
Determinants of Antimicrobial Use in the Developing World

Aryanti Radyowijati and Hilbrand Haak



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Antibiotics, one of the greatest blessings of modern medicine, threaten to become a curse to many due to large-scale inappropriate use. Aryanti Radyowijati's and Hilbrand Haak's review on determinants of this inappropriate use is more than timely and may prove extremely useful in combating the problems linked to indiscriminate prescription, dispensing and global use of antibiotics.

Antibiotics have much in common with other medicines that are used outside professional observation and control. However, the one aspect that makes their inappropriate use extra problematic, if not dramatic, is drug resistance. In 1968, biologist Garret Hardin wrote his famous article, 'The Tragedy of the Commons,' in which he remarks that people's pursuit of their own interests leads to the destruction of their common good. Hardin's "mythical" metaphor, which he uses for his argument, is the medieval common pasture in English communities. As each herdsman tries to keep as many cattle as possible on the commons, they eventually destroy the pasture and are left with nothing. This 'tragedy of the commons' can be applied to countless aspects of our present global society, including the over-prescription of antibiotics. The individual advantages that physicians, nurses, pharmacists, drug sellers, and sick people derive from the inflated use of antibiotics leads to a serious problem in the public domain of health and health care: the development of resistant strains of pathogens. And in a society whose members are becoming increasingly more individualistic, the plain message that people should restrict their use of antibiotics for the good and well-being of others is unlikely to carry much weight.

The review by Aryanti Radyowijati and Hilbrand Haak is a valuable guide to the limited amount of available literature on the use of antibiotics. They focus on those that attempt to understand practices within their wider context. Harmful practices may appear beneficial to insiders for social, cultural, political, or economic reasons. Future damage does not always outweigh today's advantages. What has been proven irrational and reprehensible from a biomedical point of view may carry a perfectly rational social logic for those steeped in the daily struggle for survival.

This review is particularly valuable because it points not only at 'irrational' beliefs and questionable practices by 'lay' members of local communities, such as parents, merchants and traditional healers, but it also draws attention to 'irrational' and harmful practices carried out by actors of the medical profession, or those closely affiliated with it. 'Culture' is not only a feature of populations living outside academia. All aspects of a culture—its beliefs, values, and emotions, its way of transmitting ideas, its pursuit of political and economic interests, its egocentrism and ethnocentrism, and its sense of superior identity—also apply to professional and scientific groups within a society. Physicians, nurses, primary health care workers, and pharmacists have their own reasons for inappropriate use and dispensing of antibiotics. They perceive advantages in practices, which, strictly speaking, conflict with their own canons.

Medicines are an attractive commodity. They are in constant demand and are considered indispensable and essential to daily function. Moreover, they are small and can easily be transported, even by sellers on foot or bicycle. Medicines, labeled as prescription only (including antibiotics), are sold without prescription, even in the formal sector. They are for sale in drugstores, general shops, kiosks and market booths, and peddlers bring them to remote villages and homesteads. Nichter and Nichter (1996) refer pessimistically to this behavior as the pharmaceuticalization and commodification of health:

The proliferation of commercially produced pharmaceuticals and a concurrent rise in medicine consumption is a concrete expression of health commodification. It entails the commodification of health to a point where medicine fixes to life's immediate problems, increasing 'appeal' to the public. Health commodities do not have to be pushed, they are demanded.



Aryanti Radyowijati and Hilbrand Haak conclude that limited information is available on 'why people use antibiotics.' I agree with them. But I would like to draw attention to the wealth of information on 'why people use antibiotics' that is available from in-depth case studies. These studies, mainly carried out by anthropologists, are less well known to health professionals. People draw antibiotics, originally 'foreign' objects, into their own world by clothing them with explanations and meanings from their own culture—a phenomenon that is sometimes called 'cultural reinterpretation.' Other terms for this process are 'bricolage,' 'creolization,' and 'pidginization.' One of the earliest examples of this cognitive process is Michael Logan's (1973) description of how Maya people in Guatemala classify antibiotics in accordance with their general hot/cold cosmology. Penicillin is seen as a 'cold' medicine and is used for various diseases that they classify as 'hot,' but which are immune to antibiotic treatment according to biomedical observers. More recent examples can be found in case studies of Ghana (Senah 1994 and 1997), the Philippines (Tan 1999) and Thailand (Sringernyuang 2000). The explanatory power of these studies should not be underestimated and in the current situation, policy makers may not have another choice than to take qualitative research on antibiotic use more seriously.

Viewed from the perspective of the 'Tragedy of the Commons,' the biomedical inappropriate use of antibiotics in all countries of the world, not only the poorer ones, may eventually lead to its own destruction. It is of critical importance that we start learning what is really going on.

Sjaak van der Geest
Medical Anthropology
University of Amsterdam

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Antibiotics play a key role in treating diseases of bacterial origin, a major cause of morbidity and mortality in the developing world. High levels of consumption, often clinically unnecessary, have led to a steady increase in drug resistance, particularly to antibiotics used in treating high prevalence diseases. The effectiveness of many antibiotics is lost almost as quickly as scientists discover them.

This review provides information from well-designed scientific studies on the factors that influence the use of antibiotics by health providers, dispensers and community members in non-industrialized countries. These practices tend to be determined by a complex and multi-layered mix of medical, psychosocial, cultural, economic, and political factors. Understanding these factors can lead to the development of more effective policies and programs to address inappropriate antibiotic use.

Determinants of antibiotic use by community members

Drug use is strongly influenced by cultural preferences and beliefs. Prescribers, dispensers, and consumers share similar perceptions on health, illness, and antibiotics. Antibiotics are often perceived as 'strong' almost magical medicines, capable of curing nearly any kind of disease. Many cultures believe that antibiotics also have the ability to prevent disease. Local cultural traditions have also developed related to the use of specific antibiotics, e.g., based on color or imitating methods used in traditional medicine. People are willing to pay high prices for antibiotics, and if they cannot afford a full course, will purchase them in smaller quantities.

Self-medication is often seen as an important determinant of improper antibiotic use. However, a patient's decisions about whether and how to use antibiotics are themselves influenced by more fundamental factors, e.g. lack of access to appropriate health care, poverty, or the stigma associated with having certain illnesses. Interventions should address these underlying determinants of self-medication, rather than focusing exclusively on the phenomenon itself.

The decision to self-medicate or to seek care from other sources is determined by perceived symptoms, knowledge about treatment options, and their availability and accessibility. Advice may be sought from physicians, pharmacists, pharmacy clerks, paramedics, traditional healers, family, or friends at any time during an illness. Each group of advisers has its own specific characteristics, advantages, and disadvantages.

Physicians influence antibiotic use in three ways: by giving verbal recommendations to buy antibiotics, by writing prescriptions, or by prescribing and directly dispensing drugs. Doctors' practices can legitimize popular choices of antibiotics, and their previous prescribing can be an important factor in determining self-medication. Despite their importance, there is evidence that some people prefer not to consult physicians for day-to-day health problems, because of the high cost and time investment, lack of trust, or the easier availability of pharmacies.

In most legal systems, qualified pharmacists must manage pharmacies, and dispensing should be restricted to drugs prescribed by a qualified physician. In practice, drugs are frequently sold without prescription, and many pharmacies conduct physical examinations or make treatment recommendations. Traditional practitioners often lack access to sophisticated medical technology, but some have started to include western medicine, including antibiotics, in their daily practice. They rarely receive training in antibiotic prescribing, and their information about drugs comes mostly from informal, non-medical sources, or from pharmaceutical representatives.

Economic considerations are also important determinants of community antibiotic use. The decision to buy medicines, and the amount of it, is often influenced by factors such as a drug's price and a consumer's ability to pay. Poverty, lack of access to appropriate health care, and drug company marketing are also often believed to cause improper use of antibiotics, but these factors have not been well examined in research studies.

Determinants of antibiotic prescribing

It is commonly believed that physicians' practices are largely determined by what they know about illness and about correct prescribing, but there is little evidence to support this assumption. There are frequent discrepancies between biomedical knowledge and prescribing practices. Knowledge may be necessary for good practice, but improving knowledge may not improve prescribing. Peer norms and the local medical culture are other important influences on antibiotic prescribing.

