Effectiveness of an Educational Intervention in Modifying Parental Attitudes About Antibiotic Usage in Children

James A. Taylor, MD*; Tao Sheng C. Kwan-Gett, MD, MPH‡; and Edward M. McMahon, Jr, MD§

ABSTRACT. Objective. To determine the effectiveness of educational materials in improving the attitudes of parents of young children about the judicious use of antibiotics.

Methods. We conducted a randomized controlled trial by recruiting parents of children who were younger than 24 months and being seen for any reason in primary care pediatric offices. At the time of enrollment, study parents indicated their level of agreement with 16 statements, including 9 statements about antibiotic usage and 7 about injury prevention. After being randomized, parents received either a pamphlet and a videotape promoting the judicious use of antibiotics (intervention group) or brochures about effective injury prevention (control group). Six weeks after enrollment, each group received another copy of the pamphlet or brochures and a follow-up questionnaire with the identical 16 statements. Responses on both questionnaires were transformed to an ordinal scale for analysis. Scores on the follow-up questionnaire for each statement about antibiotic use and injury prevention in the 2 groups were compared using linear regression, after controlling for the score obtained for the statement at enrollment.

Results. We enrolled a total of 499 eligible parents in the study; 358 (72%) completed the follow-up questionnaires. At study entry, there were no significant differences between the parents in the intervention and control groups regarding attitudes for 15 of the 16 statements assessed. However, 6 weeks after receiving the antibiotic educational materials, parents in the intervention group had significantly different attitude scores for 5 of the 9 statements about the antibiotic use. In each case, the scores reflected attitudes that would promote the judicious use of antibiotics. We found significant attitudinal change for statements about the use of antibiotics for specific conditions in children; there were no differences between the 2 groups for more general or theoretical statements about antibiotic use.

Conclusions. A simple educational effort was successful in modifying parental attitudes about the judicious use of antibiotics. Information about specific childhood conditions may be more effective in changing attitudes than more general information about antibiotic usage. Pediatrics 2003;111:e548–e554. URL: http://www.pediatrics.org/cgi/content/full/111/5/e548; antibiotic, patient education, upper respiratory tract infections.

ABBREVIATIONS. DRSP, drug-resistant Streptococcus pneumoniae; URI, upper respiratory tract infection; PSPRN, Puget Sound Pediatric Research Network; TIPP, Toward Injury Prevention Program.

The emergence of antibiotic-resistant bacterial pathogens, particularly drug-resistant Streptococcus pneumoniae (DRSP), is cause for serious and growing concern.1–5 Although the emergence of DRSP6–8 is probably multifactorial, recent evidence suggests that the injudicious use of antibiotics is partly responsible for the increasing prevalence of these bacterial strains.2,9,10 Curbing this excessive use of antibiotics will be an important part of any effort designed to reduce the prevalence of DRSP.

In an attempt to decrease the overuse of antibiotics in children, practice guidelines for the appropriate use of these medications in the management of otitis media, sinusitis, and upper respiratory tract infections (URIs) have been published.11–15 Other methods of disseminating information to pediatricians and family physicians have been advocated, including “academic detailing,” the use of physician peer leaders and drug educators, feedback to physicians comparing their antibiotic prescribing practices with those of colleagues, and computer-assisted decision support.16 Some of these techniques have been shown to be effective in modifying physician behavior.17

However, much of the overprescribing of antibiotics is driven by parental expectations and physician perception of these expectations. In a survey of a random sample of practicing pediatricians in the United States, 96% of respondents indicated that parents had requested unnecessary antibiotics for their child during the previous month; 40% reported receiving 10 or more such requests. When pressured to prescribe these medications, 30% of pediatricians reported complying with this request “occasionally” or more frequently.18 The effect of perception of parental expectations for antibiotics on physician behavior is striking. Mangione-Smith et al19 found that private practice pediatricians prescribed antibiotics to 52% of children who were 2 to 10 years of age and presenting with URI symptoms and received a diagnosis of a viral illness when the physician reported that she or he perceived that the parent desired these medications versus 9% when he or she did not have this perception. In another study, when asked to identify the single most important program to reduce inappropriate antibiotic use in children, 78% of surveyed
pediatricians indicated that educating parents about the judicious use of the antibiotics would be most efficacious.\textsuperscript{18}

