Prescription of Antibiotics for Mild Acute Respiratory Infections in Children[1]

Edilberto González Ochoa,[2] Luisa Armas Pérez,[2] José R. Bravo González,[2] José Cabrales Escobar,[2] Rubén Rosales Corrales,[2] & Gladys Abreu Suárez[3]

♦ ♦ ♦

Acute respiratory infections (ARI), the leading class of ailments causing people to seek health care, rarely require antibiotics. Nevertheless, many physicians prescribe them needlessly. Hence, reducing the unnecessary use of antibiotics is one aim of any ARI control program. To help determine whether this aim might be achieved through a combination of refresher training for family physicians and public education campaigns, two 1991 interventions were carried out in four health areas (designated A, B, C, and D) in the city of Havana, Cuba. In each area, 10 clinics staffed by family physicians were selected through simple random sampling. In two areas (A and B), a refresher training program on ARI for health personnel was instituted at each clinic, while in areas A and C a community education program was set up. No intervention was carried out in area D.

Simultaneously, from January through December 1991 trained individuals visited and administered a standard questionnaire every 15 days to 1 600 families (40 per clinic) systematically selected by random sampling. The aim of this procedure was to record the number of ARI episodes occurring among children under 5 years old, the treatment chosen in these cases, and whether antibiotics were employed.

The results showed that when the two interventions were initiated, antibiotics were prescribed for 26%, 20%, 11%, and 19% of the mild ARI cases occurring in areas A, B, C, and D respectively ($P > 0.05$). In the period immediately following the interventions, antibiotic prescription rates declined by 26% and 63% in areas A and B, while increasing by 2% and 48% in areas C and D. Overall, prescription of antibiotics in the intervention areas A and B combined decreased by 54% (95% CI: 31–69%). These data suggest that a refresher training program for health personnel can rapidly reduce the unnecessary prescribing of antibiotics for ARI cases, but that public education alone does not appear effective.

Acute respiratory infections (ARI) are among the most common childhood diseases, and acute pneumonias constitute the primary cause of death in infants and small children in developing countries (*1*). Accordingly, it is most important that ARI be addressed through sound national control programs.

Some 90% of all ARI episodes are mild and self-limiting, requiring only support measures. Despite this, they are frequently treated with antibiotics, increasing family

[1] Condensed and revised version of an article entitled "Prescripción de antibióticos para infecciones respiratorias agudas leves en niños" that was previously published in Spanish in the *Boletín de la Oficina Sanitaria Panamericana*, Vol. 119, No. 6, December 1995. Reprint requests and other correspondense should be sent to Dr. Edilberto González Ochoa, Instituto Pedro Kourí, Autopista Novia del Mediodía, KM. 6 c/ Carretera Central y Autopista Nacional, La Lisa, Ciudad Habana, Cuba. The study reported here was conducted with financial assistance provided by the International Development Research Center in Ottawa, Ontario, Canada.

[2] Pedro Kourí Institute, Havana, Cuba.

[3] Pediatric Teaching Hospital of Central Havana, Havana, Cuba.

and control program costs and encouraging microbial resistance (2).

The purpose of the study reported here was to assess the prospects for reducing antibiotic prescription in mild ARI episodes by providing refresher training to family physicians in the context of daily clinical practice, together with public education.

MATERIALS AND METHODS

The study was conducted in the city of Havana, Cuba, from 1 January to 31 December 1991.

Cuba is divided into provinces, which are subdivided into municipalities, and each municipality contains three to six health areas. Each health area contains an average of roughly 30 000 inhabitants (more in large cities) and a polyclinic that directs local health activities, each area being subdivided into health sectors that contain an average of some 150 families or 600–700 individuals.

Each health sector has a clinic staffed by one family physician and one family nurse (nurses are not authorized to prescribe drugs) who live in the same building and maintain ongoing contact with the community and medical specialists. They are responsible for all health-related activities—including preventive health measures, health promotion, recovery, and rehabilitation (3).

For every 15–20 family physicians and nurses there are 1 pediatrician, 1 gynecologist-obstetrician, 1 internist, and 1 psychologist, who together make up what is known as the basic work group, a group that coordinates with a nurse supervisor and the health area's director. These specialists, together with the family physicians, family nurses, and other health workers, constitute the health team of the area polyclinic.