Prescribers in industrialized countries may fear legal action for not practicing evidence-based medicine, but their colleagues in non-industrialized countries may be more concerned about losing clients if they do not deliver a fast cure. Many doctors report that patient demand influences their prescribing decisions. Giving a prescription is perceived as the easiest way to end a consultation, but little is known about whether patients can be satisfied by less harmful drugs than antibiotics.

Financial incentives are an important factor to prescribers, and fear of losing business or the higher profit margins of expensive drugs may result in inappropriate practices. Some physicians believe their reputations would suffer if they do not prescribe desired antibiotics. This economic rationale is especially strong in private settings where patients pay for services.

The ability to provide appropriate therapy may be limited by the lack of functioning laboratories, although physicians do not always use laboratory facilities when they are available. Consistency of drug supply can also affect prescribing. Prescribers in health facilities may adjust prescribing practices to whatever drugs are in stock.

The pharmaceutical industry has a strong financial incentive to market drugs to doctors and pharmacists in non-industrialized countries. Despite many reports on commercial pressures in drug prescribing, most of this literature is anecdotal. Little is known about how this influence works, and how it is able to encourage health care providers to use specific products.

Determinants of antibiotic dispensing and sales

Dispensers of antibiotics in non-industrialized countries range from public sector facilities, to dispensing physicians, commercial pharmacies and retail shops, and traditional healers. Each system can contain formal, informal, illegal, and clandestine aspects of antibiotic distribution. Pharmacy clerks with a wide range of backgrounds commonly handle day-to-day activities in pharmacies. Many customers do not differentiate between untrained street vendors and pharmacists, and all are regarded as knowledgeable. This variety of settings and people makes studying dispenser-related determinants of antibiotic use a challenge.

Drug dispensers have considerable influence on community drug use. The dispenser is not only expected to be knowledgeable on biomedical concepts, but also to be acquainted with popular and folk traditions. Many people prefer to purchase drugs directly from pharmacies instead of from physicians because of easier accessibility, lower cost, and closer social and cultural ties. Although quantitative aspects of dispensing have been studied, little is known about the characteristics of dispensers and the role they actually see for themselves.

The level of knowledge of dispensers about illness and correct use of antibiotics has not been well researched. Dispensers are usually prepared to negotiate the type and quantity of drugs with customers, and clients' purchasing power is often the ultimate deciding factor. Dispensers frequently defer to clients' ideas on appropriate care and necessary medicines. It is often difficult to differentiate whether pharmacy attendants or customers determine the medicines to be purchased.

Pharmacists' dispensing is also influenced by pressure and sales incentives from their suppliers. Despite reports on marketing methods from a few countries, little is actually known about industry practices in promoting antibiotic sales through pharmacies.

Program priorities

The rapid growth in antimicrobial resistance demands concerted action. Governments, public and private institutions, and medical leaders need to implement policies and programs that encourage changes in the way antibiotics are used. To achieve lasting change, interventions will need to be multifaceted, long-term, and based on solid understanding of the behaviors involved. Strategies that lean too heavily on professional education are not likely to result in large-scale or long-lasting improvement. Based on the findings of this review, some priorities for action would include the following:

Governments should create appropriate regulations and programs to address antibiotic use and resistance, especially among private medical providers and dispensers.

Health delivery systems should routinely assess appropriateness of antibiotic use, and adopt policies and ongoing quality improvement programs that encourage more appropriate use.

Health training institutions should incorporate an explicit component in their curriculum on appropriate use of antibiotics and the problem of antibiotic resistance.

Professional societies should offer modern, evidence-based continuing education programs about antibiotic use that address the behavioral aspects of prescribing and dispensing.

Pharmaceutical companies should voluntarily control promotional messages about antibiotics, and should work together with other stakeholders to deliver information about prudent and correct use of antibiotics.

Consumer organizations should be encouraged to take up antibiotic use and resistance as consumer issues, and should be subsidized to provide simple, targeted information to consumers.

International organizations involved in pharmaceutical assistance programs should “add value to access” by integrating support for activities that encourage appropriate use of the drugs they provide, or are procured with their funding.



If programs are to be effective, future research must explore, in more depth, the sociocultural rationality in antibiotic usage. The most productive approach would be to combine quantitative studies of the patterns of antibiotic use with the rich variety of qualitative methods like case simulations, focus group discussions, in-depth interviews, informal interviews, or illness diaries to explore determinants. There is a need for such studies from all regions in the world, but especially from NIS countries, China, francophone Africa, Middle Eastern countries, and the Pacific region.

More information is needed on the economic motivations and perceptions of prescribers, dispensers, and consumers. Few studies have explored whether appropriate antibiotic use can be compatible with adequate profits. Research is needed on the role of price in determining perceptions of quality in the decision to purchase expensive antibiotics.

Antibiotic use is influenced by decisions made throughout the course of the illness process. There is a need to summarize what is known from the literature about disease recognition, care seeking, and antibiotic treatment for specific priority health problems (ARI, diarrhea, STDs, and TB). It would also be revealing to conduct a comparative review of the determinants of antimalarial use to see if common approaches to behavior change are justified for both classes of drugs.

Specific topics of interest in research on community use of antibiotics include how private sector physicians' prescribing shapes the practices of dispensers and community members, and how knowledge about antibiotics enters and is exchanged among members of the community. Research is also needed on the discordance between knowledge and prescribing among prescribers, and on low use of diagnostic services. It is also not known whether improving communication between prescribers and patients could reduce unnecessary antibiotic therapy. It is not clear how dispensers' knowledge and cultural notions about antibiotics reflect the prevailing opinions of their communities, or the extent to which counter attendants model physicians' prescribing or contribute to purchasing decisions by customers.

The pharmaceutical industry is felt to be an important force in determining antibiotic use. Little is known about how drug promotion affects consumers, or whether interactions with pharmaceutical representatives are the primary sources of antibiotic information for prescribers and dispensers. Experiences are needed to determine if companies can participate in promoting better clinical practice without distorting the messages about appropriate therapy or compromising their marketing.

Introduction

Diseases of bacterial origin constitute a major cause of morbidity and mortality in the developing world. Although many of these conditions can be prevented with improved personal hygiene; immunization; and environmental sanitation, antibacterial drugs are still the main therapy for many of them. This key role of antibiotics has led to high levels of consumption and high levels of spending for this category of drugs. At present, large portions of many national drug budgets are devoted to antimicrobial drugs and they are now the largest single group of drugs procured by most non-industrialized countries⁽⁹²⁾. Antibiotics are available to the public from a variety of sources, including hospitals and pharmacies⁽⁶⁾; licensed medicine stalls and drugstores^(13,6,31); and roadside stalls and hawkers^(59,6,88). Antibiotics can be purchased without a prescription in most African, Asian, Latin American and Eurasian countries, even when this practice is illegal.

Widespread availability and inappropriate use of antibiotics by patients and healthcare providers has led to a steady increase of drug resistance, particularly to key antibiotics (cotrimoxazole, erythromycin and tetracycline, ampicillin and chloramphenicol) in the treatment of high prevalence diseases. In the future, this misuse may cause the effectiveness of many antibiotics to be lost almost as quickly as scientists discover them⁽⁹⁶⁾.

Table 1.

Prevalence of anti-microbial resistance of *E. Coli* strains isolated from children in 2 communities in Bolivia.

Percentage of *E. Coli* strains testing resistant

	Community 1	Community 2
Amikacin	0	0
Ampicillin	97	87
Cefotaxime	0	0
Cephalothin	10	25
Chloramphenicol	69	57
Ciprofloxacin	0	0
Co-trimoxazole	94	71
Gentamicin	5	0.6
Nalidixic acid	4	0.6
Nitrofurantoin	5	0
Piperacillin	54	33
Tetracycline	92	80

From: Bartoloni, A., Cutts, F., Leoni, S., et al. (1998). *Patterns of antimicrobial use and antimicrobial resistance among healthy children in Bolivia, Tropical Medicine and International Health*, 3, 2, page 120.

