Factors Affecting Caregivers’ Use of Antibiotics Available Without a Prescription in Peru

OBJECTIVE: To determine factors that affect caregivers’ decisions about antibiotic use in children in settings where antibiotics are available without prescription.

METHODS: In a house-to-house survey, 1200 caregivers in 3 periurban districts of Lima, Peru, were asked about antibiotic use in young children.

RESULTS: In this sample, 87.2% of children aged <5 years had received an antibiotic drug in their lives; 70.3% had received antibiotics before 1 year of age, and 98.8% of those had been prescribed by a physician. Given hypothetical cases of common cold and nondysenteric diarrhea, caregivers would seek medical advice in 76.4% and 87.1%, respectively, and 84.6% of caregivers said they respected medical decisions even if an antibiotic was not prescribed. Caregivers with high school–level education accepted 80% more medical decisions of not using an antibiotic and used fewer pharmacist-recommended antibiotics. For each additional year of life, the risk of self-medicated antibiotic use and the use of pharmacist-recommended antibiotics increased in 30%. (OR: 1.3, 95% CI: 1.1–1.4, P = .001 and OR: 1.3, 95% CI: 1.2–1.5, P < .001, respectively). Caregivers respected a medical decision of not prescribing an antibiotic 5 times more when physicians had explained the reason for their advice (OR: 5.0, 95% CI: 3.2–7.8, P < .001).

CONCLUSIONS: Prescribed antibiotic use in these young children is common. Even if they are available without prescription, caregivers usually comply with medical advice and follow physicians’ recommendations when antibiotics are not prescribed. Improving physician prescribing habits could reduce irrational antibiotic use, decreasing future caregiver-driven misuse. Pediatrics 2013;131:e1771–e1779
Antibiotic drugs are the most commonly prescribed medications in children, especially in children aged <5 years. In industrialized nations, preschool-age children receive an average of 2.2 antibiotic prescriptions per year.1 The majority of antibiotics given to children are for mild and self-limited conditions such as upper respiratory infections, acute pharyngitis, and watery diarrhea, conditions that usually have viral etiologies in this age group.2-4 It is estimated that 20% to 50% of all antibiotic courses given to children are unnecessary.5 In a previous study, we found that 75% in children <1 year of age in periurban Lima, Peru, had received antibiotics. Individual infants had received as many as 12 antibiotics over a 1-year period, with ∼85% of these antibiotic courses being deemed unnecessary.8 Several recent studies have shown decreased susceptibility to antibiotics for a variety of common pathogens worldwide.9-12 Increasing percentages of organisms such as Streptococcus pneumoniae, Salmonella enterica, Shigella, and diarrheagenic Escherichia coli have developed high rates of resistance to older, less-expensive antimicrobial drugs13-18 as well as important second-line agents.9,11 High rates of resistance of respiratory bacteria and enteropathogens are common in developing countries such as Peru.18-22 Several studies have associated this emergence of resistant pathogens with the misuse of antibiotics, including in the developing world.9,27-30 However, high rates of inappropriate antibiotic prescriptions by physicians are also a major source of antibiotic misuse.1,8,24,31,32 Patient demand and expectations seem to influence physician’s recommendations.33 Thus, there may be an opportunity to reduce inappropriate antibiotic use through strategies that focus on medical education.

There is little information about antibiotic use among children in the developing world, including Peru. Antibiotics can be purchased in Peru without a prescription in most pharmacies. Despite this, we previously determined that 90% of unnecessary antibiotics were prescribed by a physician; self-medication rates in that series were only 6%.9 To further evaluate current antibiotic use patterns and the factors influencing patient expectations regarding antibiotic use, we conducted a community-based survey among caregivers of children aged <5 years of age in periurban Lima, Peru.

**METHODS**

**Study Design**

This study was a cross-sectional, population-based house-to-house survey performed in Chorrillos, Independencia, and San Juan de Lurigancho, 3 periurban districts of Lima. Sample size was determined as a percentage of the population of children aged <5 years living in these districts (82 869 children living in San Juan de Lurigancho, 23 866 children living in Chorrillos, and 17 541 children living in Independencia). These data were obtained from the most recent national census (2007) available at the web page of the Peruvian National Institute of Statistics and Informatics (http://proyectos.inei.gob.pe/Censos2007). The sample size for each district was calculated by using OpenEPI software version 2.3 (http://www.openepi.com) and was based on a proportion of antibiotic usage of 50% (maximum sample size), with 80% of power and confidence interval (CI) of 95%. For San Juan de Lurigancho, the sample size was 383; for Chorrillos, 379; and for Independencia, 376 children. Assuming a nonresponse rate of ∼5%, we increased the number of interviews to 400 for each district. After mapping the districts, randomly selected clusters were used for the survey. In each selected cluster, the interviewers randomly chose a corner of a block and visited all the households until they had recruited all eligible caregivers. If >1 child lived in the house, the youngest was chosen. After the interview, an educational leaflet about antibiotics and drug resistance was explained to the caregiver.

