the continued inappropriate use of antibiotics promotes development of resistant bacterial strains.<sup>5-8</sup>

The factors that lead to inappropriate use of oral antibiotics in children are numerous, including parental lack of knowledge, parental demand, miscommunication between physician and parent, physician concern about satisfaction and time, and diagnostic uncertainty.<sup>9-18</sup> Physicians have indicated that they believe educating parents about appropriate indications for antibiotics is one of the key elements of any campaign to promote judicious use.<sup>11</sup>

Educating parents about health-related issues is complex and takes many forms. Previous work<sup>19</sup> has shown that parents are receptive to videos and that they are effective in improving patient knowledge about various health-related issues.<sup>20-21</sup> Because pediatricians have indicated that educating parents is important,<sup>11</sup> and video is an effective and easily reproducible educational medium, we developed a video promoting the judicious use of oral antibiotics and conducted a randomized controlled trial to evaluate the effectiveness of the video to positively influence parents' knowledge, beliefs, and self-reported behaviors about antibiotics.

## METHODS

### Study Design and Population

Study participants were recruited primarily from 2 pediatric primary care clinics located in an urban and suburban setting in the Boston area, with a small number from an affiliated day care center. A parent or primary caregiver was eligible to participate if he or she had a child between the ages of 6 months and 3 years, no major disabilities to prevent viewing the video, a video player available in the home, and the ability to understand English.

The target sample size was set at 78 patients per group to detect effect sizes of 0.42 or greater with power set at 0.80. An earlier review<sup>20</sup> found that audiovisual materials produced effect sizes averaging 0.42 for knowledge scores.

Potentially eligible parents were informed about the study by clinic personnel during their visit to the pediatrician, and those interested in participating were directed to trained study staff for determination of eligibility and enrollment in the study. A total of 206 study-eligible parents agreed to participate at baseline, with 100 participants recruited from each clinic site and 6 participants recruited from the day care center. After completion of the baseline interview, half were randomly assigned to view the video or to a control condition with no intervention.

Of those recruited at baseline, 94% ( $N = 193$ ) also completed a posttest questionnaire. All participants provided written informed consent before participating in the study. The study was approved by the institutional review boards of New England Research Institute, Lahey Clinic, and Dimock Street Neighborhood Health Center.

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## Intervention

A 20-minute video program was developed to educate parents on the problem of bacterial resistance to antibiotics and their appropriate use to prevent the development of resistance. The information presented in the video was determined by focus groups of parents, the expertise of physicians, and literature documenting the factors associated with inappropriate antibiotic practices.<sup>19</sup> Specifically, it included information on common viral and bacterial childhood infections, differences between bacteria and viruses that account for their susceptibility or lack of susceptibility to antibiotics, the importance of adhering to a prescribed antibiotic regimen, and ways in which inappropriate antibiotic use can lead to bacterial resistance. The video presented encounters of real parents with their child's pediatrician, visual graphics, and didactic information. Parents who were randomly assigned to receive the video were asked to view it as often as they liked over a 2-month period. At the posttest evaluation, 42% of parents reported watching the video once and 39% reported watching it 2 to 7 times during the 2-month intervention period.

In addition to the video, the parents were also given a brochure titled "What Every Parent Should Know About Antibiotics," specifically designed for this project. The brochure contained information about common viral infections, how to use antibiotics, and a statement that antibiotics are effective only against bacterial infections.

## Measurements

An interviewer-administered questionnaire was designed to assess parents' knowledge, beliefs, and behaviors regarding the appropriate use of antibiotics and reasons for the development of bacterial resistance. The knowledge scale consisted of 11 true-false questions on indications for antibiotics and practices that may lead to resistance. The internal consistency of the scale met conventional standards for reliable scales. Parents' beliefs were assessed by having participants indicate their level of agreement with statements about antibiotics on a 4-point Likert scale ranging from "strongly disagree" to "strongly agree." To assess parents' behaviors, participants were asked to indicate the frequency with which they adhered to a prescribed regimen or followed appropriate or inappropriate antibiotic practices on a 4-point Likert scale, ranging from "never" to "always." The baseline questionnaire also collected sociodemographic information such as age, sex, race, medical insurance status, income and education level, and opportunities for exposure to information about antibiotics and bacterial

resistance from other sources such as the media or their personal physician. In-person interviews were conducted with participants at baseline, and telephone interviews were conducted at the 2-month posttest assessment. The baseline questionnaire was pretested with approximately 20 parents before the start of the trial to assess comprehension and duration of administration.