In addition to prescriptions from clinically trained healthcare providers and authorized drug dispensers, the decision to use antibiotics is also made by patients through self-initiated purchase⁽²⁶⁾.

Drug use and prescribing behaviors tend to be determined by a complex and multi-layered mix of medical, psychosocial, cultural, economic and even geopolitical factors, including:

- access and non-access to antimicrobial drugs,
- poor diagnostic skills,
- economic factors,
- patient pressure,
- poor education of health workers, and
- promotional activities of pharmaceutical companies⁽⁹⁴⁾.

Consequently, attempts to improve antibiotic use are much more complicated than the mere training of prescribers, dispensers, or users of these drugs.

There is now widespread recognition of the serious health consequences of inappropriate antibiotic prescribing and use in both industrialized and non-industrialized countries^(95,96). The need for more 'rational' antimicrobial use has also been identified^(10,15,48). However, the sociocultural and economic factors that determine poor prescribing and usage practices are not always fully understood.

This review provides systematic information on factors that influence the use of antibiotics by providers, dispensers and community members in non-industrialized countries. It attempts to improve understanding, and guide the development of interventions to address inappropriate antibiotic use. Appendix I provides an overview of the studies that form the basis for the review.

Cultural aspects of pharmaceutical use

Determinants of antibiotic use by community members

Drug use is influenced by cultural preferences and beliefs. There is an almost universal desire and demand for drugs in all countries. An often-quoted notion is that ‘there is a pill for every ill’ (29,64). The term ‘antibiotic culture’ is sometimes used, and means that for every ill-defined symptom, antibiotics are indicated. This notion exists not only in the minds of lay people, but among health care professionals as well. This ‘antibiotic culture’ is responsible for the high use of this class of medicines (89,28). Folk beliefs and traditions are felt to influence antibiotic use in many cultures (18,21,22,26,29,57). Dispensers and prescribers often belong to the same ethnic or geographical groups as their patients or customers, and they share perceptions on health, illness, and antibiotics. Appreciating the importance of cultural beliefs is especially important when designing interventions to improve the use of antibiotics.

Powerful medicine

Antibiotics are a class of western medicine that is often perceived as ‘strong’ medicine: capable of curing almost any kind of disease. In their classic study in West Africa, Bledsoe and Goubaud (7) reported that people have specific criteria for selecting medicines. Color is one of the most important factors that determines perceived efficacy. Multicolored capsules are believed to be particularly effective because the different colors imply that several kinds of medicine have been combined to make a very powerful drug.

A secondary school graduate reported that he took a “red and black” capsule, the antibiotic ampicillin, after a hard day’s work on the farm, to treat the sore body and to wake up refreshed for another day (Bledsoe & Goubaud 1985, p. 280).

The perceived effectiveness of antibiotics can even reach magic proportions. When asked an opinion about the popular antibiotic Ambra-Sinto® (Tetracycline-HCl), one Brazilian respondent remarked:

“If Ambra-Sinto® does not help, nothing will!” (Haak 1988, p. 1424)

One of the consequences of this powerful image is that antibiotics may cost more than other drugs (22). A full course of antibiotics may even become unaffordable, or, if it must be used, it may be purchased in smaller quantities (50, 22). Local beliefs may influence the use of antibiotics in other ways. For example, in India it is believed that the ill body requires both antibiotics, and a tonic to enhance its innate strength. Because antibiotics are expensive, spending on them is often reduced to pay for the tonic (21).

Antibiotics to prevent illness

Many cultures believe that antibiotics have the ability to prevent disease. For example, mothers in Ghana believe that antibiotics can be used to prevent cough and fever (18). In the Philippines, taking an antibiotic is a common practice to prevent diarrhea—especially after eating foods of doubtful hygienic status. Any medicine in capsular form, including antibiotics, are considered good for preventing sexually-transmitted diseases (STDs). In Zimbabwe (57), and in the Philippines, STDs are believed to be preventable by taking an antibiotic immediately after visiting a prostitute (1).

Rural populations in Brazil regard Ambra-Sinto® (Tetracycline-HCl) as the medicine of choice against measles. It is not used to treat measles, but rather to prevent the often fatal respiratory tract infection that sometimes follows. Because it is believed that any fever in children may signify measles, most fevers are also treated with Ambra-Sinto® (29).

Popular antibiotic practices

People often establish their own criteria for which type of antibiotic to use in certain health problems. In Nigeria, ampicillin and tetracycline are believed to be suitable for the treatment of virtually any ailment, especially STDs, cough, stomach upset and diarrhea (58). In Pakistan, virtually any drug other than metronidazol are used frequently for respiratory tract infections (78). Vietnamese drug purchasers believe that antibiotics are indicated for inflammations, infections, diarrhea and fever (22). Villagers in Brazil use antibiotics to treat flu, fever, abdominal pain and diarrhea (29), and mothers in Ghana use them to treat cough, fever and rhinorrhea (18).

Table 2.

Antibiotic usage and adequacy in 287 diarrheal episodes of 8279 individuals in a Mexican community.

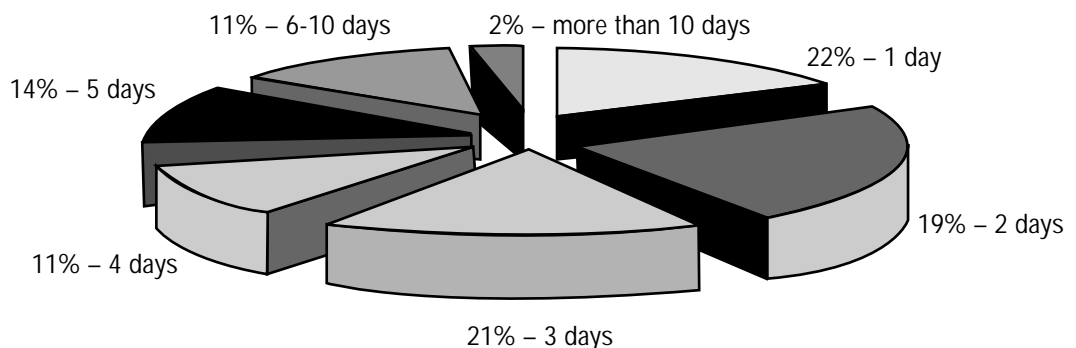
Antibiotic use in episodes of diarrhea		
	Seen by a physician n = 91	Not seen by a physician n = 196
Antibiotic use amongst all patients:		
• At least one antibiotic	64.8%	23.5%
• More than one antibiotic	22.0%	1.5%
Incorrect use by patients who took antibiotics:		
• Wrong drug/dose	64.4%	82.6%
• Short duration	53.1%	95.6%

Adapted from: Bojalil, R., Calva, J.J. (1994). Antibiotic misuse in diarrhea. A household survey in a Mexican community. *Journal of Clinical Epidemiology*, 47, 2, page 150.

Indications for drug use amongst lay people are usually broader than the diagnostic keys used by doctors and are more often focused on symptoms. Subsequently, use of an antibiotic may be stopped as soon as the target symptom has been resolved (23). Sometimes, methods used in traditional medicine are imitated. For example, antibiotic powder may be poured into a wound or mixed with pork fat and rubbed on lacerations (29).

Figure 1.

Duration of anti-microbial therapy in past episodes of acute diarrhea of 8279 individuals in a Mexican Community.



Adapted from: Bojalil, R., Calva, J.J. (1994). Antibiotic misuse in diarrhea. A household survey in a Mexican community. *Journal of Clinical Epidemiology*, 47, 2, page 151.

There are many reasons why antibiotics are used in inadequate quantities. A survey of pharmacy customers in the Philippines concluded that insufficient stocks in drugstores is one of the key factors. Some customers stated that they had bought and used small quantities at an earlier time without any harm, and others wanted to test the drug first to know whether the drug had undesirable side effects ⁽⁵⁰⁾. Antibiotic purchasers in India believe in the innate balance of strength and weakness of the body, and prefer to buy a small test dose of the antibiotic first, and the rest of the prescription only if they begin to get well ⁽²¹⁾.