**Survey Questionnaire**

The questionnaire contained 88 structured and semistructured questions and was divided into 4 parts. First, demographic data were recorded and then questions were asked regarding knowledge about antibiotics. After this, participants were interviewed regarding attitudes toward antibiotic use, by using 2 hypothetical cases describing diarrhea and the common cold. Participants were then presented with questions about their practices of antibiotic use.

**Analysis**

Data from the questionnaires were checked for consistency, with errors corrected by the interviewers in the field. Verified data were entered into an access 2007 database. Statistical analysis was performed by using Stata 11 (StataCorp LP, College Station, TX). Differences in proportions were calculated by using Fisher’s exact test. A P < .05 was considered significant. Logistic regression was used for bivariate and multivariate analysis. Results of
logistic regression were reported as odds ratios (ORs), with a 95% CI and a level of significance of $P = .05$.

The study was presented and approved by the Ethical Review Board of Cayetano Heredia University in Lima, Peru. Before administering the questionnaire, interviewers obtained verbal informed consent of the parents or the caregivers. No personal identifiers were included in the survey.

**RESULTS**

A total of 1200 questionnaires were administered to caregivers, 400 in each district, and 81.9% of the caregivers interviewed were the mothers of the children under their care (Table 1). The median age of the caregivers was 31.4 years (range: 12–76). Most of the caregivers <16 years of age were sisters of the child, whereas caregivers >48 years were most often grandmothers or aunts. The mean age of children under care was 2.3 years (range: 17 days–5.6 years); 49.8% were males. Three types of health care providers were identified: free health care services, low-cost health care services, and private practice clinics (Table 1); 40.4% of the children used free health care services. In all health care facilities, the patients were attended by a physician, most often a general physician and only rarely by a pediatrician; nurse practitioners and other midlevel providers are not available in these settings.

Participants were asked to identify common antibiotics from a list of several medications to determine their familiarity with these drugs. Overall, 3% of the caregivers identified all of the antibiotics correctly from this list, although large majorities of caregivers did correctly identify certain antibiotics. However, they were more knowledgeable about some antibiotics (Amoxicillin (85.9%) and trimethoprim-sulfamethoxazole (80.7%) were the best-known antibiotics. The purpose of this question was to determine if caregivers were familiar with these medications. Mothers with a higher educational level (high school, technical school, or university educations) had a better knowledge of specific antibiotics (Fig 1). Only 11.3% of the caregivers knew about the concept of antibiotic resistance, and 37.8% believed they cure all types of infections. Eighty-five percent of the caregivers knew that different antibiotics may be needed in children compared with adults; 67.6% of the caregivers believed that antibiotics help reduce the duration of illness, 45% believed they were useful to reduce fever, and 72.9% believed they prevent worsening of an illness. Among caregivers, 48.8% believed that antibiotics were safe drugs, whereas 49.4% believed they could cause harm.

Of the children in the sample, 87.2% had received antibiotics at least once during their lives, and 70.3% of all children had received an antibiotic before reaching 1 year of age, with 40.1% receiving antibiotics before reaching 6 months of age. Furthermore, 43.1% of the children who had used an antibiotic were currently receiving an antibiotic or had received an antibiotic in the previous month, and all of the children with reported antibiotic use had received 1 in the previous 6 months.

Of the children who had used an antibiotic ($n = 1046$), 98.8% of the caregivers reported that they had used antibiotics prescribed by a physician, 17.1% had used antibiotics recommended by a pharmacist, and 15.9% of the cases they had used them without any advice (Fig 2). Diarrhea (9.8%) and upper respiratory infections (URIs; 7.3%) were the most commonly reported diagnoses treated with antibiotics without prescription.

Given the hypothetical case of an acute URI, caregivers would seek medical advice in 76.4% of cases, and 14.0% would use a drug prescribed for a similar previous illness. In addition, 50.7% of the caregivers believed antibiotics to be necessary for URIs (Table 2). In the hypothetical case of nondysenteric acute diarrhea, 87.1%...
would seek medical advice, and 4.3% would use a drug prescribed for a similar previous illness. Caregivers more often believed that an antibiotic was indicated for acute diarrhea (65.3% of participants) than in cases of URI (50.7%; \( P \leq .001 \); Table 2). Caregivers were adherent to the recommended medication dose in 77.3% of cases, although only 62.4% reported completion of the full recommended treatment duration.

