Ecosystem approach to promoting appropriate antibiotic use for children in indigenous communities in Ecuador

Georgina Muñoz,[1] Lorena Mota,[2] William R. Bowie,[3] Arturo Quizhpe,[4] Elena Orrego,[2] Jerry M. Spiegel,[2] and Annalee Yassi[5]

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ABSTRACT

Objective. *To collect baseline data on infectious diseases and antibiotic use in two Andean indigenous communities in Ecuador in order to determine the feasibility and acceptability of applying an ecosystem approach to address associated problems.*

Methods. *In visits to 65 households with children under age 5 years, environmental risk factors for infectious diseases were evaluated through rapid assessment. Caregivers' knowledge, attitudes, and practices related to antibiotic use were determined through a knowledge, practices, and coverage survey; antibiotic use was gleaned from inspection of medicine chests; and overall health of the 91 children (including nutritional status) was assessed. A workshop was held to share results and to craft a multicomponent intervention using an ecohealth framework.*

Results. *Numerous environmental risk factors were identified, especially related to water and sanitation. Knowledge, attitudes, and practices revealed use of traditional and Western medicines and serious knowledge gaps. Antibiotics were present in 60.9% of households in Correuco and 46.8% in La Posta; malnutrition rates were 22.2% in Correuco and 26.1% in La Posta; diarrheic episodes were experienced in the previous month by 26.7% of children in Correuco and 47.8% in La Posta, with antibiotics prescribed in 50.0% and 47.1% of cases, respectively; and acute respiratory infections were incurred by 28.9% of children in Correuco and 47.8% in La Posta, with antibiotics prescribed in 53.8% and 50.0% of cases, respectively.*

Conclusions. *Environmental, social, and cultural factors must be addressed to prevent antibiotic resistance in addition to training health personnel. An ecosystem approach is well-suited for this goal.*

Key words Drug resistance, microbial; anti-bacterial agents; drug prescriptions; indigenous population; child, preschool; intervention studies; Ecuador.

[1] División de Pediatría, Hospital Vicente Corral Moscoso, Cuenca, Ecuador.
[2] Global Health Research Program, College of Interdisciplinary Studies, University of British Columbia, Vancouver, British Columbia, Canada.
[3] Division of Infectious Diseases, Faculty of Medicine, University of British Columbia, Vancouver, British Columbia, Canada.
[4] Facultad de Ciencias Médicas, Universidad de Cuenca, Cuenca, Ecuador.
[5] School of Population and Public Health, University of British Columbia, Vancouver, British Columbia, Canada. Send correspondence to: Annalee Yassi, annalee.yassi@ubc.ca

Infectious diseases remain the main cause of morbidity and mortality in low- and middle-income countries, especially among children in indigenous communities (1). In Ecuador, one of the poorest countries in Latin America, 22.5% of mortality among children < 1 year old was attributed in 2007 to pneumonia, bacterial sepsis, and diarrhea (2). While most of these conditions can be prevented with improved access to clean water, sanitation, personal hygiene, and immunization, use of antibiotics remains essential. Thus, preserving their efficacy is a global health priority (3).

Campaigns promoting careful use of antibiotics in high-income countries led to the conclusion that public campaigns can contribute to improved use of antibiotics in outpatients (4–6). However, little

research has targeted low- and middle-income countries, which not only bear the brunt of morbidity and mortality due to infectious disease but also face increasingly severe problems due to antibiotic resistance (7, 8). Factors contributing to antibiotic resistance in low- and middle-income countries include lack of knowledge by health care professionals, deficient laboratory facilities, inadequate access to health care, lack of funds for appropriate antibiotic doses, dispensation of drugs by untrained people, and availability of substandard and counterfeit drugs (9). Transmission of resistant bacteria in low- and middle-income countries is facilitated by person-to-person contact through contaminated food and unsafe water. An understanding of this complex and multifactorial scenario is crucial to developing a containment strategy (9).