Antibiotic purchasers in Vietnam didn't take a full course of antibiotics because:

- they believed that antibiotics may be harmful
- they had doubts about the actual necessity, or
- other community members told them not to take the full course of treatment.

They also stated that if they did not feel better after taking some of the drug, they would stop taking it and change to another medicine, often another antibiotic ⁽²²⁾.

Self-medication

The World Health Organization (WHO) defines self-medication as the selection of medicines by individuals to treat self-recognized illnesses or symptoms ⁽⁹⁸⁾. It does not distinguish whether a prescription was presented when buying the drug. Trying to ascertain use of antibiotics with or without prescriptions is cumbersome, because repeat prescriptions, and prescriptions for others may be presented at the point of drug sale. In addition, a doctor or a nurse cannot ensure that patients take medicines as instructed. Unless a health worker administers medication, any drug, including antibiotics, may be used differently than intended.

Self-medication is often seen as an important “determinant” of improper antibiotic use. However, a patient's decisions about whether and how to use antibiotics are themselves influenced by more fundamental factors, e.g. lack of access to appropriate health care, poverty, the stigma associated with having certain illnesses, and so forth. Interventions to improve antibiotic use should also address these underlying determinants of self-medication decisions, rather than focusing exclusively on the phenomenon itself.

There is an impressive database on self-medication and general drug use practices in the world, and attempts have been made to provide a general review of the subject ^(81,32). Self-medication is practiced widely and is by far the most common medical action.

Quantitative assessments of antibiotic use in the community (self-medication or prescribed) vary widely, and probably reflect local drug-use cultures. In a community study in Brazil, antibiotics were the group of medicines that were most often used in self-medication ⁽²⁹⁾. In a Nigerian community, all members admitted that they had used an antibiotic at least once for a variety of symptoms, and a majority of them stated that they had treated themselves once or more with antibiotics before consulting a physician ⁽⁵⁸⁾. Surveys of pharmacy sales confirm these high rates of self-medication with antibiotics. In Nigerian pharmacies, oral or injectable antibiotics were the second most frequent treatments sold for dysentery and diarrhea ⁽³⁷⁾. Customers may choose to use several drugs, including antibiotics and injections ⁽⁴⁾.

In some settings, one particular antibiotic may be extremely popular. In Brazil, one of the most common types of medicines used in self-medication is Terramicina[®] (oxytetracycline) ⁽²⁹⁾. The drug is widely used to treat all kinds of intestinal disturbances, and regarded as a practical intestinal stabilizer. Another tetracycline, Ambra-Sinto[®] (tetracycline-HCl), is regarded as the best treatment for small children who are teething. The product is even considered as a kind of calcium supplement, a drug which should be taken during dentition. Tetracycline capsules are also extremely popular in

Cameroon⁽⁸³⁾. Tetracycline, cotrimoxazole and ampicillin/amoxicillin, are also frequently used for acute respiratory infections (ARI) and diarrhea^(58, 60, 21, 22, 13, 6, 8, 78). These findings suggest that antibiotics in general, and tetracycline in specific have become “indigenized” and are used as if they are authentic local products⁽²⁸⁾.

Motives for self-medication with antibiotics include the need to save money, and the desire to act expeditiously to treat ‘confirmed’ or suspected bacterial infections⁽²⁾. For example, 50-80% of Bangladeshi patients infected with shigella took at least one antibiotic in the two weeks before a hospital visit⁽⁷³⁾. In China, 18-70% of children with ARI were self-medicated with antibiotics⁽³⁶⁾. The need to save money is particularly strong when people believe that they have experienced an illness earlier, and that they can now handle it themselves. An Indian patient stated:

...whenever I get these symptoms and go to a doctor, he gives me the same medicine and charges me 10 rupees. So why not just buy the medicines? (Dua et al 1994, p. 720)

When privacy is important, self-medication may offer a way to remain anonymous. Especially when a social stigma is involved (for example, a sexually-transmitted disease), direct purchase of an antibiotic from a pharmacy enables the patient to conceal shameful or embarrassing complaints⁽⁷¹⁾.

Sources of advice

Care seeking is an interactive process determined by three distinct factors:

- symptoms of the disease,
- knowledge of the treatment options, and
- availability and accessibility to treatment options.

Advice may be sought at any time and in any stage of the disease or the symptom. Sources of advice include physicians, pharmacists, pharmacy clerks, paramedics, traditional healers, family members and friends. Each group of advisers has its own specific characteristics, advantages, and disadvantages.

Physicians

Physicians influence the use of antibiotics in the community in three distinct ways: by giving recommendations to buy antibiotics (unwritten or ‘verbal’ prescriptions), by issuing written prescriptions, or by prescribing and directly dispensing drugs^(88,13).

Physicians are usually seen as authority figures. Their written prescriptions are valued. Doctors’ prescribing habits are thus an important factor in self-medication⁽³¹⁾. In India, 75% of pharmacy clients who bought antibiotics without a prescription based their decision to buy the drugs on an earlier recommendation from a physician⁽²¹⁾. Similar findings are reported from other countries^(50, 13, 6). In Mexico, antimicrobial therapy was found to be up to seven times more likely if a sick person had seen a physician⁽⁸⁾. Likewise, in urban Thailand, low antibiotic use rates for childhood diarrhea resulted from caregivers’ decisions not to take their children to a healthcare provider⁽⁸⁸⁾. In the Philippines, community members rank antibiotics third for the treatment of diarrhea and ARI, but physicians rank them second⁽³¹⁾. Furthermore, in a Mexican study, 61% of all episodes of diarrhea were treated with one or more antibiotics that had been prescribed by a physician⁽⁸⁾.

In contrast, physicians and public health facilities are often the last resort for some patients^(43, 55). These patients seek consultation only if an illness is perceived as serious and persistent, or only after failure of self-medication and advice from community members and pharmacists. There is evidence that people prefer not to consult physicians for day-to-day health problems, because of the high cost and time investment, lack of trust in western doctors, or easier availability of pharmacies⁽²²⁾.

These two contradictory findings point to a need for additional research into the role of physicians in community use of antibiotics. According to Hardon ⁽³²⁾, lay people often follow the example of a physician when they self-medicate. Doctors have the role of ‘legitimizing’ popular choices of pharmaceuticals, and the consequences of inappropriate antibiotic prescribing by physicians may be large. A solid understanding of the influence of physicians’ antibiotic prescribing practices on community antibiotic use is therefore of critical importance in community intervention studies.

Pharmacies

In most legal systems, pharmacies must be managed by qualified pharmacists. They also have to restrict their activities to dispensing only those drugs that are directly prescribed by a qualified physician. They are barred from diagnosis and prescription. In practice, however, drugs, including antibiotics, are sold without presenting a prescription, and many pharmacies have special rooms for physical examinations and injections ^(72, 86). In non-industrialized countries, pharmacies are often the first source of advice for patients who seek care ^(50, 36, 35). In some instances, pharmacies even have commercial contacts with medical clinics or private doctors.

Pharmacy personnel in the Philippines and Mexico give patients advice to buy antibiotics ^(50, 13), while in Egypt pharmacy staff simply refill old bottles of antibiotics, in most cases, without requesting a prescription ⁽⁴⁴⁾. Because of this easy access, Egyptian mothers consider pharmacies more convenient than physicians when treating their children’s ARI episodes ⁽⁴⁴⁾. Mothers in poor Brazilian urban slums seek treatment from pharmacies because it is cheaper and less time consuming ⁽⁷¹⁾.

Traditional medical practitioners

Traditional medical practitioners tend to practice without formal supervision. They often lack access to medical technology, such as X-ray and other diagnostic services. They rarely receive training in antibiotic prescribing, and their sources of information on indications, contraindications, and adverse effects of drugs come mostly from informal, non-medical sources, or from pharmaceutical representatives. Although they are valued and trusted by patients, their contributions to the health and well-being of patients are often ridiculed or ignored by modern medical practitioners ⁽⁵⁵⁾.