We need effective techniques for educating parents about the judicious use of antibiotics. The American Academy of Pediatrics, the Centers for Disease Control and Prevention, and the American Society of Microbiology have developed an educational pamphlet entitled “Your Child and Antibiotics” for distribution in health care providers’ offices.\textsuperscript{20} The pamphlet features color illustrations and photographs, describes the differences between viral and bacterial illnesses, lists common illnesses such as URIs for which antibiotics are usually not needed, explains the relationship between overuse of antibiotics and bacterial resistance, and encourages parents to discuss these issues with their child’s doctor. Videotape educational messages have also been shown to be an effective method to improve knowledge of health issues.\textsuperscript{21}

We conducted a randomized controlled trial to determine whether “Your Child and Antibiotics,” accompanied by a short videotape message reinforcing the key points in the pamphlet, would be effective in improving parental attitudes about the judicious use of antibiotics. The study was conducted in the offices of practicing pediatricians. In each practice, the videotape message was “personalized”: 1 of the pediatricians in the office was featured in the presentation. Before the study, we hypothesized that this intervention would result in more positive attitudes on the judicious use of antibiotics among parents randomized to the antibiotic education intervention than in parents in the control group.

METHODS

The Puget Sound Pediatric Research Network (PSPRN), a practice-based research organization composed of pediatricians in the Seattle, Washington, area, conducted this study. Eight PSPRN practices, including 7 private offices and 1 inner-city pediatric clinic, volunteered to participate. Parents of children who were younger than 24 months and being seen in the office of a participating practice for any reason were eligible for the study. A study research coordinator visited each office on a regularly scheduled basis to recruit parents and collect data. Parents of children with complex medical conditions such as cystic fibrosis, bronchopulmonary dysplasia, or congenital anomalies were excluded from the study as were those who did not speak English.

At the time of enrollment, study parents completed a questionnaire that included demographic items such as the age of their child, ages of other children, use of child care, smokers in the household, parental education level, and their child’s previous use of antibiotics. The questionnaire also included 9 statements about injury prevention. The study research coordinator encouraged parents in both the intervention and the control groups to review the materials provided and counseled them to discuss any of the issues described in the educational materials with their child’s doctor. The practicing pediatricians were not informed by the study research coordinator about which parents were enrolled in the study or the randomization of any parent.

Approximately 6 weeks after enrollment, parents who were randomized to the intervention group were mailed another copy of the pamphlet “Your Child and Antibiotics.” Similarly, control parents were sent another copy of the TIPP pamphlets. This mailing included a second questionnaire regarding antibiotic use and injury prevention identical in format and content to the questionnaire completed by the study parents at enrollment. Parents were asked to complete the follow-up questionnaire and return it to the study research coordinator by mail. No attempt was made to recontact parents who did not return the second questionnaire because we believed that a second mailing or contact from the research staff might alter the parents’ responses.

For the analysis, parental responses to the statements were transformed to an ordinal scale, with scores ranging from 6 for a response of “completely agree” to 1 for a response of “completely disagree.” There were 4 statements about antibiotic use for which parental agreement was indicative of attitudes supportive of the judicious use of antibiotics. Thus, for these statements, higher numerical scores were associated with attitudes more supportive of the judicious use of antibiotics. Conversely, there were 5 statements about antibiotic use for which parental disagreement supported the judicious use of antibiotics. For these statements, lower scores were indicative of attitudes supportive of the judicious use of antibiotics.

A similar schema was used for the statements on injury prevention. Three statements were worded such that parental agreement—and higher numerical scores—indicated an attitude associated with effective injury prevention. Conversely, 4 statements about injury prevention were worded such that a response of “completely disagree”—and lower numerical scores—were associated with attitudes consistent with effective injury prevention.

The main study outcomes were the attitude scores of parents regarding the judicious use of antibiotics 6 weeks after enrollment and receipt of the educational materials. Scores for attitudes regarding each of the 9 statements about antibiotic use and the 5 statements about injury prevention were calculated for each parent. Differences in attitude scores associated with the intervention were analyzed by a randomization test. A randomization test is a resampling procedure used to determine whether observed differences are statistically significant.