In cases in which physicians did not prescribe antibiotics, 84.7% of caregivers stated that they respected medical recommendations, and only 7.7% of caregivers stated that they would seek another physician to receive an antibiotic. Among caregivers, 17.2% reported having stored leftover antibiotics from previous prescriptions, and 24.3% would give these leftover antibiotics to their child were he or she to fall ill again.

Physicians always explained why they were not prescribing an antibiotic to 65.5% of the caregivers.

**Bivariate Analysis**

Caregivers with higher educational levels (high school graduation vs grammar school only) had a 60% greater rate of acceptance of medical recommendations (\( P = .021 \)) and a 40% reduction in the use of antibiotics recommended only by a pharmacist (\( P = .027 \)). Technical or university educations were associated with an additional reduction in the use of antibiotics recommended only by a pharmacist (\( P < .001 \)).

For each additional year of a child’s life, the rate of antibiotic use without prescription and the use of antibiotics recommended only by a pharmacist increased by 30% (OR: 1.3, 95% CI: 1.1–1.4, \( P = .001 \) and OR: 1.3, 95% CI: 1.1–1.4, \( P < .001 \), respectively). The recommendations of physicians in private practice were respected by caregivers more often than those working in free clinics (OR: 1.9, 95% CI: 1.2–2.9, \( P = .006 \)), and patients in private practices used pharmacist-prescribed antibiotics less often (OR: 0.4, 95% CI: 0.3–0.7, \( P < .001 \)). Caregivers whose physicians always explained their reasons for not prescribing antibiotics respected those medical decisions 5 times more often than caregivers who reported receiving no such explanations (OR: 5.2, 95% CI: 3.4–8.0, \( P < .001 \); Table 3).

**Multivariate Analysis**

The final model (Table 4) included the relationship of the caregiver to the child with the categories grandmother,
Aunt, and other; the age and educational level of the caregivers; the age and gender of the child; whether doctors explained why they were not using antibiotics; and the practice setting of the child’s physician. This model was used for the 3 statements evaluated in bivariate analysis (Table 3).

Adjusting for the previous mentioned factors, grandmothers used antibiotics recommended by a pharmacist 2 times more often than mothers (OR: 2.5, P = .024, 95% CI: 1.1–5.6). To determine if this was age-related or generational, we examined the differences in antimicrobial use among older mother, younger mothers, and grandmothers. Among mothers alone, older caregiver age was associated with lower rates of pharmacist-recommended antibiotic use. Caregivers with at least high school educations were more likely to accept recommendations to forgo antibiotics in a child (OR: 1.8, P = .024, 95% CI: 1.1–3.0) and were less likely to use antibiotics recommended by a pharmacist (OR: 0.6, P = .018, 95% CI: 0.3–0.9). Caregivers with technical or university educations also had reduced rates of antibiotic use recommended by a pharmacist (OR: 0.4, 95% CI: 0.2–0.7, P = .003). Pharmacist-recommended antibiotic use also declined for each additional year of caregiver age (OR: 0.95, 95% CI: 0.9–0.97, P < .001). Conversely, the use of pharmacist-recommended antibiotics and the purchase of antibiotics without a prescription increased for each additional year of life of the child (OR: 1.3, 95% CI: 1.1–1.4, P = .001 and OR: 1.3, 95% CI: 1.2–1.5, P < .001, respectively).

### TABLE 2 Caregivers’ Actions and Beliefs Given Hypothetical Cases of Common Cold and Watery Diarrhea

<table>
<thead>
<tr>
<th></th>
<th>Common Cold %</th>
<th>Watery Diarrhea %</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Would seek medical advice</td>
<td>76.4</td>
<td>87.1</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Believes an antibiotic is necessary</td>
<td>50.7</td>
<td>65.3</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Would give the last prescribed drug</td>
<td>14.0</td>
<td>4.3</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Would give natural medicine</td>
<td>3.8</td>
<td>5.8</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Would ask at the pharmacy</td>
<td>2.5</td>
<td>0.9</td>
<td>.003</td>
</tr>
<tr>
<td>Would give the drug prescribed for other child</td>
<td>2.3</td>
<td>1.3</td>
<td>NS</td>
</tr>
<tr>
<td>Othera</td>
<td>1</td>
<td>0.6</td>
<td>NS</td>
</tr>
</tbody>
</table>