Some traditional healers include western medicine, including antibiotics, in their daily practice. In India and Sri Lanka, traditional healers often dispense antibiotics to their clients ^(74, 91). For example, a recent study found that an ayurvedic healer in India used penicillin injections in the treatment of serious infections, such as skin ulcerations and for pulmonary tuberculosis and ‘asthma’ (including tropical pulmonary eosinophilia). He also applied penicillin externally in the treatment of abscesses and conjunctivitis. Because his patients demanded antibiotics, the ayurvedic healer was unable to eliminate penicillin from his practice. Rather, he interpreted penicillin as a part of ayurveda—he understood it in terms of its ability to heat and dry the body, and in respect of its antiseptic power ⁽¹¹⁾.

As any entrepreneur would, traditional healers attempt to incorporate the latest technology, into their daily practice. Competition with western doctors may be stiff and the ability to prescribe antibiotics attracts patients. Conversely, in an examination of community drug use in Brazil, traditional medical practitioners did not rank high in providing advice on taking drugs. Rather, pharmacies and physicians have assumed the role of primary healthcare providers and have introduced the common use of modern drugs, including antibiotics ^(71, 29).

Lay persons

Informal care networks can have an important influence on the use of drugs. Drug store customers in the Philippines, India, Mexico and Brazil based their decisions to buy antibiotics on advice that was given by friends or relatives ^(50, 21, 13, 71). In the Philippines, nearly 50% of mothers mentioned sources of information that were outside the formal healthcare network. They claimed that they or

their relatives “knew what to do.” A Filipino professional explained that there is a common body of knowledge in the village: “People know that Polymagma® is for diarrhea, massage with castor oil is good for an upset tummy, Aspilet® for fever” (31).

Lay networks and professional healthcare workers are not necessarily mutually exclusive. Professional health workers may live in the community in which they practice, and their practices may be influenced by folk traditions and perceptions (76). Similarly, informal care providers or lay persons may learn from health professionals and recommend western biomedical treatments. In his study in Brazil, Haak (29) illustrated this phenomena as follows:

A family from one of the villages proudly showed me their own domestic pharmacy, containing among other items, tetracycline-, chloramphenicol-, and steroid- preparations. All of these drugs had been prescribed by a physician, the mother declared with satisfaction. However, she used them completely according to her own ideas (Haak 1988, p. 1416).

The extent to which lay advice influences decisions to use antibiotics is not very well described in available research reports. What is clear is that when no better options are available or accessible, people tend to rely on successful experiences from fellow community members, and that they may even pass them on to others. But, clear data on this important source of advice is lacking and additional research data is necessary to understand the complexity of influences of care-seeking patterns in the use of antibiotics.

Economics, gender, and other factors

Economic considerations are also important determinants of community antibiotic use. In Brazil, the decision to buy medicines is often influenced by factors such as the drug’s price and the purchasers’ financial means. For example, if a patient is poor or has only limited means, a doctor’s prescription for an antibiotic and antipyretic may result in purchasing only the less costly antipyretic (29). In the Philippines, the major reason for not buying the prescribed quantity of antibiotics was the limited purchasing power of the patient (50). Further work is urgently needed to understand the economic aspects of antibiotic use in the community.

Gender is also a possible determinant of antibiotic use. In India, customers purchased antibiotics more frequently for male patients, and this difference is greatest in infants and children and smallest in patients 50 years of age or older. This likely reflects a bias in favor of males, especially male children, when it comes to providing food and healthcare (21).

Poverty, lack of access to appropriate health care, and drug company marketing are also often believed to cause improper use of antibiotics, but these factors have not been well-examined in research studies.

It is commonly believed that physicians' practices are determined by what they know about illness and about correct prescribing. If this is the case, poor prescribing could be improved by updating knowledge alone.

However, the real situation can be considerably more complex. Despite established guidelines on oral rehydration therapy for acute diarrhea in children, Indonesian prescribers feared that patients might have other infections; that only prescribing ORS was not enough; that it was better to prescribe an antibiotic immediately rather than wait for an illness to become more serious; that other prescribers might already have exhausted possible treatment options; and that patients expected to receive other types of treatments from private physicians. Most physicians believed that the advantages of antibiotic therapy outweighed the disadvantages, which were primarily seen to be the increased economic burden for patients ⁽⁴¹⁾. As this example demonstrates, many factors besides lack of knowledge are involved in improper use of antibiotics.

	Variations in prescribing						
	District Hospital	Health Centre 1	Health Centre 2	Health Centre 3	Health Centre 4	Health Centre 5	Health Centre 6
Average no. of drugs per patient	2.6	3.8	5.1	9.1	4.3	3.1	4.3
Average percentage of patients receiving at least one antibiotic	41%	45%	79%	98%	59%	42%	41%
Average no. of antibiotics per patient	1.1	1.1	1.4	2.0	1.1	1.1	1.1

Adapted from: Bosu, W.K., Ofori-Adjei, D. (1997) Survey of antibiotic prescribing pattern in government health facilities of the Wasa-west district of Ghana. *East African Medical Journal*, 74, page 139.

Table 3.
Large variations in antibiotic prescribing practices in a district in Ghana.

Lack of knowledge

Knowledge of diagnostics and therapeutics can play a role in inappropriate prescribing of antibiotics ⁽⁴⁶⁾. Javato-Laxer ⁽⁴²⁾ explains that because of their failure to determine etiologies of infections, physicians often prefer to use broad-spectrum antibiotics, believing that this will cover all possible etiologies and unusual pathogens.

It is often assumed that differences in prescribing practices of healthcare providers are related to a varying level of training and knowledge ^(9, 77, 59). However, there is little evidence to support this assumption. For example, in Bangladesh, prescribing rates for metronidazol were the same for both 'doctors' and 'medical assistants' ⁽²⁷⁾.

There are also discrepancies between biomedical knowledge and actual prescribing practices. In Indonesia, physicians in public hospitals and health centers explained their belief that viruses caused more diarrheal disease than bacteria, and thus they considered antibiotics ineffective. Private practitioners held such beliefs in similar rates. However, despite these stated beliefs, more than half of each group prescribed antibiotics for the treatment of diarrhea ⁽²⁵⁾. In a Peruvian study most physicians (36 out of 40) knew when antimicrobials were needed to treat diarrhea. However, a practice assessment demonstrated that 35 of these 36 physicians prescribed an antimicrobial to one or more surrogate patients. Questionnaire data showed that absence of blood in the stools had been mentioned, but that this knowledge did not prevent them from prescribing antimicrobial drugs ⁽⁶²⁾.

Appropriate knowledge is necessary for good practice, but it may not be a panacea for improving antibiotic prescribing practices. To what extent appropriate knowledge positively influences physicians' antibiotic prescribing decisions in non-industrialized countries is largely unknown.

Fear of bad outcomes

Prescribers in non-industrialized countries frequently weigh the 'risks' of various treatment options. There is often the fear that disease outcomes may be poor without antibiotic treatment. Whereas prescribers in industrialized countries may fear legal action for not practicing evidence-based medicine, their colleagues in non-industrialized countries may fear the risk of losing clientele if they do not deliver a fast cure, or when unpleasant side-effects accompany the prescribed medication.

Peruvian physicians mentioned a need to prevent possible 'complications' from diarrhea and they often feared having to deal with a potential case of cholera. Not prescribing an antibiotic was seen as very risky. They emphasized that mothers of children with diarrhea come only once and that proper follow-up is not ensured. To address that risk, antibiotics were often prescribed during first visits⁽⁶²⁾. On the other hand antibiotics are often considered risk-free⁽⁸⁶⁾, and side-effects or toxicity are thought to be minimal if the appropriate antibiotic is chosen⁽⁴¹⁾.

Nurses in primary care clinics in Zimbabwe also cited the fear of bad outcomes when prescribing antibiotics, even for simple health problems where they were not indicated. Consequences of not treating a potential case of pneumonia were felt to be far greater than unjustified use of an antibiotic⁽⁷⁷⁾.

In the words of one Filipino pediatrician:

Some doctors are scared that something might happen to their patients, so they start with a very strong antibiotic, for instance a first generation of cephalosporin, while all you need is to give penicillin or cotrimoxazole (...) Many doctors do not only treat the patients but also themselves. It is in fact to treat my anxiety—if anything goes wrong I know the patient is on antibiotics (In: van Staa 1993, p. 88).