The ecosystem approach to human health recognizes the complexity of public health challenges and offers an alternative for addressing problems unresponsive to conventional strategies (10). Ecosystem approaches to health are "systemic, participatory approaches to understanding and promoting human health and well-being in the context of complex social and ecological interactions" (11). Recognizing that health is contingent on biophysical, social, economic, and political environments (justice and sustainability) necessitates transcending disciplines (transdisciplinarity), taking into account various perspectives (multistakeholder participation), and considering systemic inequities (social and gender equity) (12). An ecosystem approach to health, recently deemed to be one of the most important milestones in public health research (13), therefore seems ideally suited to this challenge.

This study, emerging within a 6-year project entitled "Sustainably Managing Environmental Health Risk in Ecuador," which embraces an ecosystem approach (14, 15), sought to ascertain whether applying an ecosystem approach with its principles of transdisciplinarity, equity, participation, and sustainability (13) could contribute to improving appropriate use of antibiotics and reducing the high prevalence of infectious disease.

In Cañar province, among the poorest in Ecuador, nearly 71.0% of the population is rural (16) and 80.0% of the people identify themselves as indigenous. Tucayta is an organization of farmer peasants spread across 15 settlements, including those in this study. Three students from these communities were recruited into the ecosystem master's program at the University of Cuenca, launched within this 6-year collaboration (14). With active participation of community members, these students conducted distinct but complementary thesis studies on water quality in the communities (17), reducing pesticide use (18), and preserving the water supply in the highlands to allow for clean water in the future (19). A dissertation of a doctoral student from Canada contributed to this knowledge base by improving understanding of how social capital can be harnessed in the community to reduce exposure to pesticides (20). A fourth master's student from the University of Cuenca (G.M.) focused her thesis on infectious diseases and antibiotic use (21).

Although all five theses inform an ecosystem approach to reducing the occurrence of infectious diseases, and their findings will be taken into account when planning a comprehensive multicomponent intervention, this article focuses on the findings of the latter study (21). The specific objectives were (a) to characterize areas such as environmental risk factors; knowledge, attitudes, and practices of caregivers; antibiotic use; and child health and (b) to seek community input in applying an ecosystem approach to the identified problems.

MATERIALS AND METHODS

This descriptive study was conducted to serve as a baseline assessment from which a longitudinal intervention study could be designed. It included a small pilot intervention to seek input from the community as to the elements to include in a longitudinal multicomponent ecohealth intervention trial.

Ecuador's national government operates the *Fondo de Desarrollo Infantil* program to provide childcare services and early stimulation for young children in the most vulnerable sectors of the Ecuadorian population. Virtually all children under age 5 years in these communities (98.0%) attend the program. All households with children in the program who lived in the San José de La Posta and Correuco communities were included in this study, encompassing 65 households (31 in Correuco and 34 in La Posta) and 91 children (45 from Correuco and 46 from La Posta).

The following information was collected:

- The household and infrastructure were characterized by using a rapid assessment procedure.
- Each household's primary caregiver's knowledge, attitudes, and practices regarding infectious diseases and antibiotic use were collected with an internationally validated instrument (22). The knowledge, practices, and coverage survey was designed to provide a set of indicators of child health while promoting local participation in identifying health priorities and monitoring community health status (22). This study used modules from the survey on household, water and sanitation, breastfeeding and infant/child nutrition, growth monitoring and child anthropometry, childhood immunization, diarrhea, and acute respiratory infection; modules were adapted to the cultural context of Ecuadorian communities and validated at Quilloac, another indigenous community near La Posta and Correuco.
- Medicine chests were inspected.
- The weight and height of all children < 5 years old were measured in order to determine nutritional status.

SPSS 13 was used for statistical analysis of collected data.

The protocol followed was approved by the joint Canadian–Ecuadorian University Partnered Ethics Committee, which oversaw these community-based research projects, as authorized by the National Council on Superior Education, the body that governs postgraduate education (resolution RCP.S06.No.258.05). The project was carefully explained at the beginning and signed informed consent was obtained from every caregiver (mother, father, grandparents).

The leaders of the Tucayta communities also provided informed consent for the authors to work in their communities. Every photograph taken during the research was taken after verbal consent was provided. A general consent form was obtained for the duration of the research project.