## Data Analysis

We examined differences in the baseline characteristics of participants according to treatment condition using  $\chi^2$  tests of association. A knowledge score was calculated for each participant as the number correct out of a total of 11 items. Responses to specific behaviors and beliefs were examined individually. One-way analyses of variance were used to examine differences in posttest means for knowledge, 5 behaviors, and 5 beliefs between the 2 conditions, video intervention, and control. The dependent variables for knowledge, behaviors, and beliefs were modeled as continuous variables. We conducted an analysis of covariance to examine differences in adjusted posttest means for knowledge, behaviors, and beliefs between intervention and control conditions after controlling for baseline values and other potentially confounding factors including race, parent's age, education, clinic site, number of children in the home, and exposure to information about the pros and cons of antibiotics in the media or from discussion with their physician. A possible dose-response relationship with exposure to the video was examined by modeling the frequency of video viewing in categories of none (0), once (1), and 2 or more times (2). In these analyses, intervention participants who did not watch the video were assigned to the "none" group. We also examined the effect of the video program according to clinic site by modeling a 2-factor interaction between treatment condition and clinic site. To adjust for multiple comparisons, we considered a more conservative *P* value (*P* < .01) for tests of interaction. The analyses were conducted on 193 participants with complete data at follow-up. With the inclusion of covariates, this sample size had 80% power to detect effect sizes of 0.24 to 0.38. All *P* values are 2-sided.

## RESULTS

### Characteristics of Study Participants

Table 1 presents the characteristics of study participants overall and by treatment condition. The over-

TABLE 1. Characteristics of Study Participants by Treatment Condition

Characteristic	Overall (n = 193)	Video (n = 102)	Control (n = 91)
Mean age (years, SD)	31.1 (7.2)	31.3 (7.1)	30.8 (7.3)
Female (%)	92.7	93.1	92.3
Race (%)			
White	49.7	49.0	50.5
Black	35.8	35.3	36.3
Other	14.5	15.7	13.2
Hispanic descent (%)	14.5	14.7	14.3
Education (%)			
Grades 7-12	8.3	8.8	7.7
High school graduate or equivalent	23.8	21.6	26.4
Some college or graduated college	51.8	50.0	53.8
Postgraduate or higher	16.1	19.6	12.1
Insurance (%)			
Private	56.5	53.9	59.3
Medicaid	43.0	45.1	40.7
Self-pay or none	0.5	1.0	0
Number of children (%)			
1 or 2 children	72.0	65.7	79.1
3 or more children*	28.0	34.3	20.9
Child ever received treatment with antibiotic (%)	85.0	85.3	84.6
Exposure to information about antibiotic (%)			
Ever read about or seen anything on TV about pros and cons of antibiotics	47.7	45.1	50.6
Ever discussed the pros and cons of using antibiotics with your doctor	51.3	47.1	56.0

\* *P* < .05 for  $\chi^2$  test of difference in proportions between conditions.

all mean age of participants was 31.1 years (SD = 7.2). The majority (93%) of participants were female and the mother of the index child presenting to the clinic for medical care. Approximately half were white, 36% were black, and 15% were of Hispanic decent. A small percentage (14%) reported having postgraduate education or higher, and 52% had some college or graduated college. In general, study participants had private medical insurance or received Medicaid, and nearly all of these participants (99%) reported that their insurance covered some or all of the cost of medications, with the majority having a co-payment of \$10 or less. Twenty-eight percent had 3 or more children in the family, and most (85%) had 1 or more children who received treatment with an antibiotic, excluding during a hospital admission. About half reported exposure to information about the pros and cons of antibiotics: 48% read or saw something on TV and 51% had discussed antibiotics with their physician. These characteristics were similar between participants in the video intervention and control conditions with the exception of number of children.