Antimicrobial therapy is sometimes used as a diagnostic tool to reveal the nature of the illness. If the patient does not recover after an initial antibiotic treatment, then the need for further diagnostic activities arises.

We could have her stool examined to find out the cause of the diarrhea. That will cost you P 40. We can also give her these tablets (Flagyl®) without doing a stool examination. If she recovers, you have saved the P 40. If it gets worse, come back and we will see what we can do (In: Hardon 1991, p. 185).

Finally, the desire to play safe may even be transferred to patients. A private practitioner in the Philippines explained that he asked patients to initially purchase a limited number of tablets:

I always tell my patients to buy one fourth of the tablets that I prescribe for the full course of antibiotics, to test them out for allergic reactions. If no reaction occurs, I tell them they should go back and buy the rest. But if they always do so? (In: van Staa 1993, p. 89).

To design interventions to address inappropriate antibiotic prescription by healthcare providers, more information is necessary on risk perceptions of prescribers, as well as on how they understand concepts such as differences between various antibiotics and antibiotic categories, differences between broad and narrow spectrum antibiotics, etc.

Perceived patient demand

Perceived patient demand influences doctor's prescribing decisions. In Latin America, physicians prescribed antibiotics for conditions of viral etiology when pressed to do so by patients⁽⁸⁹⁾. Physicians in the Philippines stated that if they do not prescribe, patients may shop around for

another doctor, or buy medicines that may be more hazardous than ‘the few capsules of ampicillin’ they recommended⁽⁸⁶⁾. An Indonesian study reported that parents’ desire for potent drugs influenced private doctors’ and health center physicians’ to prescribe antibiotics to their children⁽²⁵⁾.

The influence of patient demand on physicians’ prescribing behavior is, however, controversial. Most physicians who participated in the Peruvian study believed that mothers expected a prescription. However, observations showed that variations in mothers’ behavior (passive or demanding) during visits, did not affect whether drugs were prescribed, which ones, and how many. Prescribing outcomes were generally the same for both groups of mothers. Further, the study investigated whether physicians prescribed antibiotics even if mothers asked them not to. Simulated patients visited five physicians who were previously qualified as ‘well informed.’ This study showed that physicians rarely changed their prescribing habits based on mothers’ opinions of treatment options⁽⁶²⁾.

Physicians can communicate the quality of their services to patients through the act of prescribing. In Peru, mothers visiting physicians with the best knowledge of correct treatment often left the consultation unhappy, since they received only ORS for their child with diarrhea. Paradoxically, they called these physician charlatans⁽⁶²⁾.

Patients tend to have faith in particular antibiotics, and their power as placebos may therefore be high. Physicians who prescribe these antibiotics in response to patient demand know that this placebo effect can contribute to a cure for the patient.

Research findings do not sufficiently explain whether the high trust placed on antibiotics as therapeutic agents comes from prescribers, patients, or both. Similarly, the role and quality of communication in the interaction between patients and healthcare providers is insufficiently explored. Giving a prescription or a drug is perceived as the easiest way to end a consultation, but little is known about whether patients can be satisfied by less harmful drugs than antibiotics.

Economic factors

Financial incentives are an important factor in antibiotic prescribing, and higher profit margins of expensive drugs may result in inappropriate prescribing practices⁽²⁵⁾. In rural China, health-system financing influenced the antibiotic prescription, both in frequency and in type⁽¹⁹⁾. Physicians tended to prescribe more expensive antibiotics for insured patients, resulting in higher profits for themselves⁽²⁰⁾, while patients requested more expensive drugs because they did not pay the full cost of prescriptions^(19, 20).

Fear of losing business is another important issue for prescribers. Some believe their reputations would suffer if they do not prescribe desired antibiotics. The majority of prescribers in non-industrialized countries are not well paid, and prescribing a drug may offer extra income. By recommending or prescribing a specific drug or antibiotic, prescribers may obtain a dual financial incentive: from the patient by selling a drug, and a bonus from the industry by recommending or selling a specific drug. Having expectations met may also deter patients from going to other healthcare providers. This economic rationale is especially strong in private settings where patients pay for services:

It is a Filipino custom. If you see a doctor, you must leave with at least 2-3 prescriptions at hand. Otherwise the patient might be disappointed and go to another doctor. If this is a paying patient, a doctor cannot risk that (In: van Staa 1993, p. 89).

In Vietnam, where doctors are also drug sellers, doctors are even reluctant to disclose the name of the drug that is prescribed. This ensures that patients will return, rather than simply refilling the prescription at a pharmacy⁽²²⁾.

Peer norms

Peer norms and the practice standards of senior clinicians also influence antibiotic prescribing. For example, in Indonesia in the early 1960's, drugs were very scarce. At that time, an influential senior pediatrician used streptomycin and phenobarbital to treat diarrhea. Some nurses apparently still use this formula today ⁽⁴¹⁾.

Prescribers can develop a unique local medical culture. In Peru the medical profession has developed a concept of 'diarrhea parenteral' that is quite different from western knowledge about disease causation. 'Diarrhea parenteral' may occur when an infection is present that affects a system other than the gastrointestinal tract (e.g. ARI) and that may cause diarrhea to develop. Antibiotics are felt to be necessary to treat the primary infection, which in turn would result in a cure of the diarrhea episode. As the concept is also taught in Peruvian medical schools, it may explain why many Peruvian physicians give antibiotics from the very beginning of each episode of diarrhea ⁽⁶²⁾.

Timely laboratory results

Lack of access to quality laboratory services is often regarded as a deterrent to the rational use of antimicrobial agents. In Bangladesh, more than 90% of antibiotics were used on an empirical basis. Reasons stated for antibiotic use, included limited availability of facilities for microbiological testing, unreliable results, and frequent differences in test outcomes from different laboratories ⁽⁶⁸⁾.

Lack of laboratory facilities or the inability of patients to pay for microbiological tests were said to be the main reason for prescribing antibacterials and antiamebics in a diarrhea prescribing study in Pakistan. However, the extremely short consultation time between doctor and patient was also a major reason for omitting laboratory tests ⁽⁵⁶⁾.

Interestingly, availability of laboratory facilities and personnel does not always stimulate physicians to use them before prescribing antibiotics. All hospitals in a Malaysian study had facilities for microbiological culture, but only 20% of antibiotic prescriptions were made on the basis of microbiological reports ⁽⁵¹⁾. Javato-Laxer ⁽⁴²⁾ also found in the Philippines, that despite availability of diagnostic facilities, half of the patients with antimicrobial treatments were given them prior to the identification of an etiologic agent.

Unstable antibiotic supply

The ability of prescribers to provide appropriate antimicrobial therapy may also be limited by the availability of indicated antibiotics. In Bangladesh and India, it was reported that medicines given in primary care facilities were usually prescribed according to availability patterns, and not according to patient needs. Most prescribers used a list of drugs that were in stock and they adjusted prescribing practices accordingly ^(27, 80). A Tanzanian study reached similar conclusions when comparing prescribing practices in different types of health facilities. Overuse of antibiotics in hospitals was thought to be caused by the range of antibiotics available there, which was much wider than in health centers ⁽⁵³⁾.

Pressure of pharmaceutical promotion

The pharmaceutical industry has a strong financial incentive for marketing drugs to doctors and pharmacists in non-industrialized countries. Company sales representatives and commercially-oriented drug publications are known to be a major source of information for prescribers ⁽⁹⁾. In Indonesia, prescribers receive payment for issuing certain drugs during promotional events. In the Philippines, pharmaceutical companies reinforce the notion of risk-free medicines and promote a 'why worry' attitude among doctors. However, despite many reports on commercial pressures in drug prescribing, most of this literature is anecdotal. While much is written about the influence of industry in the use of antibiotics, little is known about how this influence works, and how it is able to encourage health care providers to use specific products.

