

# Can a Nationwide Media Campaign Affect Antibiotic Use?

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**A**ntibiotic resistance to pathogenic bacteria prevalent in community settings has been identified as an emerging threat to public health. An important factor in the development of antibiotic resistance is overuse of antibiotics.<sup>1-4</sup> Of particular concern is overprescription of antibiotics for the treatment of viral upper respiratory infections (URIs)<sup>5-7</sup> or otitis media (OM) among children.<sup>6-8</sup>

Physicians may overprescribe antibiotics as a response to patient expectations.<sup>9</sup> It also has been suggested that under the pressure of high caseloads, especially during winter months, physicians lack either the time or the skills necessary to explain why antibiotics have no clinical effect on viral infections<sup>9,10</sup> and to offer alternative supportive treatment such as a “wait-and-see” approach for acute OM.<sup>11</sup>

Effective strategies for reducing the misuse of antibiotics should include physician education as well as an effort to decrease patient demand.<sup>12</sup> Such a multifaceted approach is taken by the National Campaign for Appropriate Antibiotic Use of the US Centers for Disease Control and Prevention, which recommends physician and medical student education as well as information for patients.<sup>13</sup> Community-wide educational campaigns have been shown to lead to reductions in antibiotic purchasing<sup>14-16</sup> and demand for antibiotics on the part of parents.<sup>17</sup>

Overprescription of antibiotics also is a problem in the Israeli health-care system. Use of antibiotics to treat viral URI and influenza is an issue of particular concern, because it is estimated that up to 10% of the Israeli population suffers from influenza annually, creating a substantial burden on health services.<sup>18</sup> During the winter of 2005-2006 Maccabi Healthcare Services (MHS), Israel’s second largest health maintenance organization (HMO), initiated a nationwide media campaign aimed at increasing awareness of the misuse of antibiotics among the general public. The main focus of the campaign was on the inappropriate use of antibiotics in the treatment of influenza and URI. We report the results of a population-based study conducted to evaluate the impact of this campaign on parental knowledge and awareness of appropriate antibiotic use as well as on patterns of actual antibiotic use.

**Objective:** To evaluate the effectiveness of a nationwide media campaign to reduce antibiotic overuse among children.

**Study Design:** Prospective observational study of the pediatric population of a health maintenance organization (HMO) comparing antibiotic use during the baseline (November 2004-February 2005) and study (November 2005-February 2006) periods.

**Methods:** During January 2006 the HMO conducted a media campaign to increase public awareness of the risks of misusing antibiotics, particularly for influenza-like diseases. Antibiotic purchasing rates during specific periods in the study winter were compared with those during corresponding periods in the baseline winter among children diagnosed with upper respiratory infection (URI), otitis media (OM), or pharyngitis. After the intervention, a random subset of the study population was surveyed by telephone to estimate the level of exposure to the campaign and attitudes toward antibiotic use.

**Results:** The study population consisted of 101,401 children in the baseline winter and 84,979 in the study winter. We noted reductions in antibiotic purchasing for URI, OM, and pharyngitis during the postintervention period compared with the preintervention period (URI odds ratio [OR] = 0.75, 95% confidence interval [CI] = 0.69, 0.81; OM OR = 0.65, 95% CI = 0.59, 0.72; pharyngitis OR = 0.93, 95% CI = 0.89, 0.97). Parents of children with URI exposed to the media campaign were more likely to agree with standards of appropriate antibiotic use than parents not exposed ( $F_1 = 4.18, P = .04$ ).

**Conclusions:** A media campaign aimed at changing patient behavior can contribute to reducing the rate of inappropriate antibiotic use.