An ecohealth approach requires not only a systematic effort to incorporate community participation in decision making but also local understanding of etiology, as for community action re-

search generally (23). (In order to have a comparison group against which to evaluate the effectiveness of an intervention at a future stage of the project, the community action/intervention component was conducted only in San José de La Posta, with Correuco left to serve as a comparison community.) After the topics were established, three community workshops were held that targeted caregivers. Content focused on the main issues identified in the risk factor analysis and household survey, with open dialogue and demonstrations about child health issues. The World Health Organization framework of driving forces, pressures, states, exposures, effects, and actions (DPSEEA) (24, 25)—used by this team in other settings—was used to craft an ecosystem health intervention (26, 27).

RESULTS

Household and infrastructure

As shown in Table 1, households generally lacked sanitary services in both communities, especially for stool disposal. Only 32.3% of Correuco households and 17.6% of La Posta households had a designated place for hand washing. In both communities, tap water was neither purified nor treated (67.7% and 82.7% in Correuco and La Posta, respectively), but only 9.7% of Correuco households and 8.8% of La Posta households used bottled water. Hand washing was practiced before eating and before preparing foods in 20.0% to 30.0% of cases; only 19.0% of caregivers in Correuco and 8.8% in La Posta reported hand washing after changing diapers and after using the toilet.

TABLE 1. Household infrastructure, water, and sanitation services, Correuco and La Posta, Ecuador, 2008

Characteristic	Percent in Correuco	Percent in La Posta	*P*
Household			
Floor			
Cement	19.4	29.4	0.35
Wood	35.5	0.0	**< 0.001**
Dirt	45.2	70.6	**0.04**
Walls			
Adobe	51.6	64.7	0.29
Bricks/blocks	41.9	35.3	0.59
Wood	6.5	0.0	0.14
Hand washing facilities	32.3	17.6	0.17
Water source			
Tap water	100.0	100.0	NA
Nonpotable	0.0	2.9	0.34
Stool disposal			
Sewage system	32.3	0.0	**< 0.001**
Open field	35.5	35.3	0.99
Latrine	32.3	64.7	0.01
Waste disposal (collecting system)	51.6	0.0	**< 0.001**
Hygienic practices			
Water storage	45.2	47.1	0.88
If so, containers covered	64.3	43.8	0.10
Purified water			
Bottled	9.7	0.0	0.07
Boiled	35.5	26.5	0.44
No purified	54.8	73.5	0.12
Hand washing			
Before eating	25.8	32.4	0.56
Before meal preparation	29.0	20.6	0.44
After defecation	19.4	8.8	0.22

Note: NA: not applicable. Boldface indicates significant difference.

TABLE 2. Characteristics of children: breastfeeding and nutrition, growth monitoring and anthropometry, immunization, Correuco and La Posta, Ecuador, 2008

Characteristic	Percent in Correuco	Percent in La Posta	*P*
Female	51.1	52.2	0.92
Mothers who breastfed children	100.0	100.0	NA
Nutritional status[a]			
Normal	31.1	13.0	**0.04**
Mild malnutrition	33.3	47.8	0.16
Moderate malnutrition	22.2	26.1	0.67
Severe malnutrition	6.7	6.5	1
Overnutrition	6.0	6.5	0.92
Immunization card	42.2	37.0	0.61
Immunization scheme complete (among those with card)	73.7	70.8	0.76
Vaccine			
Rotavirus	36.8	11.8	**0.01**
Pneumococcal	5.3	0.0	0.12

Note: NA: not applicable. Boldface indicates significant difference.
[a] Data from Waterlow et al. (28).