In all analyses, we adjusted for the effect of clustering into different pediatric practices using generalized estimating equations techniques.\textsuperscript{23} Scores of parental attitudes regarding each of the 7 statements about injury prevention were similarly analyzed. For placing the results in context, differences in attitudes between parents in the 2 groups were considered to be statistically significant at $P < .0055$ ($0.05$ divided by 9 statements), using the technique described by Bonferroni.\textsuperscript{24} Similarly, differences in attitudes about injury prevention were considered to be statistically significant at $P < .0071$ ($0.05$ divided by 7 statements).

For assessing potential confounding that might have occurred despite randomization, the characteristics of parents and their children in the antibiotic education and injury prevention groups were assessed with the use of $\chi^2$ and $t$ tests. In the main analyses, we adjusted for any characteristic for which there was a statistically significant difference in prevalence between the 2 groups. Finally, differences in characteristics between parents who completed the follow-up questionnaire and those who enrolled in the project but did not return the questionnaire were also evaluated.

The study was approved by the Institutional Review Boards of
RESULTS

We enrolled a total of 500 parent-child dyads from the 8 participating PSPRN practices. Study data were collected between March 2000 and October 2001. One child who was initially enrolled in the study was later found to have complex congenital heart disease; data from this child and his parent were excluded from the analyses. Initial mean attitude scores for each of the antibiotic and injury prevention statements are shown in Table 1. In general, parental attitudes were supportive of the judicious use of antibiotics.

Follow-up questionnaires were returned by 358 parents (response rate of 72%). The educational level of parents who completed and returned the follow-up questionnaire was significantly higher than that of nonresponders ($P < .001$), and children of responders tended to be younger (mean age 8.5 months vs 9.6 months; $P = .08$). There were no other differences in measured characteristics between the 2 groups. However, parents who completed the follow-up questionnaire had some attitudes more supportive of the judicious use of antibiotics at study entry than parents who did not return the follow-up questionnaire. Specifically, those who returned the follow-up questionnaires had significantly more disagreement with the statements regarding the efficacy of antibiotics in resolving URI symptoms (mean score 2.30 vs 2.75 for parents not returning the questionnaire; $P = .005$) and the utility of administering antibiotics to their child when URI symptoms have persisted for 5 days (mean scores 2.78 and 3.33, respectively; $P = .001$). There were no differences in attitudes regarding injury prevention at enrollment between parents who returned or did not return the follow-up questionnaire.

Among 252 parents who were randomized to receive the antibiotic education materials, 174 returned the follow-up questionnaire (69.0%) compared with 184 (74.5%) of 247 of those who received injury prevention educational materials ($P = .177$). The characteristics of parent-child dyads in the 2 groups who returned the follow-up questionnaire are compared in Table 2. There were no statistically significant differences between the groups. Overall, parents who returned questionnaires were highly educated, with 72% having graduated from college. At study entry, parents who were later randomized to the antibiotic education group had significantly more agreement with the statement, “Too many children are treated with antibiotics when not necessary,” than those who received injury prevention information (mean scores 4.90 and 4.67, respectively; $P = .005$). There were no statistically significant differences between the 2 groups for any other antibiotic or injury prevention attitude score at the time of enrollment.

Attitudes regarding the judicious use of antibiotics among parents who received the antibiotic education materials 6 weeks after study enrollment are compared with attitudes in those who were randomized to the injury prevention group (Table 3). Parents in the intervention group had significantly different attitude scores for 5 of the 9 statements about antibiotic use in their children from those in the control group. In each case, these scores were indicative of attitudes that would promote the judicious use of antibiotics. Thus, parents who received the antibiotic education materials were statistically less likely to agree that antibiotics are necessary when a child’s nasal discharge turns to green in color, that it is worth trying...
an antibiotic in their children when URI symptoms persist for 5 days, that antibiotics are useful in treating colds, that giving antibiotics to a child with a URI can prevent a bacterial infection, and that antibiotics help URI symptoms clear up more quickly than parents who did not receive these materials. There were no statistically significant differences between groups for the remaining 4 statements.

The effect of the intervention was similar in parents of differing educational levels for 7 of the 9 statements. However, there was a significant interaction between education level and the intervention for the statement, “Parents should never prescribe antibiotics when they are unnecessary” ($P = .005$), and the statement, “Physicians should never prescribe antibiotics when they are unnecessary,” ($P = .004$). In both cases, the intervention was more effective in parents who had no education beyond high school than in those with more education.