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## METHODS

### National Campaign

Maccabi Healthcare Services is responsible for providing health services for 1.7 million mem-

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### Take-Away Points

Overuse of antibiotics, particularly for the treatment of viral illnesses for which these medications offer no benefit, contributes to the development of antibiotic resistance and increases in costs. Our study of a media campaign stressing appropriate antibiotic use demonstrated the following:

- A campaign based on television programming was an effective way to impart knowledge regarding appropriate antibiotic use to a large audience.
- Parents exposed to a media campaign demonstrated greater knowledge regarding appropriate antibiotic use than parents not exposed.
- Antibiotic use for presumed viral conditions dropped in the period after the campaign.

under study, we identified all physician visits of children under the age of 18 years for whom a diagnosis of URI, pharyngitis, OM, or influenza was recorded. (A list of diagnoses is provided in [eAppendix A](#) available at [www.ajmc.com](http://www.ajmc.com).) For each case identified, we retrieved the visit date, diagnosis, patient identification number, and physician identification number. Demographic indicators

available from membership files include age, sex, status as an immigrant from the Commonwealth of Independent States after 1990, and residence in Arab villages or neighborhoods with a high percentage of ultraorthodox residents. We have found that recent immigrants and members of minority populations differ in their use of medical services; therefore, we included this demographic information in the analysis.

bers, approximately 25% of the Israeli population. In January 2006, MHS initiated a comprehensive mass media campaign to increase public awareness of the risk of misusing antibiotics, particularly for the treatment of influenza-like diseases. The campaign, which consisted of radio and television advertisements, in conjunction with a concurrent 4-part television series, was targeted at parents of children. The advertisements projected the general message that antibiotics are not an appropriate treatment for colds and other viral URIs. The television series presented the serious implications of misusing antibiotics. The media campaign was carried out during a 2-week period in January 2006 to affect the peak of antibiotic use in the months of January and February of every year.

### Assessments of Campaign Effectiveness

The study focused on the impact of the campaign on the use of the antibiotics for the treatment of acute viral conditions; therefore we excluded children for whom antibiotic treatment might have been provided for another diagnosis or for chronic conditions. For this reason, children meeting any of the following criteria were excluded from the study population: (1) additional diagnoses recorded during the same physician visit; (2) instances of any diagnoses of URI, OM, or pharyngitis in the 6 months preceding the physician visit; or (3) antibiotic purchase within 30 days prior to the physician visit.

We evaluated the effectiveness of the campaign in 2 ways. First, to determine whether the campaign affected actual use of antibiotics, we conducted an analysis of medical and administrative information drawn from the MHS central computer database. The impact of the campaign on antibiotic use was assessed by comparing monthly antibiotic purchasing rates during the preintervention (November-December 2005) and postintervention (January-February 2006) periods of the study winter with the corresponding periods of the baseline winter (November 2004-February 2005).

The outcome variable of interest was an antibiotic purchase within 3 days of a first visit for URI, OM, or pharyngitis. For all eligible children in the analysis data set, we searched the MHS pharmacy database for purchases of antibiotics prescribed by the diagnosing physician occurring within 3 days after the patient visit. All antibiotic purchases require physician prescription and are subsidized by the HMO; therefore, we assumed that we would capture the vast majority of purchases. We limited our analysis to purchases within a relatively short period and required that the diagnosing physician be the same as the prescribing physician to maximize the likelihood that the diagnosis and antibiotic purchase were indeed linked.

Second, a random sample of parents of children diagnosed with URI were surveyed by telephone to assess changes in attitudes toward antibiotic use. The survey was intended to assess the level of exposure to the campaign and to allow for a comparison of attitudes toward antibiotic use among respondents exposed and unexposed to the campaign. The research received approval from the MHS research committee.

### Antibiotic Utilization

All systems of care in MHS are computerized and data are channeled to and stored in a central database in which a member identification number is used to link information from different sources. Data from all physician visits are captured and stored in a central computer system. For the periods

under study, we identified all physician visits of children under the age of 18 years for whom a diagnosis of URI, pharyngitis, OM, or influenza was recorded. (A list of diagnoses is provided in [eAppendix A](#) available at [www.ajmc.com](http://www.ajmc.com).) For each case identified, we retrieved the visit date, diagnosis, patient identification number, and physician identification number. Demographic indicators

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### Telephone Survey

The telephone survey commenced several days after the campaign officially ended and was conducted over a period of 2 weeks. The survey sample consisted of 860 randomly selected parents of MHS members identified in the course of the antibiotic utilization analysis described above. We selected the survey population from among those with URI as it was the most common condition studied, accounting for 57.1% of

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the study population in the baseline year. Of those contacted, 53% (n = 456) completed interviews.