Knowledge, attitudes, and practices

Breastfeeding and infant/child nutrition, growth monitoring and child anthropometry, childhood immunization. Characteristics of the children are presented in Table 2. It is noteworthy that 26.3% and 29.2% of children in Correuco and La Posta, respectively, had not had complete immunizations. Although not shown in Table 2, it was noted that in the preceding 30 days, 31.9% of children had a diarrheic episode (26.7% in Correuco and 37% in La Posta); 28.9% of children from Correuco and 47.8% from La Posta incurred an acute respiratory tract infection; and, of them, 15.4% from Correuco and 50% from La Posta showed symptoms of respiratory distress. Regarding nutritional status, only 31% of children in Correuco and 13% in La Posta had adequate nutritional status as per the classification of Waterlow et al. for acute malnutrition (28).

Diarrhea and acute respiratory infection. As shown in Table 3, knowledge

TABLE 3. Caregivers' knowledge about diarrhea and acute respiratory infection in children, Correuco and La Posta, Ecuador, 2008

Knowledge about	Percent in Correuco	Percent in La Posta	*P*
Diarrhea			
Traditional remedies	83.9	67.6	0.13
Western medication	29.0	17.6	0.28
Alarming symptoms			
Asthenia, malaise, hyporexia, and abdominal pain	77.4	61.8	0.18
Dehydration signs and symptoms	16.1	11.8	0.62
Stool characteristics	3.2	8.8	0.35
Tetracycline most common medical treatment known	55.6	66.7	0.36
Dosage adequate	0.0	16.7	**0.02**
Learned from			
Health personnel	80	66.7	0.23
Family	20.0	0.0	**< 0.001**
Pharmacy	0.0	33.3	**< 0.001**
Acute respiratory infection			
Traditional remedies	93.5	76.5	0.06
Western medication	9.7	8.8	0.90
Alarming symptoms			
Difficulty at feeding	3.2	2.9	0.94
Tachypnea	0.0	5.9	0.17
Heavy coughing	42.5	35.3	0.55
Wheeze	16.1	17.6	0.87
Fever, malaise, headache	35.5	38.2	0.82
Amoxicillin most common medical treatment known	100.0	100.0	NA
Dosage adequate	0.0	0.0	NA
Learned from			
Health personnel	33.3	100.0	**< 0.001**
Family	66.7	0.0	**< 0.001**
Pharmacy	0.0	0.0	NA

Note: NA: not applicable. Boldface indicates significant difference.

of medical treatment for diarrhea was correct as reported by only 29.0% and 17.6% of respondents from Correuco and La Posta, respectively. Knowledge of warning signs for diarrheal disease and acute respiratory tract infections was quite low.

Antibiotic use. As shown in Table 4, antibiotics were prescribed for more than 50% of cases of diarrhea; most commonly used was trimethoprim-sulfamethoxazole (40.0% in Correuco and 50.0% in La Posta), followed by amoxicillin in 20.0% of cases in Correuco. Antidiarrheal drugs for symptom relief were not used or prescribed. The results for respiratory tract infection were similar. As reported by caregivers, drugs were prescribed by doctors in most cases, but caregivers' responses to questions about dosage and treatment duration for diarrheal disease and respiratory infections were incorrect in 100.0% of cases in Correuco and 83.3% in La Posta; antibiotics for diarrhea were self-prescribed by a family member in 20.0% of cases in Correuco; in La Posta, 33.3% of drugs for diarrhea were prescribed at the pharmacy, which could be explained by the fact that two health centers are available to Correuco's population but only one is close to La Posta. Only 80.0% of children in Correuco and 50.0% in La Posta finished their prescribed treatments for diarrhea; only 42.9% of cases of respiratory infection in Correuco and 54.5% in La Posta completed treatment as directed.

Medicine chest results

Antibiotics were present in 60.9% of households in Correuco and in 46.8% in La Posta (Figure 1).

Children's nutritional status

In both communities, there was a high rate of moderate (22.2% and 26.1% in Correuco and La Posta, respectively) and severe (6.7% and 6.5% in Correuco and La Posta, respectively) malnutrition.

Formulating the ecosystem approach

As shown in Table 5, application of the DPSEEA framework (21) identified that the health effects of greatest concern to the community were repeated diarrheic episodes and upper respiratory tract infections. With respect to exposures, it was noteworthy that piped water was found to be of poor quality by one member of the team, which, along with hygienic practices, perpetuates the cycle of agent exposure and infectious disease and seeking of medical treatment.