Antibiotic delivery systems in non-industrialized countries range from free, clinic-based provision in the public sector, to dispensing private physicians, commercially oriented sales systems (pharmacists and shop-keepers), and traditional healers (curanderos and herbalists). In each of these systems, formal, informal, illegal, and clandestine aspects of antibiotic distribution may be present⁽⁸²⁾. Each setting also presents different incentives for and barriers to appropriate antibiotic prescribing and use. Different types of clients may be drawn to different delivery systems, and patients may prefer to use different systems at different times. The variety in systems and preferences makes studying dispenser-related determinants of antibiotic use a difficult task.

Day-to-day activities in pharmacies are commonly handled by pharmacy attendants or clerks. Depending on the system, these clerks or attendants can have a variety of educational backgrounds. Igun⁽³⁸⁾ found that most Nigerians do not really differentiate between untrained street vendors and pharmacists, and that all are regarded as knowledgeable. In Somalia, nurses and pharmacists were present in private pharmacies, but that a variety of lay people (family members, and children) attended customers⁽⁷²⁾. In some countries, anybody working in a pharmacy may be considered to be a 'pharmacist.'

In people's opinion, pharmacists are those who deal with pharmaceuticals and able to give them advice when they have a health problem (Duong et al 1997, p. 1135).

Contrary to the term 'pharmacist'—which appears to have similar meanings in most settings—the terms 'chemist' or 'drug seller' have different meanings in different countries. In some countries, this group of professionals may have had simple drug-related training. For example, drug retailers in Nepal can attend a government sponsored training⁽⁸⁷⁾, but in Indonesia, they need a government license to run their shop⁽⁵⁴⁾. Shop keepers are another category. This category of dispensers operates from general stores that also sell some medicines. Their level of education is often low, and they usually do not have pharmaceutical training⁽⁸⁶⁾.

Drug dispensers have a great deal of influence on community drug use. Their position is often to mediate between health professionals and the popular sector⁽⁸¹⁾. The dispenser is not only thought to be knowledgeable on biomedical concepts of health and disease, he is also expected to be acquainted with popular and folk traditions, and he utilizes both in his communication with clients. People prefer to purchase drugs directly from pharmacies instead of from physicians because:

- There are more pharmacists than doctors in most regions;
- The medicines are cheaper to purchase;
- People have closer social and cultural ties to pharmacy attendants;
- They can conceal shameful or embarrassing complaints;
- They have greater confidence in western drugs than western doctors; and
- A visit to a pharmacy is generally less time consuming than visiting a public health facility⁽⁸¹⁾.

Community members appreciate the help of dispensers, and hold them in high esteem. Haak reported from a rural town in Brazil⁽²⁹⁾ that community members considered a particular pharmacist 'better than a doctor.' Logan⁽⁵²⁾ reported that her poor and often illiterate Mexican informants referred to some pharmacists as 'casi como doctor' (almost like a doctor).

In some countries, dispensers prefer to refer patients with serious problems to formal healthcare systems. Price⁽⁶⁵⁾ noted that Ecuadorian pharmacists consider their role as managing the more common health problems. When it comes to serious health problems, such as heart disease, bronchitis, TB and high blood pressure, they refer patients to physicians.

Most of the literature about dispensers focuses on the quantitative aspects of dispensing—which antibiotics are dispensed, at what price, for what problem, whether a prescription was presented, etc. Little is known about the characteristics of the dispensers themselves. More research is needed to understand their cultural ideas regarding antibiotics; training; knowledge about drugs; and their social position in the community. Little is also known on the role that dispensers actually see for themselves; what kind of diseases they feel they can handle themselves; which diseases they refer to physicians.

Given the diversity of settings, general conclusions on antibiotic dispensing in non-industrialized countries are impossible, but available studies give an impression of serious problems in this sector. For example, a Bolivian study reported that antibiotics were dispensed for 92% of adults and 40% of children with watery diarrhea ⁽⁶⁾. Drug store personnel in Thailand dispensed antibiotics in various dosing schedules, regardless of the diagnosis, and most dispensed antibiotics for 2 days or fewer ⁽⁷⁹⁾. A majority of Sri Lankan pharmacies dispensed 2 capsules of tetracycline when asked ⁽⁹⁰⁾, and another Bolivian study reported that a maximum of 4 antibiotic tablets was typically dispensed ⁽⁶⁾.

Economic incentives

Pharmacists are usually prepared to negotiate the type and quantity of drugs to be procured, and clients' purchasing power is often the ultimate decisive factor. Quantities of antibiotics dispensed by pharmacies in Bolivia varied according to clients' ability to pay ⁽⁶⁾. Similarly, in India, pharmacies changed prescriptions so that they would suit the financial means of customers ⁽²¹⁾. In Nigeria, every pharmacist believed that other pharmacies would prescribe drugs for watery diarrhea, not just ORT. Hence, they all sold antibiotics for watery diarrhea, and made profits at the expense of those who would prescribe "ORT only" ⁽³⁹⁾.

Client demand

To increase their competitive edge over physicians, dispensers may combine advice with popular treatment strategies, such as avoidance of certain foods, drinks and behaviors. They frequently defer to clients' ideas on appropriate care and necessary medicines. For example, chemists in Nairobi, Kenya, were willing to sell smaller doses of antibiotics at the request of patients ⁽⁴⁰⁾. Similarly, in India, antibiotics were provided at the presentation of prescriptions from non-allopathic physicians, or even without any prescription at all ⁽²¹⁾. Pharmacy staff in Nigeria stated that they believe that parents want medicines that 'stop' their children's diarrhea. If they refuse to meet these expectations, they feared that parents would go to another pharmacy ⁽³⁹⁾.

It is difficult to differentiate whether clients or pharmacy attendants recommend the purchase of medicines. In São Paulo, Brazil, products were bought at the customer's own initiative in 34% of the encounters, at the attendant's initiative in 22%, and in the remaining 44% of the encounters, products were prescribed by a physician ⁽¹⁷⁾. In another study of 226 encounters in two rural areas in Brazil, 42% of the products were self prescribed ⁽²⁹⁾. None of these studies focused on antimicrobials, pinpointing to the need for more dispenser focused research into the antibiotic selection process in retail settings.

Table 4.

Antimicrobials dispensed by pharmacy personnel to simulated patients in a Bolivian community.

	Health complaint					
	Acute diarrhea (6-months-old) (n=10)	Acute diarrhea (adult) (n=12)	Mild fever + rhinorrhea (2-yrs-old) (n=12)	Fever + sore throat (8-yrs-old) (n=11)	Fever + acute dysuria (young woman) (n=12)	Purulent urethral discharge (adult male) (n=12)
% Pharmacies requiring a medical prescription	10	0	0	9	0	33
% Pharmacies dispensing systemic antimicrobials	40	92	24	91	58	67
Antibiotics dispensed (number of simulations)	Sulphoguanide (2) Furazolidone (1) Tetracycline (1)	Tetracycline (6) Sulphathiazol (4) Neomycin (2) Streptomycin (2) Furazolidone (1)	Co-trimoxazole (2)	Ampicillin or Amoxicillin (8) Co-trimoxazole (2)	Pipemidic acid (3) Sulphamethizol (1) Nitrofurantoin (1) Norfloxacin (1) Nalidixic acid (1)	Ciprofloxacin (3) Co-trimoxazole (2) Benzathine penicillin (2) Dicloxacillin (1) Procaine penicillin (1) Spectinomycin (1)

From: Bartoloni, A., Cutts, F., Leoni, S., et al. (1998). Patterns of antimicrobial use and antimicrobial resistance among healthy children in Bolivia, *Tropical Medicine and International Health*, 3, 2, page 119.

Lack of knowledge

Lack of knowledge of how and when to dispense antibiotics may also be an important determinant. When questioned about their antibiotic dispensing for watery diarrhea, dispensers in Nigeria argued that most clients were living in unsanitary personal and environmental situations, and that antibiotics were therefore indicated ⁽³⁹⁾.

The level of knowledge of dispensers about the ingredients of antibiotic preparations has not been well researched. One client simulation study showed that pharmacy attendants were not aware of which tetracycline preparations they had in stock ⁽⁹⁰⁾. The same study quoted a pharmacy attendant when he explained that knowledge on drugs was not of major importance:

“The patient knows what he wants and we know the price” (Wolffers 1987, p. 320).

