Antibiotic Use for Upper Respiratory Tract Infections
How Well Do Pediatric Residents Do?

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Background: Antibiotics are often used inappropriately for the treatment of upper respiratory tract infections in children, and the emergence of resistant bacteria is a growing public health concern.

Objective: To assess awareness and compliance with the Centers for Disease Control and Prevention (Atlanta, Ga) and American Academy of Pediatrics (Elk Grove Village, Ill) principles for judicious antibiotic use for upper respiratory tract infections among residents from a sample of pediatric residency programs in the mid-Atlantic region of the United States.

Participants and Methods: Residents at the participating programs were requested to complete a survey questionnaire.

Results: Of the 524 pediatric residents surveyed, 74% (388 participants) completed the questionnaire. Familiarity with the principles increased with a year of training; 16%, 36%, and 50% of first-year (PL1), second-year (PL2), and third- or fourth-year (PL3/PL4) residents, respectively, had heard or read about the principles ($\chi^2_{trend}, P<.001$). In response to a direct question about the use of antibiotics for an otherwise well, afebrile 18-month-old child with purulent rhinorrhea, 29%, 25%, and 15% of PL1, PL2, and PL3/PL4 residents, respectively, would prescribe antibiotics within 10 days of onset of illness ($\chi^2_{trend}, P=.008$). A significant difference was found between PL1 vs PL3/PL4 participants (difference = 20%; 95% CI = 3%-26%). If the same infant had a temperature of 38.8°C, then 63%, 45%, and 47% of PL1, PL2, and PL3/PL4 residents, respectively, would prescribe antibiotics ($\chi^2_{trend}, P=.008$).

Conclusions: Awareness among pediatric residents about the judicious use of antibiotics for upper respiratory tract infections is often lacking, and inappropriate use of antibiotics for this condition continues to be prevalent. This was especially noted among PL1 residents, with an improving trend noted with increasing years of training.

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O VERUSE of antibiotics and the emergence of resistant bacteria continue to be the subject of many debates. Reported figures on the number of prescriptions written for patients with upper respiratory tract infections are alarming. Antibiotics were prescribed for 46% of children with upper respiratory tract infections and for 75% of children with bronchitis. In 1992, upper respiratory tract infections were the second leading cause for antibiotic prescription and accounted for more than 17 million prescriptions. Bergus et al reported that by ages 3 months and 6 months, 37% and 70% of children, respectively, had received 1 or more antimicrobial agents.

The need to curtail outpatient antibiotic use has emerged from the dramatic increase in multidrug-resistant Streptococcus pneumoniae. The US Pediatric Multicenter Pneumococcal Surveillance Study Group found that from 1993 to 1996, the percentage of pneumococci that were penicillin nonsusceptible increased from 14% to 21%. A longitudinal survey of children receiving amoxicillin prophylaxis for recurrent otitis media showed that the proportion of children with resistant pneumococci increased from 0% to 25% during prophylaxis and returned to baseline within 3 to 5 months after discontinuation of treatment.

In 1998, the Centers for Disease Control and Prevention (CDC), (Atlanta, Ga) and the American Academy of Pediatrics (AAP), (Elk Grove Village, Ill) published principles for the judicious use of antibiotics in common pediatric respiratory tract infections, including common cold, otitis media, sinusitis, and pharyngitis. Our study was done to assess awareness and compliance with these principles among residents from a sample of pediatric residency programs. A direct question asking residents to indicate whether they had heard or read about the principles was used.
PARTICIPANTS AND METHODS

PARTICIPANTS

The study, which involved survey responses to CDC/AAP principles and to clinical vignettes by which residency programs, but not individual respondents, could be identified, was ruled exempt from review by the institutional review board at the Inova Fairfax Hospital (Falls Church, Va). We contacted large residency programs in the mid-Atlantic region, and 12 programs responded. These included 2 programs each in Maryland and the District of Columbia, and 4 each in Virginia and North Carolina. The median number of residents per level of training per year in these programs was 13, and the range was between 9 and 22 residents. Pediatric residents at all levels of training were surveyed. The chief residents of each program coordinated the distribution and collection of completed questionnaires. Our predetermined goal was a response rate of at least 70%. Follow-up letters and telephone calls were used to improve response rates.

SURVEY INSTRUMENT

The survey questionnaire contained 17 questions, including information about year of training, awareness of CDC/AAP principles, and 6 vignettes, each requiring forced-choice answers (yes, no, or uncertain). These vignettes were on (1) short-duration, purulent rhinorrhea; (2) acute otitis media; (3) otitis media with effusion; (4) acute wheezy bronchitis; (5) pneumonia; and (6) pharyngitis. The first 5 case scenarios pertained to an 18-month-old child, and the sixth scenario, to a 4-year-old child. In addition, direct questions regarding management of an afebrile and a febrile 18-month-old child with purulent rhinorrhea were included. Attendance at a daycare center was introduced as a variable to see whether it had any effect on the decision to use antibiotics. The study was conducted from October 1998 to April 1999.

STATISTICAL ANALYSIS

All survey responses were categorical in nature. For comparisons between residency groups, percentage differences with 95% confidence intervals (CIs) are reported. For comparisons among residency groups, \( \chi^2 \) analysis for trend is reported. All calculations were performed using SAS software version 6.12 (SAS Institute, Cary, NC).