The state of the community was such that health personnel do not provide daily service in their community, and, according to community members who attended the workshop, often do not have updated knowledge; instead, they appear to rely on information provided by pharmaceutical companies. The community expressed the need for the health system to better consider Ecuador's ethnic and cultural diversity. In indigenous communities, the health of the ecosystem and that of humans are seen as one, with individual well-being linked to that of the community and the environment.

The driving forces and pressures component of Table 5 was derived by synthesizing the comments of the community and information gathered by other team members (17–20) as well as other experts (29).

Those who participated in the meetings explicitly expressed appreciation in having obtained a baseline assessment of the communities for the purpose of designing an ecosystem approach to address these problems. A health party called "ally kawsay" (water, health, and joy) was thrown, encouraging the population to preserve their health.

DISCUSSION

Antimicrobial resistance is increasing worldwide, and it is a naturally occurring biological phenomenon; the process is amplified by use and misuse of antimicrobials (30). It is generally agreed that preventing the spread of resistance to existing and future antimicrobials requires using antimicrobials appropriately and reducing the burden of infectious disease through preventive hygiene and infection control practices (31–33). Significant progress has been made in high-income countries through efforts such as characterizing knowledge, attitudes,

TABLE 4. Caregivers' treatment practices for diarrhea and acute respiratory infection, Correuco and La Posta, Ecuador, 2008

Characteristic	Percent in Correuco	Percent in La Posta	*P*
Children presenting with diarrhea in last 30 days	26.7	37.0	0.29
Children presenting with acute respiratory infection in last 30 days	28.9	47.8	0.07
Household medicine chests with antibiotics	60.9	46.8	0.40
Use of traditional remedies			
For diarrhea	41.7	35.3	0.73
For acute respiratory infection	38.5	36.4	0.85
Use of Western medicine			
For diarrhea	50.0	47.1	0.88
For acute respiratory infection	53.8	50.0	0.90
Diarrhea			
Drug type			
Amoxicillin	20.0	0.0	0.28
Trimethoprim-sulfamethoxazole	40.0	50.0	0.75
Unknown	40.0	50.0	0.75
Treatment completed	80.0	50.0	0.33
Prescribed by			
Medical doctor	80.0	66.7	0.63
Pharmacy personnel	0.0	33.3	0.19
Family	20.0	0.0	0.28
Acute respiratory infection			
Drug type			
Amoxicillin	42.9	36.4	0.79
Trimethoprim-sulfamethoxazole	57.1	9.1	0.04
Unknown	0.0	54.5	**0.03**
Treatment completed	42.9	54.5	0.64
Prescribed by			
Medical doctor	85.7	27.3	**0.03**
Pharmacy personnel	0.0	63.6	**0.02**
Family	14.3	9.1	0.74

Note: Boldface indicates significant difference.

FIGURE 1. Mother displaying antibiotics kept in the household, Correuco, Ecuador, 2008

and practices that determine prescribing (34–37); training physicians in good prescribing practices (37–39); having public education campaigns (4, 37–41); and improving infection control (38). However, antibiotics in low- and middle-income countries are often available to the public from a variety of sources, including hospitals, pharmacies, licensed medicine stalls and drugstores, roadside stalls, and hawkers, as also found in this study. Moreover, this study found that geographic and cultural difficulties in accessing health care services result in a considerable proportion of the population seeking treatment at pharmacies, where personnel are not qualified to prescribe drugs.

In Correuco and San Jose de la Posta, although more than 90.0% of the population has tap water, its quality and safety are poor (19) with coliform bacteria present well above the permitted level. Unhygienic practices, such as inadequate water storage, untreated drinking water, and lack of hand washing, were very prevalent. Improving the quality of drinking water, education about hygienic practices, and access to sanitation are crucial to decreasing the burden of infectious disease and thus the need for antibiotics.