There were differences between the study participants at the 2 principal sites of enrollment. Children in the urban clinic ( $N = 87$ ) were more likely to be black (77% vs 1%) and receiving Medicaid (86% vs 3%) than children from the suburban practice ( $N = 100$ ). Parents in the urban clinic were also less likely to have attained college or postgraduate education (45% vs 90%) than parents from the suburban practice.

### Intervention Effects on Knowledge, Beliefs, and Behaviors

Table 2 shows the percentage of parents who answered each knowledge item correctly at enrollment. On average, respondents answered 7.50 of these questions correctly at pretest, increasing to an average of 7.90 items on the posttest. Nearly all respon-

dents knew that leftover antibiotics should not be stored and given later. The most difficult items were whether all ear infections needed to be treated with antibiotics and whether colds were caused by bacteria.

Table 3 presents unadjusted and adjusted posttest mean knowledge, belief, and behavior scores for all study participants in the video intervention compared with the control condition. In unadjusted analyses, we found no significant differences in posttest mean knowledge scores, beliefs, and self-reported behaviors between the video intervention and control conditions. In multivariate analyses, posttest scores were strongly correlated with pretest levels, and controlling for covariates generally had little impact on the magnitude of the video versus control group differences with the exception of the frequency of occurrence of 1 behavior: "I throw out any leftover antibiotic medicine" (Table 3). There was a significantly greater mean score on the reported frequency of throwing out leftover antibiotic in the video intervention compared with the control group (3.82 vs 3.62, respectively,  $P = .02$ ). In multivariate analyses that examined a potential dose-response relationship with exposure to the video, we found no consistent increase in the effect of the video intervention with greater number of times viewed (no viewing vs 1 viewing vs 2 or more viewings) for any outcome variables.

Given the diverse sociodemographic characteristics of the 2 clinic populations, we also examined the potential for a differential effect of the video according to clinic location (Table 4). In multivariate analyses, we found a significant interaction between treatment condition and clinic site for 1 self-reported behavior: "I ask for antibiotics even if not needed" ( $P = .01$ ) and a borderline significant interaction for knowledge scores ( $P = .02$ ). The positive effect on posttest mean behavior scores between the video and control group on the frequency of asking for antibiotics even if not needed was greater among participants from the urban clinic (1.14 vs 1.40, respectively) than from the suburban clinic (1.16 vs 1.22, respectively). Posttest mean knowledge scores were significantly higher for the video group than for the control group among participants from the urban clinic location (6.92 vs 6.03, respectively;  $P = .003$ ), but there was little difference in posttest knowledge scores between conditions among participants from the suburban clinic site (9.19 vs 9.14).

In addition, we asked participants both before and after the intervention whether they believed there were any problems with receiving too many antibiotics over time (Table 4). In unadjusted analyses, a significantly higher percentage of participants in the video compared with the control group responded affirmatively (81% vs 68%, respectively;  $P = .007$ ). The results were unchanged after adjusting for baseline values and other potentially confounding variables. The positive effect was limited to participants from the urban clinic site, where nearly twice as many participants in the video group compared with the control group (67% vs 34%, respectively;  $P = .007$ ) believed there were problems; there was essen-

**TABLE 2.** Distribution of Correct Responses to Knowledge Test Items

Statement	% Correct
1. Taking an antibiotic when it is really not needed can lead to resistant bacteria.	80
2. Antibiotics kill all kinds of germs.	67
3. If you don't finish all the antibiotic prescribed by the doctor, it can lead to resistant bacteria.	77
4. A cold is usually caused by bacteria.	49
5. Antibiotics usually help someone with a cold feel better.	77
6. If a child has a high fever, they should usually get antibiotics.	64
7. All ear infections in young children need to be treated with antibiotics.	34
8. If a child has yellow-green discharge from their nose, they should get antibiotics right away.	60
9. You can stop taking an antibiotic about the time that you feel better or your symptoms go away.	85
10. If a child has a throat infection, they should always get antibiotics.	50
11. You can save leftover antibiotic medicine and give it to your child anytime.	98