Two questions were used to assess the respondents' level of exposure to the campaign. Respondents were first asked, "Do you remember seeing or hearing a recent advertisement about treatment by antibiotics?" Afterward, full descriptions of the advertisements on television and radio were presented, and the respondents were asked to recall if they had seen or heard the advertisements. Those who answered yes to at least 1 of the questions were classified as "exposed." Those who answered no to both questions were classified as "not exposed."

Parental knowledge regarding correct use of antibiotics was assessed using a series of statements (see [eAppendix B](#) available at [www.ajmc.com](http://www.ajmc.com).) For each statement the respondent was asked to quantify his or her level of agreement, using a scale ranging from 1 ("strongly disagree") to 10 ("strongly agree"). Each statement reflected an aspect of knowledge regarding appropriate antibiotic use. For example: "Use of unnecessary antibiotics can result in the development of antibiotic-resistant bacteria." We generated a composite variable, counting the number of responses of 9 or 10 (high level of agreement) for each respondent. Thus, a high score indicated strong agreement with standards for appropriate use of antibiotics, whereas a low score indicated poor agreement. We excluded from the analysis those items to which more than 20% of respondents answered "don't know."

### Data Analysis

To assess the effectiveness of the campaign in reducing rates of antibiotic purchases, the study winter was divided into 2 parts: the 2 months prior to the intervention (November and December) and the 2 months during and after the intervention (January and February). We used a series of binary logistic regression models adjusted for demographic factors to compare rates of antibiotic purchase in the preintervention and postintervention periods of the study winter with the parallel periods in the preceding winter. Binary logistic regression models were constructed for each of the diagnoses of interest, using a Bonferroni correction to hold the overall *P* value for the model to .05. For each of the 3 conditions studied, we con-

structed 2 regression models to compare antibiotic purchasing in the baseline winter versus the study winter. The first model in each pair focused on the preintervention period and the second focused on the postintervention period. In addition, we used general linear models to estimate the effect of exposure to the campaign, as determined by survey, with the level of agreement with appropriate use of antibiotics. All analyses were performed using SPSS version 14 (SPSS Inc, Chicago, IL).

## RESULTS

### Antibiotic Utilization

During the baseline winter, 206,235 children under age 18 years received any of the diagnoses of interest. Of these, 101,401 children had no instances of these diagnoses within the preceding 6 months, had no other diagnoses recorded at the same physician visit, and had not received antibiotics in the preceding 30 days, and therefore met the criteria for inclusion in the study population. The corresponding figures for the study winter were 180,110 and 84,979, respectively. During the study winter, URI was the most commonly identified condition in the population under study (53.2%), followed by pharyngitis (39.2%). Otitis media accounted for an additional 7.6% of children ([Table 1](#)). The small number of cases of influenza disease (1073 patients during the study winter) were excluded from analysis.

We detected small differences in the distribution of the diseases under study between the baseline and study winters. The rate of URI declined slightly between the baseline and study winters (from 57.1% to 53.2%), while the rates of OM and pharyngitis increased (6.7% to 7.6%, and 36.1% to 39.2%, respectively) ([Table 1](#)). These differences, though statistically significant, did not appear to indicate major changes in morbidity patterns that might have resulted in changes in antibiotic prescribing practices. Fewer than 10% of children diagnosed with URI in the baseline winter made an antibiotic purchase within 3 days of diagnosis. The corresponding percentages after OM and pharyngitis were approximately 40% and 60%, respectively ([Figure 1](#)).