The findings in Correuco and La Posta enhance the notion that good-quality research is still lacking in the area of antimicrobial resistance, and integration of other important factors such as social, cultural, economic, and behavioral factors as well as the role of antimicrobials in agriculture and veterinary medicine needs to be taken into account when designing interventions. Further research on all the factors that influence antimicrobial use in these communities could provide a unique opportunity to gain knowledge about relevance to other indigenous and nonindigenous communities worldwide.

Conclusion

While this study achieved the objectives of providing a baseline description of many of the factors that might be driving the transmission of infectious diseases as well as inappropriate antibiotic use, its limitations include the fact that not all environmental factors could be rigorously evaluated. Also antibiotic use was characterized only from a survey of caregivers; further research involving health providers and pharmacists is desirable. Child health was also evaluated only from a symptom survey and clinical examination conducted by the lead author; reviews of medical records might provide a deeper understanding of the incidence and prevalence of infectious diseases and appropriate use of antibiotics.

It is clear that the knowledge, attitudes, and practices of caregivers, although undoubtedly relevant, fall short of explaining the magnitude of the problem. Child malnutrition, poor water quality, and lack of proper sanitation combined with other social and environmental factors must be taken into consideration. Now that the baseline assessment has been conducted and community interest was piqued, the stage is set for formulating and rigorously evaluating a comprehensive ecosystem approach to this important health problem.

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TABLE 5. World Health Organization driving forces, pressures, states, exposures, effects, and actions framework applied to infectious diseases in indigenous communities, Correuco and La Posta, Ecuador, 2008

Element (theme and key variables)	Action
Driving forces	
Globalization and worldwide economic and financial deregulation	Action for the right to health
Commercialization of goods and health services	Health promotion at the international level from an ecosystem approach where human health depends on health of the ecosystem
Medicalization of health	
Environment and climate change	
Biodiversity loss	Indigenous communities' acknowledgment
Large-scale resource depletion	
International travel and commerce	
Microorganism transport through manufactured products and "exportation" of resistant organisms	
Solidarity amid globalization	
Protective factors: health, dignity, and sovereignty	
"Abya Yala" communities' dignity	
Indigenous communities as actors and directors of their activities	
Pressures	
Pharmaceutical industry	Empowerment of Ecuadorian state in health matters, with a holistic, equitable, participative, and transdisciplinary approach
Industry preference toward production of medication for chronic diseases	
Extensive market for antibiotics in fields of human health, agriculture, and farming	Regulation of commercialization of national and international drugs
Conflict between pharmaceutical industry and patents of ancestral knowledge	
Ecuadorian state organization	Strengthening of health area, open vision (theoretical and practical) considering ethnic and cultural realm, coverage, and transdisciplinarity
Low social investment and health expenditure	
Weakening of state organisms	
Lack of regulation regarding price production, commercialization, and sale of antimicrobial medication	Ecuadorian economy activation, implying indigenous communities' participation, preserving identity and culture
Low awareness, monitoring, and policy regarding antibiotic-resistant bacteria and proper antibiotic use	
No integrated national health system, scarce qualified human resources, low salaries, work instability, and migration	Declaration of indigenous communities' right to health, where this right is achieved through execution of other rights such as housing, education, and freedom
Current system vision based on disease welfarism; health not considered in its whole context	
National plans and programs do not consider ethnic and cultural diversity	
Medical programs do not address health as indigenous population understanding, which links ecosystem and human beings	
Indigenous medicine is stigmatized compared with Western medicine	
States	
Per capita expenditure designated to tertiary level and pharmaceutical expenditures	Development and execution of plans and programs aimed at development of Ecuadorian population, evaluation of them related to health, economy, education, and cultural topics from ecosystem approach
Poor households with poor sanitary conditions	
Economy	Improvement of indigenous communities' quality of life through provision of basic sanitary infrastructure services
Indigenous communities live from agriculture	
Poverty levels very high	
Basic infrastructure services[a]	Proper, integral health care, where nutritional status is preserved
Not universal, deterioration in indigenous communities	
Nutrition	Education and training of health personnel, parents, children, and communities with regard to infectious disease
High rate of growth retardation among indigenous population, lacking food security, insufficient diet, and frequent infections[b]	Promotion of rational use of antibiotics
Education of indigenous populations[b]	
Achieve only 6.9 years of formal education	
Children mismatched in age and grade	
High prevalence of illiteracy	
No universal access to education	
Ecuadorian indigenous groups have assumed ownership of their culture	
Health	
Limited access to health services	
Current national programs: amplified immunizations, integral care of prevalent infancy illnesses, micronutrient deficiency control, malaria control; directly observed treatment, short course; rubella, measles, yellow fever surveillance	