RESULTS

Of the 524 residents in the participating residency programs, 74% (388 residents) returned completed questionnaires. Distribution of residents across the different years of training was comparable with 130, 121, and 137 residents in the first (PL1), second (PL2), or the third or fourth (PL3/PL4) year of training, respectively. As only 14 (3.5%) of the residents were PL4, PL3 and PL4 residents were combined as a single group. Overall, only 34% (133/388) of the respondents had read or heard about the principles (Figure 1). Familiarity with the principles increased with year of training; 16%, 36%, and 50% of PL1, PL2, and PL3/PL4 residents, respectively, had heard or read about the principles \( (\chi^2_{\text{trend}}, P < .001) \). Differences between resident groups were significant (PL1 vs PL2: difference = 20%, 95% CI = 8%-32%; PL1 vs PL3/PL4: difference = 34%, 95% CI = 23%-46%; PL2 vs PL3/PL4: difference = 14%, 95% CI = 2.5%-28%).

In response to a direct question about the use of antibiotics for an otherwise well, afebrile 18-month-old child with purulent rhinorrhea, 29%, 25%, and 13% of PL1, PL2, and PL3/PL4 residents, respectively, chose to prescribe antibiotics within 10 days of onset of illness \( (\chi^2_{\text{trend}}, P = .008) \). No significant difference was seen between PL1 vs PL2 residents, but a significant difference was found between PL1 vs PL3/PL4 residents \( (\text{difference} = 20\%, \ 95\% \ CI = 3\%-26\%) \). The difference between PL2 vs PL3/PL4 residents was only marginally significant \( (\text{difference} = 10\%, \ 95\% \ CI = 0.3\%-19\%) \).

If the same infant had a temperature of 38.8°C, then 63%, 45%, and 47% of PL1, PL2, and PL3/PL4 residents, respectively, would prescribe antibiotics \( (\chi^2_{\text{trend}}, P < .008) \). Willingness to treat in the presence of fever was significantly higher for all groups \( (\text{PL1: difference} = 34\%, \ 95\% \ CI = 22\%-46\%; \text{PL2: difference} = 20\%, \ 95\% \ CI = 7\%-32\%; \text{PL3/PL4: difference} = 45\%, \ 95\% \ CI = 27\%-63\%) \).

The willingness to prescribe antibiotics in response to a question about the need for improving awareness among this group of healthcare providers, who represent practicing physicians of the future.
Inappropriate use of antibiotics for upper respiratory tract illnesses in children continues to be commonly reported among pediatric residents. This was especially noted among PL1 residents. It was encouraging to see an improving trend with increasing years of training both in awareness of the principles and reported antibiotic use. This could represent experience accrued during training or possibly greater familiarity with current literature. Instilling correct practice habits and increasing awareness among physicians-in-training should be a priority. Investing additional resources in this important target group could be rewarding. Developing appropriate prescribing habits during the period of training could have long-lasting benefits both for the physicians and the community at large. The CDC/AAP principles could serve as an evidence-based framework to develop practice methods more scientifically.

Studies from Finland and Japan have shown that restricting the use of macrolides reduced the prevalence of macrolide resistance among group A streptococci. Similarly, a reduction in the prevalence of penicillin-resistant Streptococcus pneumoniae nasal carriage has been demonstrated after restricting antibiotic use. Thus, reducing inappropriate antibiotic use is an important first step in reducing the prevalence of resistant microorganisms.

Barriers faced by physicians in adhering to clinical practice guidelines were recently reviewed. Lack of awareness, lack of familiarity, lack of agreement with the guidelines, and the inertia of previous practice were some of the barriers identified. Rather than difficulty with acceptance of guidelines, lack of awareness and familiarity are the more likely barriers for physicians-in-training, thus emphasizing the need for continued efforts at improving education and awareness.

In a survey of family practice residents regarding use of clinical practice guidelines, 78% of residents felt that such guidelines improved their residency education, and 75% thought it improved patient care. In a study from Israel, more senior residents and certified family practitioners felt that clinical practice guidelines did not constrain clinical freedom as compared with uncertified general practitioners and junior residents.

Our study included 12 different institutions in the mid-Atlantic region and may not be representative of overall attitudes and practices of residents in this region. Before these results can be generalized, studies spread across different geographic regions will be needed to provide a more comprehensive representation. As in any study based on a survey, there is a concern around whether respondents differed from nonrespondents, and it is not possible for us to ascertain differences based on this study. As the responses were based on self-report, they do not clearly reflect what residents would do when faced with similar situations in actual practice. It is possible that the respondents overstated their compliance with the principles, as they were aware of our intentions. If so, our data may be an underrepresentation of the magnitude of the problem.

In collaboration with the CDC, AAP, or other professional organizations, educational modules can be developed that specifically target the needs of residents. Knowledge gaps will have to be identified so that appropriate interventions can be designed. Seminars, noon conferences, and other teaching sessions can be used as platforms to disseminate this information. Introducing this topic at the beginning of each academic year may be valuable, as it will provide PL1 residents the opportunity to learn correct concepts from the very beginning and also reinforce them among senior residents. Online physician education is becoming a popular teaching tool. Web-based tutorial systems may be more efficacious than print-based guidelines.

It is possible to assess the practice patterns of residents in relation to common ambulatory ailments at con-
What This Study Adds

Upper respiratory tract infections are a leading rationale for outpatient antibiotic prescription. In 1998, the CDC and the AAP published principles for the judicious use of antibiotics for common pediatric respiratory tract infections. Our study was done to assess awareness and compliance with these principles among residents from a sample of pediatric residency programs.

In summary, results of this regional study bring to light the fact that awareness among pediatric residents about the judicious use of antibiotics for upper respiratory tract infections is often lacking. Although PL3/PL4 residents were better informed and used antibiotics more judiciously than PL1 residents, intervention measures targeted at this group as a whole could have a beneficial impact on limiting unnecessary antibiotic use.

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REFERENCES

9. Stephenson J. Icelandic researchers are showing the way to bring down rates of antibiotic-resistant bacteria. JAMA. 1996;275:175.

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