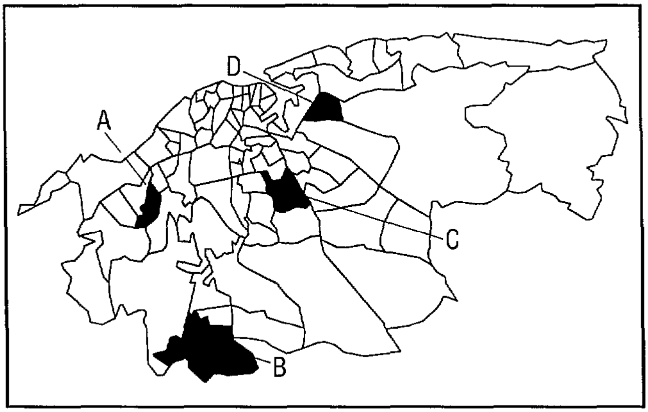
Four of Havana's 15 municipalities were selected for reasons of convenience and the similarity of their social, economic, cultural, and health indicators. One health area was then selected from each municipality using a similar procedure. As additional requirements, it was stipulated that the selected areas would be far enough apart to minimize the influence of programs in the other three areas, and also that each area would have no pediatric hospital within its territory but that there would be such a hospital in a neighboring municipality to which the whole population would have similar access. In this manner the following municipalities were selected: La Lisa in the northwest, Boyeros in the southwest, Arroyo Naranjo in the southeast, and Guanabacoa in the northeast.[4]

The four selected health areas, which are shown in Figure 1, were Aleida Fernández (A) in La Lisa, with 33 727 inhabitants and 45 family physicians and nurses; Santiago de las Vegas (B) in Boyeros, with 46 111 inhabitants and 45 family physicians and nurses; Mantilla (C) in Arroyo Naranjo, with 34 868 inhabitants and 49 family physicians and nurses; and Guanabacoa (D) in the municipality of the same name, with 28 806 inhabitants and 52 family physicians and nurses. Each of the selected areas had a degree of urbanization comparable to that of the other areas as well as economic, social, and demographic indicators similar to those of its respective municipality.

In each area, 10 clinics were chosen by simple random selection, each having one family physician and one family nurse. All of the family physicians had graduated

[4] Some of the study period health indicators for La Lisa, Boyeros, Arroyo Naranjo, and Guanabacoa, respectively: rate of aging (the number of inhabitants ≥65 years old divided by the number 0–14 years old)—0.37, 0.32, 0.19, 0.37; index of economically dependent population—0.51, 0.41, 0.48, 0.53; average number of persons per bedroom—2.06, 1.93, 2.11, 2.0; homes with a gas stove—42%, 48%, 40%, 40%; infant mortality per 1 000 live births—7.5, 10.0, 13.3, 8.1; and percentage illiteracy (people unable to write their names)—0.17, 0.02, 0.03, 0.11.

Figure 1. A map of Havana showing the areas where the study was conducted. The letters A through D show the specific locations of the four study areas of Aleida Fernández (A), Santiago de las Vegas (B), Mantilla (C), and Docente Guanabacoa (D).



from Havana's *Instituto Superior de Ciencias Médicas* within the preceding five years.

The 40 clinics' medical records were used to obtain information about the frequency of ARI episodes treated in 1991 (*4, 5*). These records did not provide information about the prescriptions written by clinic physicians during house calls or other encounters outside the clinic; nor was it possible to learn about such prescriptions from pharmacies, because the areas' pharmacies did not maintain individualized records. It was therefore decided to survey a systematic random sample of 40 families served by each clinic (1 600 families in all) to estimate the numbers of ARI cases in children under 5 years of age that were treated with antibiotics during the study period (*5, 6*).

In June–December 1990, before the study period began, medical personnel of health areas A and B and the general population in areas A and C were surveyed to assess their knowledge and beliefs regarding ARI management. During this stage a home survey questionnaire and educational materials for medical and nursing personnel dealing with appropriate ARI management (including rational use of antibiotics and other drugs) were prepared and tested on a group of families in the municipality of Playa.

Actual health personnel training took place from January through July of 1991. A special refresher training course was initiated for the family physicians of the 20 clinics located in areas A and B (Table 1). This refresher course, conducted as part of the program of residency or specialization in general medicine, had the three following components: (a) one 3-hour session providing a preliminary test of the participating physicians' ARI knowledge, followed by a video on clinical exploration of the childhood respiratory tract and discussion of the video's content; (b) an audio-visual slide presentation on treatment of ARI in children (produced by the *Instituto Nacional de Epidemiología Emilio Coni* in Santa Fe, Argentina) and a round table discussion of its content; and (c) a group discussion of the clinical and therapeutic guidelines prepared for the study in progress. The nurses participated in component (c) during the meetings of the basic working groups. Six

Table 1. A chart showing the types of interventions carried out in each of the four health areas covered. Havana, Cuba, 1991.