Finally, parental attitude scores regarding injury prevention in their children, based on responses to the follow-up questionnaires, are shown in Table 4. Parents who received TIPP sheets had significantly more disagreement with the statements regarding the effectiveness of swimming lessons in toddlers in preventing drowning and the usefulness of walkers in teaching children how to ambulate than those who received the antibiotic education materials. There were no statistically significant differences between the 2 groups of parents for the remaining 5 statements about effective injury prevention.

**DISCUSSION**

The results of this study suggest that a simple educational intervention can significantly alter parental attitudes regarding the use of antibiotics in their children. The process of distributing a brochure, augmented by brief discussion and/or a videotape message, is compatible with busy office practice. Our results indicate that the intervention was more successful in modifying parental beliefs about the need for antibiotics for specific conditions in their children (e.g., green nasal discharge) than in changing attitudes about more general, or theoretical, issues related to antibiotic usage.

### TABLE 2. Characteristics of Parents and Their Children Who Completed Initial and Follow-up Questionnaires ($n = 358$)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Education Group ($n = 174$)</th>
<th>Prevention Group ($n = 184$)</th>
<th>$P$ Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child’s age (mo)</td>
<td>8.8 ± 6.3†</td>
<td>8.2 ± 5.9†</td>
<td>.35</td>
</tr>
<tr>
<td>Antibiotic prescriptions in previous year</td>
<td>1.10 ± 1.92†</td>
<td>1.02 ± 1.83†</td>
<td>.70</td>
</tr>
<tr>
<td>Siblings in household (%)</td>
<td>55.5</td>
<td>57.6</td>
<td>.69</td>
</tr>
<tr>
<td>Smoker in household (%)</td>
<td>9.8</td>
<td>10.4</td>
<td>.88</td>
</tr>
<tr>
<td>Child care ≥20 h/wk (%)</td>
<td>10.3</td>
<td>10.9</td>
<td>.87</td>
</tr>
<tr>
<td>Parental education level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High school graduate (%)</td>
<td>7.5</td>
<td>4.9</td>
<td>.49</td>
</tr>
<tr>
<td>Some college (%)</td>
<td>23.0</td>
<td>20.8</td>
<td></td>
</tr>
<tr>
<td>College graduate (%)</td>
<td>69.5</td>
<td>74.3</td>
<td></td>
</tr>
</tbody>
</table>

* Summary values shown do not include information for parent–child dyads with missing data for a characteristic, including 7 children missing previous antibiotic prescription data, 2 dyads with missing cigarette smokers in the household data, 2 children with missing sibling data, and 2 parents with missing educational level data.

† Data presented are means ± standard deviation.

### TABLE 3. Parental Attitude Scores Regarding the Judicious Use of Antibiotics 6 Weeks After Receiving Educational Materials About Antibiotics or Injury Prevention

<table>
<thead>
<tr>
<th>Statements for which complete agreement (score = 6) indicated attitudes supportive of judicious use of antibiotics</th>
<th>Education Group Scores</th>
<th>Prevention Group Scores</th>
<th>$P$ Value†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Giving an antibiotic to a child with cold symptoms can prevent an infection from occurring</td>
<td>343 1.86</td>
<td>2.16</td>
<td>.005§</td>
</tr>
<tr>
<td>Is worth trying an antibiotic when my child has cold symptoms for 5 days</td>
<td>352 1.93</td>
<td>2.34</td>
<td>.001§</td>
</tr>
<tr>
<td>Treatment with antibiotics is necessary when a child’s nasal discharge turns from yellow to green in color</td>
<td>347 2.61</td>
<td>3.47</td>
<td>.001§</td>
</tr>
<tr>
<td>Antibiotics help a child’s cold symptoms clear up more quickly</td>
<td>352 1.64</td>
<td>2.01</td>
<td>.001§</td>
</tr>
<tr>
<td>Antibiotics are helpful in treating colds</td>
<td>354 1.52</td>
<td>1.87</td>
<td>&lt;.001§</td>
</tr>
</tbody>
</table>

* Number of parents who responded to the statement on both the initial and the follow-up questionnaires.

† $P$ values computed with the use of regression analysis and adjusting for the clustering of parent–child dyads into different practices.

‡ Values presented are group means.