* Other actions for the common cold case were to wait until the cold is gone (11 cases) and to ask a neighbor for advice (1 case). Other actions for the watery diarrhea included to wait until the diarrhea is gone (5 cases) and to ask a neighbor for advice (3 cases).
TABLE 3 Multivariate Analysis of Factors Affecting Caregivers’ Decisions About Antibiotic Use in Children Aged <5 Years

| Factor                                      | OR   | P      | 95% CI | OR   | P      | 95% CI | OR   | P      | 95% CI |
|---------------------------------------------|------|--------|--------|------|--------|--------|------|--------|--------|-------|
| Caregiver (compared with mother as caregiver) |      |        |        |      |        |        |      |        |        |       |
| Grandmother                                 | 1.7  | .088   | 0.9–5.8| 0.8  | .381   | 0.4–1.4| 1.1  | .801   | 0.6–1.8|
| Aunt                                        | 2.0  | .194   | 0.7–6.6| 1.7  | .136   | 0.8–3.6| 0.8  | .667   | 0.3–2.0|
| Other                                       | 1.0  | .976   | 0.5–2.0| 0.3  | .052   | 0.1–1.0| 1.5  | .249   | 0.8–2.8|
| Age of the caregiver                        | 1.0  | .257   | 1.0–1.0| 1.0  | .359   | 1.0–1.0| 0.98 | .052   | 0.97–1.0|
| Caregiver’s education level (compared with only grammar school) |      |        |        |      |        |        |      |        |        |       |
| High school                                 | 1.6  | .021   | 1.1–2.4| 1.2  | .562   | 0.7–1.9| 0.6  | .027   | 0.4–0.9|
| Technical school or university              | 1.4  | .213   | 0.8–2.3| 1.0  | .867   | 0.5–1.7| 0.3  | .000   | 0.2–0.6|
| No. of children aged <3 y living in house   | 1.0  | .978   | 0.7–1.4| 0.9  | .505   | 0.6–1.3| 0.8  | .162   | 0.5–1.1|
| Age of the child                            | 1.0  | .424   | 0.9–1.1| 1.3  | .001   | 1.1–1.4| 1.3  | .000   | 1.1–1.4|
| Gender (male)                               | 0.9  | .653   | 0.7–1.3| 1.2  | .336   | 0.8–1.7| 1.1  | .681   | 0.8–1.5|
| Site of child’s medical care (compared with cost-free health care service) |      |        |        |      |        |        |      |        |        |       |
| Attends private practitioner or low cost service | 1.6  | .023   | 1.1–2.5| 0.8  | .165   | 0.6–1.1| 0.5  | .000   | 0.4–0.7|
| Attends low-cost health care service        | 1.4  | .076   | 1.0–2.0| 0.8  | .234   | 0.5–1.2| 0.6  | .017   | 0.4–0.9|
| Attends private practitioner                | 1.9  | .006   | 1.2–2.9| 0.8  | .288   | 0.5–1.2| 0.4  | .000   | 0.3–0.7|
| Doctors explain why he/she is not prescribing antibiotic (always or sometimes) | 3.6  | .000   | 2.6–5.1| 0.9  | .393   | 0.6–1.2| 0.9  | .711   | 0.7–1.3|
| Always                                      | 5.2  | .000   | 3.4–8.0| 1.1  | .680   | 0.6–2.0| 1.3  | .371   | 0.7–2.2|
| Sometimes                                   | 1.8  | .011   | 1.1–2.9| 1.5  | .182   | 0.8–2.8| 1.6  | .120   | 0.9–2.9|
| Daily spending on food (proxy measure of socioeconomic status) | 1.0  | .696   | 1.0–1.0| 1.0  | .606   | 1.0–1.0| 1.0  | .007   | 0.9–1.0|

Caregivers who took their children to private practitioners were more likely to accept their physicians’ decisions to avoid antibiotics (OR: 1.8, 95% CI: 1.1–2.9, P = .020), and were less likely to use antibiotics recommended only by a pharmacist (OR: 0.4, 95% CI: 0.3–0.7, P = .001; Table 4). Even after adjusting for other variables, regular physician explanations for not prescribing antibiotics increased caregiver acceptance of their recommendations (OR: 5.0, 95% CI: 3.2–7.8, P < .001; Table 4). When physicians only sporadically explained their reasons, however, caregiver acceptance increased only modestly compared with those physicians who offered no explanations (OR: 1.8, 95% CI: 1.1–3.0, P = .014). In those cases, caregivers were more likely to use antibiotics on a pharmacist’s recommendation (OR: 1.9, 95% CI: 1.02–3.6, P = .042).