	Type of intervention		
Health area	Training for family physicians and family nurses	Public education	Expected result
A	Yes	Yes	Reduction in the unnecessary prescription of antibiotics
B	Yes	No	Reduction in the unnecessary prescription of antibiotics
C	No	Yes	None
D	No	No	None

months later a follow-up session was held to discuss problem situations that can arise in the clinical and therapeutic management of ARI.

One epidemiologist, one pneumologist, and two nurses from the central research team (which also included a second epidemiologist, a biostatistician, a pediatrician, and two psychologists), together with the professors of pediatrics involved in the refresher course, made monthly visits to provide ongoing advisory assistance to the family physicians and nurses. During each advisory visit, current scientific materials on traditional herbal medicine and WHO materials on adequate ARI management were distributed, examined, and discussed.

The community education conducted in areas A and C had four discrete components. One of these consisted of (a) group discussions and (b) talks followed by discussions. The group discussions, which were held in participants' homes, were aimed at mothers, other child care-givers, and members of the health brigade (a group including informal leaders and family nurses charged with recruiting among the general public). Overall, 20 group discussions were held, these having an average of nine participants each. The talks, over 80 in all, were given by the nurses and took place in the clinic waiting rooms during hours set by the maternal-child health program for consultation. These activities were conducted under the direction of a psychologist from the central research team. Guidance for the sessions was provided by the ARI prevention guidelines in the maternal-child health program recommendations and by two pamphlets produced by the specialized team for public consumption.

The second community education component consisted of having clinic health personnel and the surveyors in areas A and C distribute educational materials; the third entailed dissemination of educational materials to the area A population by health team personnel; and the fourth involved distribution of printed information by health brigade members and by several directors of one street's neighborhood association. From January to December 1991 the sample population in each area was visited every two weeks by one of four trained surveyors with mid-level training in health-related biochemistry. (The survey training was provided both individually and in groups at the Pedro Kourí Institute.)

All of the surveyors received instruction in the clinical manifestations, anatomic location, and most common causative agents of ARI as well as in techniques for conducting the interview and administering the survey questionnaire. This training was carried out in three 6-hour work sessions by a pediatrician, a pneumologist, and a psychologist from the central research team. Following this training, the surveyors underwent two written evaluations and two practical evaluations to determine their eligibility to participate in the research.

The surveyors interviewed the head of each nuclear family (usually the mother of the children involved but occasionally the grandmother) to determine whether any child under age 5 had exhibited ARI symptoms during the two weeks preceding the visit. (Because information was also collected on individuals of other ages irrespective of ARI status, no family was excluded.) Between 26% and 32% of the families had children under age 5.

For each affirmative response regarding ARI symptoms, the surveyors filled out a questionnaire (*4*) on which they indicated the type of ARI, diagnosis, type of health care received, and measures recommended by the physician or adopted independently without intervention of a health professional. On the following visit, data were collected on the procurement and consumption of antibiotics and other drugs, as well as the duration and evolution of symptoms. If a child who had had ARI again showed respiratory symptoms after having been asymptomatic for a period of 48 hours, the new symptoms were counted as a new ARI episode.

The following signs and symptoms were deemed indicators of mild ARI: clear nasal discharge, obstructed nostrils, cough, hoarseness, or inflamed throat or tonsils (without membranes or exudates and without swollen ganglia)—all in the absence of intercostal in-drawing, purulent sputum, rales, stridor, or poor physical condition impeding feeding (Table 2). Prescription of antibiotics (penicillin, sulfamethoxazole with trimethoprim, erythromycin, ampicillin, chloramphenicol) was considered unnecessary in these mild cases.

The surveyors' work was supervised by two nurses from the central research team, and was also monitored periodically by the researchers, to ensure proper data-gathering. In the preparatory phase, patient records from each clinic were examined to verify the consistency and agreement of ARI case data. This could not be done for patients treated at home, however, since there were no corresponding clinic records.

The data were summarized by quarter (three-month periods starting 1 January) and semester (six-month periods starting 1 January) to match the periods of National Health System administrative reports. Health personnel training took place in January through July, while the community education process ran from April through December.