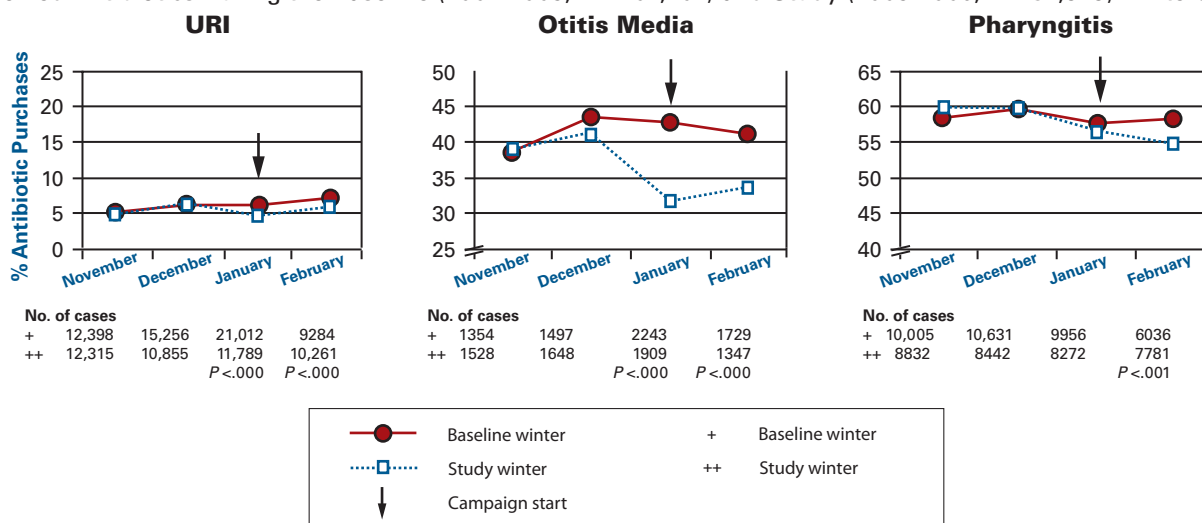
Logistic regressions adjusted for demographic parameters (age, sex, religious status, and immigration status) indicated a significant reduction in purchases following URI diagnosis during

■ **Table 1.** Distribution of URI, Otitis Media, and Pharyngitis in Study Population, Baseline (2004-2005), and Study (2005-2006) Winters

Study Period	Percentage (No. of Children)		
	URI	Otitis Media	Pharyngitis
Baseline winter (n = 101,401)	57.1 (57,950)	6.7 (6823)	36.1 (36,628)
Study winter (n = 84,979)	53.2 (45,220)	7.6 (6432)	39.2 (33,327)

URI indicates upper respiratory infection.

**Figure 1.** Proportion of Children Under Age 18 Years Diagnosed With URI, Otitis Media, or Pharyngitis Who Received Antibiotics During the Baseline (2004-2005; n = 101,401) and Study (2005-2006; n = 84,979) Winters



URI indicates upper respiratory infection.

the postintervention period compared with the parallel period in the baseline winter (odds ratio [OR] = 0.75; 95% confidence interval [CI] = 0.69, 0.81) (Table 2). A more substantial reduction in antibiotic purchasing was associated with OM during the postintervention period compared with the same months in the preceding winter (OR = 0.65; 95% CI = 0.59, 0.72). Similarly, analysis of antibiotic purchasing associated with pharyngitis revealed minor reductions between the baseline and study winters during the postintervention period (OR = 0.93; 95% CI = 0.89, 0.97) (Table 2). In none of the 3 conditions studied did we observe a significant reduction in antibiotic purchases during the preintervention period of the study winter compared with the parallel period in the baseline winter.

### Survey

More than half of the survey respondents (54%) reported exposure to the media campaign. Exposure to the media campaign was positively associated with appropriate attitudes toward antibiotic use. Parents of children with URI who were exposed to the media campaign were more likely to express agreement with standards of appropriate antibiotic use than parents who were not exposed to the campaign ( $F_1 = 4.18, P = .04$ ). The sex of the responding parent appeared to influence the attitudes toward antibiotic use ( $F_1 = 10.29, P = .001$ ); female parents were more likely to agree with standards of appropriate use than male parents (Figure 2).