§ Statistically significant $P$ values after correcting for multiple tests.
overuse of antibiotics. Although not a main focus of the project, we also found that the TIPP pamphlets had at least a modest effect in changing parental attitudes about effective injury prevention.

Previous studies of the effect of interventions designed to educate parents about the appropriate use of antibiotics in children have had mixed results. Trepka et al25 assessed the impact of a multifaceted community-wide effort to reduce the inappropriate use of antibiotics. The intervention consisted of distribution of the pamphlet “Your Child and Antibiotics” (the same pamphlet used in our study) and presentations to groups of parents and providers. Parents of young children who resided in the intervention and a control community were surveyed before and after the educational effort. Parents who lived in the exposed community had a significantly greater increase in awareness about antibiotic resistance than those in the control community. In addition, the reduction in the number of viral respiratory illness diagnoses for which parents thought antibiotics were indicated was greater in the intervention community.

In a study of similar design as ours, Bauchner et al26 conducted a randomized controlled trial of the effectiveness of an educational 20-minute videotape and accompanying brochure in modifying parental knowledge and attitudes about antibiotics.26 Parents were recruited from pediatric primary care offices and completed a questionnaire at the time of enrollment. Those who were randomized to the intervention group received the educational materials, whereas those in the control group did not get any materials. After a 2-month study period, parents completed a second questionnaire that assessed knowledge, attitudes, and reported behaviors regarding antibiotic use. After responses on the initial questionnaires were adjusted for, there were few differences found between parents in the intervention and control groups on the second questionnaire in this study.

Several differences may account for the different results found in the study by Bauchner et al26 and our project. For example, we recruited a more highly educated population of parents, with 94% having education beyond high school compared with 68% in the study by Bauchner et al. The specific items that we included in our questionnaire may have been more sensitive in detecting changes in attitude than those used by the other investigators. Our study also had a larger sample size and a shorter time period between the initial and follow-up questionnaires, both characteristics that would increase the chance of detecting differences between a control and intervention group. Finally, it is possible that differences in educational content in the 2 studies might have led to different results.

One way to interpret our results is to apply the transtheoretical model of behavior change.27 This model has been a useful concept for studying many health behaviors, including smoking cessation, physical activity, and diet.28–30 One case study in Australia examined a change in antibiotic prescribing patterns using the transtheoretical model.31 According to this model, individuals consider the decisional balance (weighing the pros and cons) of a behavior while progressing in a series of states known as the “stages of change” (precontemplation, contemplation, preparation, action, and maintenance) that result in changed behavior. To facilitate stages of change, people consciously and subconsciously engage in “processes of change”: consciousness raising, counterconditioning, dramatic relief, environmental reevaluation, helping relationships, reinforcement management, self-liberation, self-reevaluation, social liberation, and stimulus control.27

Applying the transtheoretical model to decreasing parental demand for antibiotics, we found that an educational intervention resulted in no significant effect on agreement with statements reflecting different processes of change, such as consciousness raising (“Too many children are treated with antibiotics...
when not necessary,” “Physicians should never pre-
scribe antibiotics when they are not necessary”), en-
vironmental reevaluation (“Overuse of antibiotics
can make bacteria resistant to antibiotics”), and help-
ing relationships (“Parent should not try to persuade
a doctor to prescribe antibiotics”). However, the in-
tervention did result in changes in agreement with
statements reflecting the decisional balance (pros
and cons) of antibiotic use. Specifically, as a result
of the intervention, parents agreed less with some of
the statements representing perceived advantages to
using antibiotics (“Giving an antibiotic to a child
with cold symptoms can prevent an infection from
occurring,” “It is worth trying an antibiotic when my
child has cold symptoms for 5 days,” “Treatment
with antibiotics is necessary when a child’s nasal
discharge turns from yellow to green in color”).
Changing the decisional balance is potentially im-
portant in reducing antibiotic demand because it
motivates parents to move along the stages of behav-
ioral change. In this way, reducing the parents’ ex-
pectations of the utility of antibiotics may subse-
quently reduce their demands for unnecessary anti-
biotics for their children.