Using these data, each health area's antibiotic overprescription in each 1991 quarter was estimated by dividing the number of mild ARI episodes for which antibiotics were prescribed by the total number of episodes. The first quarter estimate was then taken as a baseline, and the trends observed over the entire study period in areas A and B were compared with those observed in areas C and D. It was assumed that reductions ascribable to the aforementioned interventions would show up during the second semester, because of the time normally needed to achieve behavioral change (*6–8*).

Areas A and B were compared separately with area D, where no intervention occurred and which, accordingly, was the area most representative of prescribing habits under baseline conditions. Comparisons

Table 2. Guidelines for management of acute respiratory infections (ARI).*

Type of ARI	Clinical manifestations	Behavior
ARI of the upper respiratory tract:		
Mild	Nonpurulent nasal secretion; nasal obstruction; hoarseness; reddened throat; sore throat without lymphadenopathy, exudates, or membranes	Support therapy
Moderate	Purulent exudate in the nose, throat, and ears; earache; reddened or convex eardrum; sore throat or earache with cervical lymphadenopathy	Support therapy, antibiotics
ARI of the lower respiratory tract:		
Mild	Discrete inspiratory stridor that disappears in repose; dry irritative cough; sibilance without polypnea or in-drawing	Support therapy
Moderate	Respiratory frequency greater than 40 per minute, or greater than 50 in children age 1 year or less; persistent or barking cough; purulent bronchial secretion; hoarse or moist rales	Support therapy, antibiotics, outpatient treatment,† home intervention (when indicated)
Severe	Pronounced stridor with difficulty exhaling, intercostal in-drawing, or sibilance; difficulty exhaling when in repose; inability of the patient to feed self; cyanosis; convulsions; sternal retraction; thoracic pain; epiglottic membranes; plaintive moaning; dehydration; poor overall state; loss of consciousness	Hospitalization, antibiotics, maintenance of free airways, support therapy, symptomatic treatment, treatment of complications

*These guidelines were developed by E. González, G. Abreu, and L. Armas based on the WHO-sponsored Health Systems Research Project on Acute Respiratory Infections in Children (Nepal, 1984).

†Hospitalization should be considered for cases with serious social problems, where access to a health center is limited, when the patient is less than 3 months old, premature, or suffering from congenital malformations, severe chronic disease, or malnutrition.

were also made between the sum of the data from areas A and B and the sum of the data from areas C and D, in order to compare those areas where a refresher training program was instituted for health personnel with those where it was not.

Hypothesis tests for proportions in independent populations and tests of multiple proportions with a level of significance of $P = 0.05$ were conducted. In significant cases, relative risk (RR) was calculated, considering the populations of areas A and B as exposed populations; in addition, the preventable fraction (PF) in the exposed population and the preventable population fraction (PPF) in the general population, together with their 95% confidence intervals (CI), were calculated (*9–11*) using the following formulas:

$$PF = 1 - RR$$

$$PPF = (P_1 \times PF)/[RR + (P_1 \times PF)]$$

$$95\%\ CI = 1 - RR^{1\pm(1.96\sqrt{\chi^2})}$$

where P_1 is the proportion of the population at risk exposed to the intervention (*12*).

Regarding the training of physicians in areas A and B, these calculations were made both before and after the intervention, it being assumed hypothetically that 80% of all family physicians in those areas had been included in the intervention. In addition, areas A and B, where the intervention was directed toward health personnel, were compared to area D, the control area, where there had been no intervention. In this latter case it was assumed hypothetically that only 50% of the family physicians from areas A and B had received training. The Microstat and Epi Info 5.1 statistical packages were used to perform the calculations.

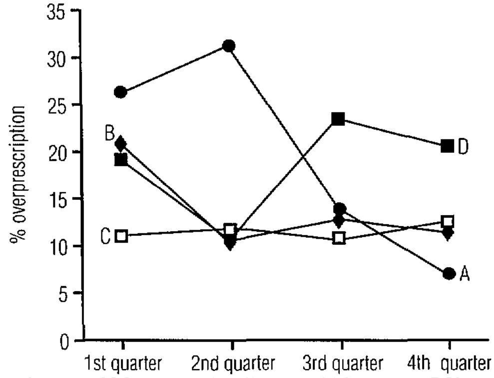
RESULTS

Quarterly Comparisons

At the outset of the health personnel training intervention, in the first quarter, antibiotic overprescription was estimated at 26% (16/60 episodes) in health area A, 20% (7/34) in B, 11% (4/34) in C, and 19% (13/66) in D. The differences detected were not statistically significant ($P > 0.05$).