## DISCUSSION

For this study we used a combination of computerized patient care data and survey data to examine the effectiveness

of a nationwide media campaign to encourage appropriate use of antibiotics in cases of URI, OM, and pharyngitis. Our results demonstrate a significant decrease in antibiotic purchases for the treatment of the conditions studied subsequent to the campaign and greater knowledge regarding appropriate antibiotic use among parents exposed to the campaign. These findings suggest that the media campaign had an impact not only on parents' attitudes but also on the actual use of antibiotics.

The problems of antibiotic resistance and injudicious use of antimicrobials, especially for viral diseases, are widely recognized. Interventions may address patient or parent knowledge of appropriate antibiotic use and highlight the problem of antibiotic resistance, with the aim of reducing demand for antibiotics.<sup>14,17</sup> For patient education purposes, it appears that video presentations are more effective than written materials.<sup>19</sup> Assuming that overprescription of antibiotics is a multidimensional problem, several programs have combined interventions aimed at physicians, the general public, and patients. One intervention successfully reduced antibiotic use by combining educational materials mailed to households with office-based patient and clinician education.<sup>1</sup> Another program reduced antibiotic prescription rates by conducting a community-wide campaign involving not only education of pediatricians and family physicians but also a component geared toward parents and the general public.<sup>14</sup>

It has been suggested that physicians, although aware of the need to reduce antibiotic use, have difficulty resisting pressure from patients and parents.<sup>9,10</sup> Therefore, our intervention focused on changing the attitudes of parents rather than of physicians, in an attempt to harmonize pa-

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rental expectations with accepted medical practice. Our findings are consistent with those of previously published studies of educational approaches intended to reduce inappropriate use of antibiotics.<sup>1,14,16</sup> Our program demonstrated the impact of a campaign focusing on parental attitudes and knowledge as a means of reducing inappropriate antibiotic use. This finding is in contrast to that of a previous study,<sup>19</sup> which suggested that changes in parents' attitudes are not sufficient to reduce antibiotic prescribing by physicians, especially in situations in which the utilization rate prior to the intervention was low.

An unexpected finding of our study was a significant reduction in antibiotic use associated with both OM and pharyngitis during the period of the campaign. Although routine antibiotic treatment for OM is no longer accepted,<sup>8</sup> it may be difficult to convince parents of the wisdom of withholding antibiotics in this situation. Our data demonstrated, however, that the media campaign supported the professional literature and contributed to reductions in antibiotic use not only for viral URI, but also for OM. The reduction in antibiotic use for pharyngitis, though less pronounced than that for OM, suggests acceptance of the message of reducing unnecessary antibiotic use beyond the specific diagnoses addressed in the campaign.

Several limitations of this study warrant consideration. First, the differences in antibiotic purchasing observed between the study winter and the baseline winter could stem from reasons other than the intervention itself. For instance, we noted a higher prevalence of URI during the winter preceding the campaign, which could have created an atmosphere that encouraged antibiotic use. It also is possible that the observed reduction is part of a trend of decreasing use of antibiotics not related to the campaign. However, the reduction in the rate of antibiotic purchasing was observed only in the

**Table 2.** Changes in Antibiotic Purchasing Rates for Selected Conditions in Association With a Media Campaign, Compared With the Precampaign Period<sup>a</sup>

Condition and Study Period <sup>b</sup>	OR	95% CI for exp(β)	
		Lower	Upper
<b>URI</b>			
Precampaign	0.962	0.891	1.039
Postcampaign	0.749	0.694	0.808
<b>Otitis media</b>			
Precampaign	0.970	0.874	1.076
Postcampaign	0.652	0.591	0.718
<b>Pharyngitis</b>			
Precampaign	0.968	0.929	1.009
Postcampaign	0.931	0.890	0.973