Parents likely use information from a variety of
sources to weigh the “pros and cons” of antibiotic
use, and this information in turn shapes their atti-
dudes. Ideally, the information communicated by pri-
mary care physicians should be current, evidence-
based knowledge. However, in 1 survey, 53% of
pediatricians and 71% of responding family physi-
cians indicated that they would prescribe an antibi-
otic for a child with a 1-day history of purulent
rhinorrhea, although evidence to support such pre-
scribing is lacking. Thus, it is reasonable to suspect
that when parents have inaccurate knowledge about
antibiotics, their primary care physicians may be
partly responsible either by the omission of accurate
information or by the transmission of inaccurate
information. Standardized interventions could help
offset the unavoidable variability in information re-
ceived from physicians during office visits. Our re-
sults indicate that standardized written and video-
tape material can change parental attitudes about
antibiotics by increasing their knowledge about the
pros and cons of antibiotic use in specific conditions.

There are several other possible explanations for
our findings. First, familiarity with the design and
statements on the initial questionnaire might have
resulted in scores indicative of attitudes supporting
the judicious use of antibiotics that were seen on the
follow-up questionnaires. “Measurement-induced
improvement” may have occurred as respondents
experienced the questionnaire for a second time, al-
lowing them to become better able to discern the
meaning of the statements, thus producing better
scores. Alternatively, the statements on the initial
questionnaire might have been a de facto interven-
tion causing study parents to seek out information
specifically about the issues addressed in the state-
ments. However, both of these phenomena should
have influenced the intervention and control parents
similarly and would not explain the differences ob-
erved between the 2 groups. Because parents re-
ceived another copy of either the antibiotic or the
TIPP pamphlet, depending on randomization, along
with the follow-up questionnaire, parents may have
used the pamphlet as a “study aid” in responding to
the statements on the questionnaire. That differences
between the intervention and control groups were
only statistically different for 5 of the 9 statements on
antibiotic use suggests that this was not a wide-
spread practice. Finally, statistically significant dif-
fferences between the 2 groups of parents were found
for the 5 statements in which a response of “com-
pletely agree” was indicative of attitudes support-
ing the judicious use of these medications. There
were no differences for the 4 statements in which a
response of “completely disagree” was indicative of
attitudes supportive of the judicious use of antibiot-
ics. The use of negatively worded statements or re-
versing the orders of the responses has been used in
surveys to detect acquiescent behaviors and the ten-
dency for respondents to agree with statements more
than disagree. Although importance of this effect is
controversial, it is possible that parents who received
the educational materials about antibiotics, cogni-
zant that they were being “tested” on this subject,
were more attentive in their responses on the fol-
low-up questionnaire items on antibiotic use that
were negatively worded or scored than those in the
group control.

Because our follow-up occurred only 6 weeks after
enrollment and implementation of the intervention,
it is unknown whether the changes in attitudes
found in parents who received the antibiotic educa-
tional materials were sustained. It is also unclear
whether our educational intervention would lead to
similar changes in attitudes in other groups of par-
ents with different demographic characteristics.
However, the results of our study may provide guid-
ance for future parental educational efforts regarding
antibiotic usage, injury prevention, and other topics.
In particular, parents may be more responsive to
information specific to conditions that they encoun-
ter in their children, which may influence their deci-
sional balance, than to information related to a more
theoretical or societal benefit.

ACKNOWLEDGMENTS

Funding for this study was provided by GlaxoSmithKline in
conjunction with the Aetna Foundation’s Quality Care Research
Fund.

Members of the Puget Sound Pediatric Research Network who
participated in this study are Matthew Allen, MD; Cynthia Brown,
ARNP; Pakhi Chaudhuri, MD; T. Michael Claudson, MD; Ruth A.
Conn, MD; Benjamin Danielson, MD; Steven Dassell, MD; Kathryn
Del Beccaro, MD; Christianne Eldred, MD; JoEllen Estvold, MD;
Robert T. Fukura, MD; Kathryn Koelemay, MD; Lenna Liu, MD,
MPH; Ourania Malliris, MD; Jo Montgomery, ARNP; Sarah F.
Munson, MD; Elizabeth K. Neuzil, MD; Catherine Nobis, MD;
Tracie O’Neill, MD; Zaiga Phillips, MD; Rob Roskin, MD; Jeffrey
R. Scott, MD; Don Shirfin, MD; James Stout, MD, MPH; Roberta L.
Winch, MD; Agnes Wong, MD; Kyle E. Yasuda, MD; and Marina
S. Zeiber, MD.

We thank Danika Claudson for help in conducting the study.

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*Pediatrics* 2003;111;e548
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