As indicated in Figure 2, antibiotic overprescription decreased during the study period in areas A and B, while increasing slightly in areas C and D. In area A, overprescribing increased in the second quarter but decreased notably in the two following quarters. In area B, overprescribing declined in the second quarter and thereafter remained at about the same level. In area C, no significant changes were observed in prescribing patterns, while in area D a decrease was seen in the second quarter, an increase in the third, and a slight decrease in the fourth.

Figure 2. Percentage overprescription of antibiotics (cases where antibiotics were prescribed over the total number of cases seen) for mild ARI episodes in study children under 5 years of age, by quarter of the study area. Havana, Cuba, 1991.



	1st quarter	2nd quarter	3rd quarter	4th quarter
A	26.6%	31.1%	14.3%	7.8%
B	20.6%	10.5%	13.3%	11.7%
C	11.4%	12.2%	11.1%	12.3%
D	19.6%	10.6%	23.6%	20.3%

Apparent Effects of Interventions

As indicated in Table 3, antibiotic overprescription for mild ARI cases in children under 5 declined by approximately 63% in area A and by 26% in area B in the second semester (following the intervention). In contrast, such overprescribing increased by 2% and 44%, respectively, in areas C and D. When the area A and B data were combined, apparent overprescription declined by 54% in the second semester;

while in areas C and D combined apparent overprescription increased by 22%, and in areas B and C combined it declined by a relatively modest 12%.

When the first and second semester figures for area A were compared, these yielded an RR of 0.38 (95% CI = 0.21–0.66), a PF (expressed as a percentage) of 62% (95% CI = 36–77%), and a PPF of 57% (95% CI = 32–75%). When the figures for areas A and B were combined by adding, they yielded an RR of 0.46 (95% CI = 0.30–0.71), a PF of 54% (95% CI = 31–69%), and a PPF of 48% (95% CI = 27–63%).

As Table 3 indicates, patterns of overprescription for children 1–4 years old were fairly similar to those described above. In area D, overprescription more than doubled in the second semester (going from 10.5% to 23.1%), while in area A it declined notably and in areas B and C it remained nearly constant. Overall, overprescription declined by approximately 51% in areas A and B combined (the region where the health personnel intervention occurred) while increasing approximately 62% in areas C and D combined.

Estimated overprescription of antibiotics for mild ARI cases among infants (see Table 3) decreased by 48%, 82%, and 35% in areas A, B, and D, respectively, while increasing slightly in area C. When areas A and B were taken together, the estimated second semester reduction was 62%, while when areas C and D were combined the reduction was 51%.

Comparisons Between Areas Following Interventions

Considering all the study children, it may be seen that second semester antibiotic overprescription for mild ARI cases in area D (21.9%) was approximately twice that observed in areas A (10.5%) and B (11.3%). Taking as the baseline value the overprescription rate found in area D and keeping P_1 equal to 50% (0.5) in both cases, the RR values were 0.46 (95% CI = 0.26–0.82) for area A and 0.49 (95% CI = 0.27–0.89) for area B; the respective PF were 54% (95% CI = 12–76%) and 51% (95% CI = 13–73%);

Table 3. Percentage overprescription of antibiotics (cases where antibiotics were prescribed over the total number of cases seen) for mild ARI episodes in study children under 5 years of age, by semester of study period, study area, and age group, showing the percentage reduction of such overprescription in the second semester compared to the first. Havana, Cuba, 1991.

	Age group								
	<1 year			1–4 years			<5 years		
Area	1st semester	2nd semester	% reduction	1st semester	2nd semester	% reduction	1st semester	2nd semester	% reduction
A	17.1	8.9	48.0	32.7	11.4	65.1	28.1	10.5	62.6
B	15.8	2.9	81.6	15.1	15.0	0.7	15.3	11.3	26.1
A+B	16.6	6.3	62.0	26.5	13.1	50.6	23.6	10.9	53.8
C	0.0	4.9	—	13.4	14.0	−4.5	11.5	11.7	−1.7
B+C	10.7	3.9	63.6	14.2	14.4	−1.4	13.2	11.6	12.1
D	27.0	17.6	34.8	10.5	23.1	−120.0	15.2	21.9	−44.1
C+D	21.7	10.6	51.2	11.7	19.0	−62.3	13.8	16.9	−22.4
A+B+C+D	18.9	8.4	55.6	18.9	16.5	12.7	18.7	14.3	23.5

and the respective PPF were 37% (95% CI = 7–57%) and 34% (95% CI = 8–53%).