**TABLE 3.** Knowledge Score, Belief Items, and Behavior Items by Treatment Condition

Variable or Scale	Condition	Unadjusted Posttest Mean	Adjusted Posttest Mean*	P Value
Knowledge score (range 0–11 points)	Video	8.06	8.04	.31
	Control	7.79	7.82	
Belief items (range 1–4 points)				
Resistant bacteria are not an important problem in medicine	Video	1.71	1.68	.24
	Control	1.53	1.56	
There will always be a new medicine that can kill resistant bacteria	Video	2.09	2.08	.31
	Control	2.18	2.19	
Most doctors give antibiotics to sick children when they should	Video	2.97	2.96	.34
	Control	3.01	3.03	
Antibiotics can have bad side effects	Video	2.82	2.86	.30
	Control	2.82	2.77	
I worry that my children are given too many antibiotics	Video	1.96	1.97	.08
	Control	2.15	2.14	
Behavior items (range 1–4 points)				
I throw out any leftover antibiotics	Video	3.81	3.82	.02
	Control	3.64	3.62	
I give my child the antibiotic medicine for all the days prescribed by the doctor	Video	3.77	3.78	.87
	Control	3.79	3.79	
I stop giving my child the antibiotic medicine when he or she starts to feel better	Video	1.28	1.29	.27
	Control	1.21	1.21	
I ask the pediatrician for an antibiotic even if he/she does not think my child needs one	Video	1.15	1.15	.13
	Control	1.25	1.25	
I give leftover antibiotics to my child before talking to a doctor or health care professional	Video	1.09	1.10	.42
	Control	1.05	1.05	

\* Posttest means and *P* values from analysis of covariance model adjusting for baseline score, site, age, race, education, insurance, number of children in the family, child ever treated with an antibiotic, and exposure to information on the pros and cons of antibiotics from media sources or from discussion with doctor.

**TABLE 4.** Adjusted Means for Outcomes by Site and Intervention Effects

Outcome	Site	Group	Unadjusted Posttest Means	Adjusted Posttest Means
Knowledge score*	Urban	Video	6.92	8.28
		Control	6.03	7.52
	Suburban	Video	9.19	7.80
		Control	9.14	8.02
Believe that too** many antibiotics are a problem	Urban	Video	67%	73.5%
		Control	34%	42.0%
	Suburban	Video	94%	88.4%
		Control	94%	87.1%

Posttest means are adjusted for baseline scores and all covariates.

\* Statistically significant effect found for site by intervention interaction ( $P < .05$ ).

\*\* Statistically significant effects found for site ( $P < .01$ ) and site by intervention interaction ( $P < .01$ ).

tially no difference between conditions among participants from the suburban clinic site (94% in the video group vs 94% in the control group).

## DISCUSSION

The impact of this intervention—a carefully developed video about antibiotic resistance—on parent knowledge, beliefs, and self-reported behaviors regarding antibiotics was modest. In analyses conducted with the entire study sample, after controlling for potential confounding variables, only 1 difference was found: Parents in the intervention group were more likely to throw out leftover antibiotics than parents in the control group. However, in subgroup analysis the intervention had some effects on parents from the urban clinic. There are a number of possible explanations for these findings: The video was not powerful enough to affect parent knowledge, parent knowledge was already high, or the parents did not view the video.

The video was carefully developed based on the knowledge and opinions of parents and physicians.<sup>19</sup>

Parental surveys and focus groups were used in planning, developing, and editing the video. Parents who participated in the survey groups were of diverse ethnic and educational backgrounds, ensuring that the video was appropriate for a wide spectrum of parents. Nevertheless, it remains possible that the information in the video was not presented in the appropriate form or language or was not strong enough to influence parent knowledge.