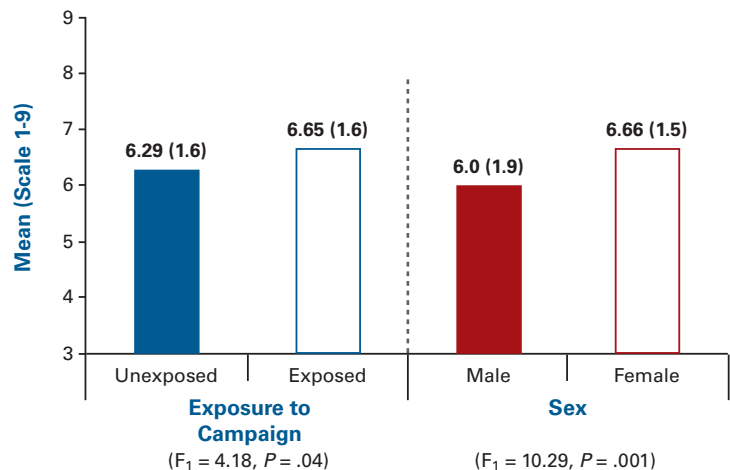
CI indicates confidence interval; OR, odds ratio; URI, upper respiratory infection.

<sup>a</sup>Logistic regressions were adjusted for selected demographic factors: child's age at time of physician visit; child's sex (0 = female, 1 = male); immigrant from the Commonwealth of Independent States (immigrant since 1998 = 1, 0 = other); religious status (Jewish ultraorthodox religious identified by type of monthly journal they prefer to read = 1, 0 = other).

<sup>b</sup>The precampaign period was November-December 2005; the postcampaign period was January-February 2006. Comparisons were to the parallel periods in the baseline winter.

postintervention period and not the preintervention period. Therefore, we believe that a reduction in the background rate of antibiotic use independent of the campaign is unlikely to explain our findings. We limited our analysis of antibiotic purchases to those prescribed by the diagnosing physician, thus potentially underestimating the true rate of use among children diagnosed with the conditions under study. In fact, our survey indicated that only 1% of parents sought an antibiotic

**Figure 2.** General Linear Model—Effect of Exposure to Media Campaign on Parental Awareness of Appropriate Antibiotic Use by Sex of Parent<sup>a</sup>



<sup>a</sup>Telephone survey (n = 456) of parents of children diagnosed with upper respiratory infection. Parenthetical values above the columns are standard deviations.

prescription from a second physician after the diagnosing physician failed to provide one.

An additional concern is that the nature of the intervention precluded the use of random treatment and comparison groups. However, the broad population exposure to the mass media campaign (estimated at 54% of survey respondents), coupled with the use of administrative data on utilization, allowed us to evaluate the impact of the program on antibiotic purchasing across the entire population. Moreover, possible confounders were controlled by excluding cases with additional diagnoses recorded at the same visit, or those with instances of the diagnoses of interest during the preceding 6 months. With respect to parental attitudes, those exposed to the media campaign may have differed from those not exposed in their attitudes toward appropriate use of antibiotics. However, because our goal was to examine the potential impact of such a campaign on its true target population—those normally exposed to the influence of the media—we were less concerned with a need to control for rates of exposure.

The strengths of the current study include the fact that it examined the impact of a widely targeted intervention on the entire population of a large HMO. The survey data allowed us to address an intermediate outcome—changes in knowledge regarding appropriate antibiotic use—while purchasing data reflected the impact on the final outcome, reduction in purchases. Our results demonstrate not only a short-term change in purchasing behavior, but also an effect on parents' attitudes toward antibiotic use in the wake of the campaign. These findings support our conclusion that a nationwide media campaign is an effective strategy to reduce overuse of antibiotics among children. Although it is not known whether the intervention as a whole or specific components would be effective in other countries, the approach we describe here may offer a promising model for designing future intervention aimed at decreasing antibiotic use in ambulatory care.

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NHS-S, BGS, JT, NLF); drafting of the manuscript (BH, NHS-S, BGS, ADH, NLF); critical revision of the manuscript for important intellectual content (BH, NHS-S, BGS, JT, ADH, ST, NLF); statistical analysis (BH, NHS-S, JT); administrative, technical, or logistic support (ST, NLF); and supervision (NLF).

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