If C + D is taken as the baseline, to which A + B is compared keeping P_1 equal to 50% (0.5), then RR = 0.64 (95% CI = 0.42–0.99), PF = 36% (95% CI = 2–58%), and PPF = 22% (95% CI = 1–32%).

For those children 1–4 years old, comparison of areas A and D yielded an RR of 0.46 (95% CI = 0.24–0.90), while comparison of areas B and D yielded an RR of 0.61 (95% CI = 0.33–1.13). For the children less than 1 year old, the RR were 0.50 (95% CI = 0.15–1.65) and 0.16 (95% CI = 0.02–1.16) for these two comparisons, respectively. When comparing area A with C and area B with C for children 1–4 years old in the second semester, the RR values were 0.81 (95% CI = 0.39–1.68) and 1.07 (95% CI = 0.54–2.11), respectively. Nevertheless, comparison of area C and D prescription data for the second semester revealed statistically significant differences ($P = 0.004$).

DISCUSSION AND CONCLUSIONS

At the outset of the study period, antibiotics were being prescribed for approximately 20% of the mild ARI cases in the overall study area—a figure quite similar to that reported in other countries (*3, 13–16*). In area A, the increase in the rate of antibiotic prescription in the second quarter may have been associated with an influx of new medical personnel into the area following initial training—as a result of transfers, illness, or promotion. This influx was much less pronounced in the remaining areas. The decline in the rate of prescription in area D during the second quarter could have been due to hazard fluctuations.

More than a modification of theoretical knowledge is required to change physicians' prescribing habits and improve the quality of care (*7, 17, 18*). It is also important to develop the mental and psychomotor skills of health professionals and to address other matters such as individual communication, continuing training in health centers, and rigorous clinical pharmacology instruction at the undergraduate level (*7, 8, 17–19*).

For this reason our refresher training, while included in an academic program for training specialists in general medicine, was designed as a self-contained methodologic package based on teaching sessions with active participation and periodic advisory visits. The scientific training of primary health care personnel is consistent, in this case, with that of physicians specializing in general medicine or of professionals in the process of obtaining their specialization; nor is it surprising to find deficiencies in knowledge of ARI treatment within a given health sciences graduate program, independent of the conceptual differences existing among various therapeutic schools of thought.

Experiences in other developing countries have shown that education programs do not provide optimum improvement in theoretical knowledge. Following a training program in Yemen (*20*), for example, few differences were observed between the theoretical knowledge of health personnel in the intervention area and those in the control area. Nevertheless, immediate changes were observed in prescribing habits, quite possibly as a result of the quality and frequency of the supervision provided after training.

According to preliminary data from the Pedro Kourí Institute, at the outset of this research study the theoretical knowledge of family physicians about therapeutic management of ARI, as indicated by a knowledge survey, showed numerous weaknesses. However, after the initial training sessions the percentage of correct responses was found to improve from 38% (18/48) to 68% (30/44).

The results of this theoretical evaluation following initial health personnel training were not optimal. However, as seen in

Yemen (*20*), prescription of antibiotics did show a satisfactory decrease, perhaps as a result of the quality of the supervision provided following training. This suggests that direct counseling through periodic visits tends to exert a greater influence on prescribing habits (*18*) than does purely academic instruction.

Some health professionals tend to prescribe antibiotics less frequently than others, even in similar contexts. In the first quarter, physicians in area C were found to prescribe antibiotics considerably less frequently than those in the other areas, including area D. The absence of notable changes in this area C pattern during the second semester (unlike the 48% increase observed in area D) could not be attributed to differences in morbidity or methods used to obtain data or teaching activities preceding the intervention. Accordingly, we have thus far been unable to explain the fact that no statistically significant differences were observed when areas A and B were compared with area C, but that statistically significant differences were observed when second semester data for these two areas were compared with those for area D. It is possible that this result is associated with some therapeutic behavior instilled by the professors of the basic work groups in area C, who did not participate in the special training program conducted for areas A and B. In general, however, the results tend to confirm the hypothesis being tested, since no favorable changes were observed in the control areas in the second semester.

Prescriptions written for children less than 1 year old did not show statistically significant reductions, but reduced sample size may have affected the results. In addition, the similarity between the second semester antibiotic prescription rates in areas A and B combined, area C, and areas B and C combined (see Table 3) suggests that public education did not exert a significant influence on physicians' prescribing habits.