DISCUSSION

Despite the fact that caregivers prefer to seek medical advice when their
children are ill and access to health care facilities in this setting is not a problem, our data show that children in these communities are exposed to antibiotics early in life, with 87% in children <5 years of age having received antibiotics on ≥1 occasion. These data are similar to a previous study in these districts of Lima in which the prevalence of previous antibiotic use was 75% in children <1 year of age. This rate demonstrates a high frequency of antibiotic use at a relatively younger age than in the industrialized economies of the United States, Canada, north-central Europe, and Italy, where children ≤5 years of age had an overall lifetime prevalence of reported antibiotic therapy of 72%.1

There are limited data at present concerning health-seeking behavior in other Latin American countries. It seems that, in some, caregivers are much more likely to seek out a health care provider when a child experiences an illness, and drug prescriptions for them are mainly driven by physicians. Rates of self-medication may be higher in settings with more limited access to formal medical care. In our survey, caregivers with access to medical care tended to prefer obtaining a physician’s advice. Similar behavior may increase in other Latin American countries with policies that improve access to health services.

Physicians were responsible for almost antibiotic use (98.9%) in our study. This is much higher than found in other studies in other Peruvian areas. However, our survey did not seek to determine whether such antibiotic use was appropriate.

Misconceptions about antibiotics exist at the community level, and these may lead to higher self-medication rates or result in pressure on physicians’ prescription habits. Eighty-four percent of caregivers in our series respected medical decisions even if an antibiotic was not prescribed, unlike other studies from the developing world and Latin America where self-medication was more common. In our study, this respect was influenced by several factors, including educational level; caregivers educated at the high school level or higher more often accepted the medical decision to withhold antibiotics when compared with their less-educated counterparts. In previous studies, lower educational levels were a predictor of parents’ expectations to receive an antibiotic. Additionally, private practitioners have more influence on caregivers, possibly because they had more time to explain the reasons behind their decisions. Our study found that when an explanation was given, caregivers were 5 times more likely to respect the medical decision not to prescribe an antibiotic. The absence of such an explanation led to a higher tendency to seek advice at a pharmacy. Although antibiotics could be obtained at a pharmacy without a prescription, only 17.5% of respondents had used an antibiotic recommended by a pharmacist, and only in 15.8% of cases had they been used without any advice. As noted earlier, the educational level of the caregiver influenced this use of pharmacist-recommended antibiotics.

In our study, most antibiotic use in Lima was physician-directed, and the majority of antibiotics prescribed were for mild and self-limited conditions. Self-medication can result from previous indiscriminate practices, and caregivers may learn to misuse medications from physicians’ behavior; suggesting that clinicians must take responsibility for the future antibiotic misuse by the caregivers. Caregivers may be encouraged to misuse antibiotics if they receive these drugs for the treatment of their children in the absence of a compelling indication, with a resulting lack of appreciation for these medications’ risks and potential adverse effects. This may influence the increase in antibiotic self-medication and antibiotic use recommended by a pharmacist with each additional year of children’s lives.

The reasons for inappropriate use of antibiotics by physicians remain unclear from our survey. Other studies have related the excess prescription of antibiotics to maintaining patient satisfaction, physician training or beliefs about the putative beneficial effects of antimicrobial drugs, the availability of complementary tests, or the fear of a potential complication.

This study has several limitations. Because this is a survey of self-reported information on events that had taken place during a child’s life, recall bias may have influenced results. A respondent’s intentional deception or misunderstanding of the question may also have contributed to inaccuracies. Even though the interviewers were well trained and supervised, we cannot exclude the possibility that they had some influence on the respondents.

This study is important because it highlights that, in this setting, even when antibiotics are available over the counter, the great majority of their excessive use is not driven by the caregiver or pharmacist. Rather, most antibiotic use is related to physician advice. Most caregivers comply with physicians’ advice when an antibiotic is not prescribed, and they are much more likely to seek out a health care provider when a child experiences an illness. Thus, educating physicians on the appropriate indications for antibiotic use is one of the most important factors in promoting such appropriate
use. This suggests that if effective communication can be achieved between parents and physicians, antibiotic misuse could be reduced. The goal of reducing the emergence and spread of resistant pathogens may best be addressed by physician training in appropriate antibiotic use and by emphasizing the need for careful and regular discussion of the need for antibiotics, or lack thereof, with caregivers. This focus could be more effective and less expensive than educating an entire community in settings where antibiotic regulations are poor and limited resources for interventions exist.

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