(Continues)

TABLE 5. (Continued)

Element (theme and key variables)	Action
Indigenous populations marginalized from development, state benefits, science and technology	
Lack of complete health teams, pharmaceuticals, laboratories, diagnostic tools	
Medicines easily accessible from pharmacies, self-medication, incomplete antibiotic treatments	
Migration	
Internal and external, positive and negative effects	
Exposures	
Biologic, economic, environmental, cultural, geographic, social, and political factors turn indigenous community inhabitants into susceptible hosts for infectious diseases.	Improvement in nutritional status Rational use of antibiotics and antimicrobials
Inappropriate use of antibiotics leads to bacterial resistance, super bacteria.[c]	
Effects	
Morbidity and mortality	
Infectious diseases are main causes of children's morbidity and mortality, in particular pneumonia and gastroenteritis[d]	Early diagnosis and timely treatment of infectious diseases
High chronic malnutrition rate	Nutritional improvement
Disequilibrium in good life along with nature, due to human action; microorganisms that cause infectious disease have evolved, showing resistance to antimicrobials	

[a] Corresponds to Table 1.
[b] Corresponds to Table 2.
[c] Corresponds to Table 3.
[d] Corresponds to Table 4.

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RESUMEN

Enfoque ecosistémico de promoción del uso adecuado de antibióticos en niños de comunidades indígenas del Ecuador

Objetivo. Recopilar datos iniciales sobre las enfermedades infecciosas y el uso de antibióticos en dos comunidades indígenas andinas del Ecuador, con el objeto de determinar la factibilidad y la aceptabilidad de aplicar un enfoque ecosistémico para abordar los problemas asociados.

Métodos. Mediante visitas a 65 hogares con niños menores de 5 años, se valoraron los factores de riesgo ambientales de las enfermedades infecciosas mediante una evaluación rápida. Se identificaron los conocimientos, las actitudes y las prácticas de los cuidadores relacionados con el uso de antibióticos por medio de una encuesta de conocimientos, prácticas y cobertura; el uso de antibióticos se dedujo a partir de la inspección de los botiquines; y se evaluó el estado general de salud de los 91 niños (incluido su estado de nutrición). Se organizó un taller para transmitir los resultados y para diseñar una intervención de múltiples componentes basada en un marco ecosistémico de la salud.

Resultados. Se encontraron numerosos factores de riesgo ambientales, especialmente los relacionados con el agua y el saneamiento. El análisis del conocimiento, las actitudes y las prácticas reveló el uso de medicamentos tradicionales y occidentales, y profundas brechas de conocimiento. Había antibióticos en 60,9% de los hogares de Correuco y en 46,8% de La Posta; las tasas de desnutrición eran de 22,2% en Correuco y de 26,1% en La Posta; el mes anterior a la encuesta 26,7% de los niños de Correuco y 47,8% de los niños de La Posta habían tenido episodios de diarrea, con prescripción de antibióticos en 50,0% y 47,1% de los casos, respectivamente; y 28,9% de los niños de Correuco y 47,8% de los niños de La Posta habían tenido infecciones respiratorias agudas, con prescripción de antibióticos en 53,8% y 50,0% de los casos, respectivamente.

Conclusiones. Deben abordarse los factores ambientales, sociales y culturales para prevenir la resistencia a los antibióticos, además de capacitar al personal de salud. Un enfoque ecosistémico es adecuado para alcanzar esta meta.

Palabras clave Farmacorresistencia microbiana; agentes antibacterianos; prescripciones de medicamentos; población indígena; preescolar; estudios de intervención; Ecuador.