It is possible that in order to change traditionally deep-rooted popular ideas and opinions it may be necessary to improve and prolong the educational process. One study conducted in Bolivia and Peru showed that community-based educational interventions aimed at reducing drug use may generate variable and contradictory results, depending on the teaching techniques employed (*21*).

Our data appear to indicate that in-service training for health personnel, periodically reinforced by supervisory interviews, quickly reduces the overprescription of antibiotics for mild ARI cases under the Cuban health system's operating conditions. Similar results have been obtained in Fiji, Nepal, Papua New Guinea, Vanuatu, Yemen, and Bagamoyo, places where declines in infant mortality and pneumonia mortality were accompanied from a very early stage by reduced antibiotic overprescription (*2, 20, 22–26*).

A U.S. study conducted in Tennessee reported a 22% reduction in oral cephalosporin use and a 50% reduction in the use of potentially toxic antibiotics following educational interventions (*8*). In our study, the tendency of health personnel to apply the standardized guidelines for ARI management increased in roughly the same measure that new information on the subject was available, an observation supporting the premise that information is a source of motivation not only for the less qualified health team members but also for the most qualified specialists. The maintenance of such favorable change should be promoted through sustained provision of information and periodic discussions.

If we take into account the fact that the vast majority of all episodes of ARI are mild, a reduction of 36% (95% CI = 14–54%) in antibiotic prescription could be quite significant economically, particularly under the conditions currently prevailing in Cuba. It should be noted, however, that irrespective of economic concerns, there continues to be an appreciable percentage of mild ARI episodes for which antibiotics are unnecessarily prescribed. Hence, the enhancement of in-service training and ongoing counseling, as provided by visiting professionals, can produce good results within the framework of Cuba's social and health organization.

Cuba's current economic crisis, which has been brought on by factors of an essentially exogenous nature, has reduced the availability of antibiotics in the pharmaceutical market. A new government regulation, which went into effect in April 1991,[5] authorizes the dispensing of drugs in community pharmacies only through medical prescriptions written on a scrip that has been stamped and identified with the physicians' professional registration number. The regulation was applied with equal force throughout the city of Havana, so that it is unlikely that it has contributed to the differences observed between the four health areas studied.

The supply and sale of drugs in Cuba has been assigned to a group of state enterprises run by the Ministry of Public Health within the single existing health system. Unlike most other countries, Cuba offers no commercial avenues for advertising drugs manufactured by private concerns that might interfere with a process of providing training in rational drug use (27). Of course, public attitudes toward drug consumption in general and antibiotic consumption in particular might influence the results of a training program for professionals and should be the subject of future research.

The special program of refresher training in clinical and therapeutic ARI management that was aimed at personnel from the primary health care teams appears to have appreciably reduced the unnecessary prescribing of antibiotics for mild ARI episodes. Since the four study areas had similar sociodemographic characteristics, were served by physicians who had recently graduated from the same school, and had similar degrees of public access to health services and drugs, the intervention conducted is the only factor that appears to explain the reduced prescription of antibiotics in areas A and B. These results, consistent with findings obtained in other countries, should be considered in the current planning of health personnel training.

Acknowledgments. We are grateful for the cooperation of the study population and of the health personnel at the 40 clinics and 4 polyclinics involved in the study. We are also extremely grateful for the valuable contributions of nurse supervisors Enma Alonso Labrada and María del Carmen Abreu Viart, and of the statistics and computer staff of the Pedro Kourí Institute.

REFERENCES

1. World Health Organization. ARI: program for the control of acute respiratory infections. Geneva: WHO; 1988. (Document WHO/ARI 89.3).
2. Merson MH. Acute Respiratory Infections Control Programme: summary overview, progress and plans. Geneva: World Health Organization, Acute Respiratory Infections Control Programme; 1989.
3. Cuba, Ministerio de Salud Pública. Experiencia de programación a nivel nacional y local en la República de Cuba. In: Paganini J, Capote R. *Los sistemas locales de salud: conceptos, métodos, experiencias.* Washington, DC: Pan American Health Organization; 1990.
4. González E, Bravo J, Armas L, Pérez A, Rojas V. Metodología para un estudio epidemiológico sobre infecciones respiratorias agudas. *Rev Cubana Med Trop* 1992;44:83–91.
5. Bravo J, González E. Procedimiento muestral para una encuesta de estudio sobre infecciones respiratorias agudas. *Rev Cubana Med Trop* 1992;44:79–83.