Because of numerous campaigns of various professional societies and many articles in the popular press, it is possible that parents have become more knowledgeable about antibiotic resistance over the past few years. If this occurred, it would have been more difficult for the video to improve parent knowledge and change belief and behaviors. Evidence supporting this explanation is available. First, our subgroup analysis indicated that the video was more effective in the low-income urban practice. These families were less well educated, so the video had a larger impact on knowledge. Second, in a recent study of a community intervention trial on parental

knowledge and awareness of antibiotic resistance, investigators reported that before the intervention many parents were aware of the concept of resistant bacteria and were concerned about the overuse of antibiotics.<sup>22</sup> Third, we recently completed a national survey of physicians regarding their attitudes about immunizations. Included in the survey were questions about antibiotics. Of the first 100 physicians, 48% reported that they feel less pressure to dispense antibiotics today than 3 years ago (personal communication, Lukshme Kagliotta, MD, November 12, 2000). Only 12% indicated more pressure. This suggests that parent knowledge about appropriate indications for antibiotics may have increased.

The third possibility is that parents who received the video did not watch it. However, the data from our postintervention interview indicated that 81% parents viewed the video at least once. An analysis based on the number of times the video was viewed showed no consistent dose-response effect. Although it remains possible that parents reported but did not watch the video, we do not believe that the lack of video viewing accounts for the results.

The decision to dispense an oral antibiotic to a parent for a child is a complex medical decision.<sup>9</sup> Many of the diagnoses for which oral antibiotics are routinely indicated, such as acute otitis media, group A streptococcal pharyngitis, pneumonia, and sinusitis, are difficult to make and subject to physician interpretation of signs and symptoms, particularly if no microbiological information is available.<sup>9,14</sup> Many factors may influence the decision, including parent-physician communication, physician and parent characteristics, and evidence that supports or does not support the use of antibiotics.<sup>9-18</sup> Over the past few years new models of physician decision making have been described that account for physician and parent characteristics and external clinical evidence.<sup>23</sup> Shared decision making has evolved as an important aspect of medicine.<sup>24,25</sup> We believe that much of oral antibiotic prescribing in children does involve discretion, with various options available to physicians and parents. As parents become more aware of concerns of antibiotic resistance, it may be possible for physicians to negotiate with parents to withhold antibiotics when they are not indicated. Indeed, we believe that some parents are already requesting that antibiotics be withheld.

Changing physician behavior has become an important focus of medicine over the past decade. The intent is to improve quality of care. Numerous reviews have indicated that successful methods to change behavior include continuing medical education with active discussion, patient and physician reminders, clinical paths for hospitalized patients, educational outreach, audit and feedback, and decision support.<sup>23,26-31</sup> In general, multifaceted approaches are more effective than approaches based on a single method.<sup>26</sup> In a qualitative study from Great Britain, 50 general practitioners and 50 consultants were asked why they changed their clinical practice.<sup>32</sup> They cited an average of 3 reasons for each change. The 4 most frequently cited reasons were organizational factors, education, contact with pro-

fessions, and patient request. Clearly, the approach to promoting the judicious use of oral antibiotics in children must be balanced, including education of both physicians and parents.

Studies that find no difference between intervention and control groups are always disappointing. Nevertheless, the video used in this project was carefully developed, well received by parents, and, we believe, valuable for them to view. We did not test its effect over a long period of time. It may be effective if viewed on a regular basis in a practice setting, particularly if it is combined with other intervention strategies.

The campaign to promote the judicious use of oral antibiotics is critically important for the future well-being of children. The campaign should be multifaceted and include guidelines, decision support, clinical paths, reminders and consensus statements for physicians, and public health announcements, magazine articles, handouts, and videos for parents.

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## COMPASSION-LESS TRAINING

During [the first 10 years of medical study] . . . no one ever taught me how to relieve pain, or how to keep it from occurring. No one ever told me that I could sit by the bedside of a dying person and hold his hand and talk with him.

Winckler M. *The Case of Dr Sachs*. New York, NY: Seven Stories Press; 1998

Submitted by Student

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