[5]National Drug Program, Ministry of Health, 1991.

6. Stenford MG. Planificación y análisis de evaluación de intervenciones en atención de salud en países en desarrollo. *Bull Int Union Tuberc Lung Dis* 1990;65:19–23.
7. Avorn J, Soumerai S. Improving drug-therapy decisions through educational outreach: a randomized controlled trial of academically based detailing. *N Engl J Med* 1983;308:145–163.
8. Shaffner W, Rey W, Federesplei C, Miller W. Improving antibiotic prescribing in office practice: a controlled trial of three educational methods. *JAMA* 1983;250:1728–1732.
9. Jenicek M, Cleroux R. *Epidemiología: principios, técnicas, aplicaciones.* Barcelona: Salvat; 1988:123–154.
10. Sibley JC, Sackett DL, Neufield V, et al. A randomized trial of continuing medical education. *N Engl J Med* 1982;306:511–515.
11. Haynes RB, David DA, McKibbon A, Tugwell P. A critical appraisal of the efficacy of continuing medical education. *JAMA* 1984;251:61–64.
12. Teutsch SMA. Framework for assessing the effectiveness of disease and injury prevention. *MMWR* 1992;41:(RR–3)1–12.
13. Organización Mundial de la Salud. ¿Más medicamentos significa más salud? La prescripción en su debida perspectiva. *Bol Med Esen (OMS)* 1988;7:14.
14. Andrew M, Toverud EL. Prescription of drugs in Norway to children 0–12 years. *Tidsskr Nor Laegeforen* 1990;110:3215–3219.
15. Lansang MA, Lucas Quino R, Tupasi TR, et al. Purchase of antibiotics without prescription in Manila, The Philippines. *J Clin Epidemiol* 1990;43:61–67.
16. Martínez-García MC, Muñoz O, Peniche A, Ramírez-Grande ME, Gutiérrez G. Acute respiratory infections in Mexican rural communities. *Arch Invest Med (Mex)* 1989; 20:255–262.
17. Soumerai S, Avorn J. Principles of educational outreach (academic detailing) to improve clinical decision making. *JAMA* 1990;263;549–556.
18. Avorn J, Harvey K, Soumerai SB, Herxheimer A, Plumridge R, Bardelay G. Information and education as determinants of antibiotic use: report of Task Force 5. *Rev Infect Dis* 1987;9(suppl 3):S286–S296.
19. Lee D, Balasubramaniam K, Ali HM. Drug utilization studies: their transferability between industrialized and developing countries. In: *Drug utilization studies: methods and uses.* Geneva: World Health Organization; 1993:193–218. (Regional Publications, European Series, 45).
20. Hogereil H, Walkes G. Efectos del programa de medicamentos esenciales sobre el uso racional de medicamentos: la experiencia de Yemen Democrático. *Bol Med Esen (OMS)* 1988;7:16.
21. López R, Kroeger A. Intervenciones educativas populares contra el uso inadecuado de medicamentos. *Bol Oficina Sanit Panam* 1994;116:135–144.
22. Roesin F. Estudio de intervención sobre IRA en Kelin, Indonesia. *Bull Int Union Tuberc Lung Dis* 1990;65:29.
23. Organización Mundial de la Salud. Utilización más racional de los antibióticos en las infecciones agudas de las vías respiratorias en los niños. *Bol Med Esen (OMS)* 1990;19:5.
24. Pandey MR, Daulaire N, Sharma PR, Neupane RP, Starbuck ER. Informe de estudio de intervención sobre IRA en Nepal. *Bull Int Union Tuberc Lung Dis* 1990;65:25.
25. Sutrisna B, Frerichs RB, Reinold AL. Randomized controlled trial of effectiveness of ampicillin in mild acute respiratory infections in Indonesian children. *Lancet* 1991; 338:471–474.
26. Kahn JA, Akbar N, Adiss DG. Acute respiratory infections in children: a case management intervention in Abottabad District, Pakistan. *Bull World Health Organ* 1990; 68:577–585.
27. Cuba, Ministerio de Salud Pública. *Plan de perfeccionamiento del Programa Nacional de Medicamentos.* Havana: MINSAP; 1994.

Manuscript submitted on 5 July 1994. Accepted for publication in the *Boletín de la Oficina Sanitaria Panamericana* (following revision) on 15 March 1995. Accepted for publication in condensed form in the *Bulletin of the Pan American Health Organization* on 18 May 1995.