Influence of the pharmaceutical industry

Pharmacists' dispensing patterns are also influenced by pressure of their suppliers. Ferguson ⁽²⁴⁾ reported that pharmacists who purchased drugs from pharmaceutical firms recommended more expensive medications and more medications per person than those who purchased medications from wholesale distributors. These differences were attributed to sales incentives offered by pharmaceutical firms. Incomes depended heavily on sales volumes and could go up as high as 600% or 700% through sales' commissions. Haak described marketing methods in Brazil that resulted in pharmacies trying to sell more of certain drugs because of incentives provided by suppliers ⁽²⁹⁾. van Staa ⁽⁸⁶⁾ describes a system of sales representatives visiting pharmacies and medical representatives visiting physicians, both trying to boost consumption of given drugs. In Sri Lanka, the vast majority of pharmacy attendants admitted that sales representatives of pharmaceutical firms were their major source of information on drugs ⁽⁹⁰⁾.

Despite reports on marketing methods from a few countries, little is actually known about industry practices in promoting antibiotic sales through pharmacies.

Lack of regulation and enforcement

When selling drugs to customers, dispensers often ignore national legislation. Drugs are routinely dispensed without prescriptions. Dispensers in India stated that they simply ignored legislation on dispensing antibiotics, as they knew that law enforcement was impossible because of the large number of small drug stores ⁽²¹⁾. In Kenya, chemists sold drugs in envelopes without any dosing instructions. Some chemists sold antibiotics under the name "Septrin," as requested by customer, although another antibiotic was actually provided ⁽⁴⁰⁾.

Many other possible determinants of antibiotic dispensing practices have not been adequately studied (see Appendix 2). One particularly important factor is the influence of private physicians as models for dispensers' practices. Dispensers frequently say to customers that a given drug is widely used by medical practitioners. Sri Lankan pharmacy attendants carefully studied physicians' prescriptions to ensure that their advice was in line with that of physicians ⁽⁹⁰⁾.



Antibiotics are essential, widely used elements in the treatment of infections. However, the threat of antimicrobial resistance is growing, and antibiotics that were once life saving are increasingly losing their effectiveness. The development of resistance is an important feature of bacterial ecology in every country, and resistant antimicrobial strains from one area eventually spread throughout the world due to increased global mobility ⁽⁹⁵⁾.

From a biomedical perspective, antibiotic use is frequently inappropriate. Even though appropriate use of antibiotics exerts ecological pressure to increase resistance, reducing unnecessary or inappropriate use must clearly be a priority. There are important gaps in our knowledge about why inappropriate use occurs, but the rapid growth in antimicrobial resistance demands concerted action. Governments, public and private institutions, and medical leaders need to implement policies and programs that encourage important changes in the way antibiotics are used.

The determinants of antibiotic use are complex, involving many motivations on the part of prescribers, dispensers, and consumers. There will be no quick fixes to the problem of inappropriate antibiotic use. To achieve lasting change, intervention approaches will need to be multifaceted, long-term, and based on solid understanding of the behaviors involved. Strategies that lean too heavily on professional education are not likely to result in large-scale or long-lasting improvement.

Based on the findings of this review, some recommended priorities for action are addressed below.

Governments and delivery systems

Governments should create appropriate regulations and programs to address antibiotic use and resistance, especially among private medical providers and dispensers.

To achieve lasting changes in antibiotic use, governments must recognize the importance of the private sector. In most countries, most antibiotic use takes place outside the public system. On this issue among others, governments can no longer afford to ignore the private sector. Given the complexity and scope of the problem of antibiotic misuse and limited government resources, improved enforcement of regulations pertaining to the prescription-only status of antibiotics will not offer a satisfactory or meaningful solution. Governments can also facilitate improved private sector practices by implementing professional licensing and continuing education requirements, appropriate regulation and oversight of antibiotic promotion, financial support for institutions and groups willing to undertake interventions to improve current practices, and targeted support for applied research on the issue.

Health delivery systems should routinely assess appropriateness of antibiotic use, and adopt policies and ongoing quality improvement programs that encourage more appropriate use.

Although most antibiotics are dispensed and consumed in private sector settings, substantial amounts are used within public health facilities and other organized health delivery systems. Antibiotics are generally the largest component of a drug budget, and improvements in their use can lead to large financial savings as well as better clinical care. Institutional settings offer many unique opportunities for interventions, including improving drug supply or lab systems; implementing standard treatment guidelines; auditing and feeding back data about prescribing; linking the performance reviews of health personnel to quality measures; controlling access by company representatives; and organized antibiotic education programs aimed at patients. The presence of an ongoing, multifaceted antibiotic improvement program should be one component of the assessment and accreditation of all health institutions.

Health professions

Health training institutions should incorporate an explicit component in their curriculum on appropriate use of antibiotics and the problem of antibiotic resistance.

Providing correct knowledge to health practitioners will never be sufficient to assure appropriate use. However, without correct knowledge, appropriate use is impossible. Training institutions for physicians, clinical officers, nurses, pharmacists, and other health workers should contain an explicit component that focuses on understanding common infectious diseases and their appropriate management, the role of antibiotics, and patient perspectives on treatment. Professionals in training should be sensitized to the issue of antibiotic resistance and its consequences, and inoculated against future promotional arguments by pharmaceutical companies.

Professional societies should offer modern, evidence-based continuing education programs about antibiotic use that address the behavioral aspects of prescribing and dispensing.

In general, professional societies and organizations should assume responsibility for addressing the gaps in knowledge of professionals in practice. They must acknowledge that antibiotic misuse and the growth of resistance are issues of urgent, current, and future importance for their members. Modern, evidence-based continuing education programs are designed to accomplish much more than simply filling gaps in knowledge. They can be structured to encourage active problem solving by participants, establishment of peer norms of practice, and consideration of behavioral and communication issues in dealing with patients and community members.



Companies, consumers, and donors

Pharmaceutical companies should voluntarily control promotional messages about antibiotics, and should work together with other stakeholders to deliver information about prudent and correct use of antibiotics.

Pharmaceutical companies play a pivotal role in providing society with antibiotic products and information. However, the corporate incentive to maximize sales may well conflict with the public good for this class of drugs, since overuse and incorrect use have the unfortunate consequence of accelerating antimicrobial resistance. In order to preserve the useful lifetimes of the current generation of antibiotics, pharmaceutical companies should exert voluntary controls over promotional messages that encourage unnecessary use of antibiotics and over the activities of medical representatives that foster overuse. In addition, companies should work together with governments, professional societies, and consumer groups to deliver information about prudent and correct use of antibiotics to practitioners, dispensers, and community members.

Consumer organizations should be encouraged to take up antibiotic use and resistance as consumer issues, and subsidized to provide simple, targeted information to consumers.

In many countries, consumer organizations have begun to focus on pharmaceutical issues, including access to essential drugs, equitable drug pricing, and availability of accurate drug information to consumers. Generally, little attention has been paid to antibiotics as a specific class of drugs even though they typically consume the largest proportion of drug expenditures and are widely misused. Further-more, the accelerating development of antibiotic resistance is an important consumer protection issue. Governments should encourage consumer organizations to focus more actively on antibiotic use and resistance, and support them to provide appropriate information to consumers. This may help to create a countervailing force to pharmaceutical company promotion that encourages unnecessary use.

International organizations involved in pharmaceutical assistance programs should “add value to access” by integrating support for activities that encourage appropriate use of the drugs they provide, or are procured with their funding.

With the recent global emphasis on access to drugs for the treatment of TB, malaria, and HIV infections, international organizations and donors are becoming increasingly involved in shaping national pharmaceutical policies and programs. Many of these organizations provide antimicrobials or the financing to obtain them. It is vital that these organizations safeguard the long-term effectiveness of drugs by insisting on national policies that promote appropriate use. Donors should “add value to access” by routinely setting aside a fixed component of support (10-15% of the total value of the pharmaceutical products) for activities that encourage the appropriate use of the drugs provided.

There have been many anecdotes, but few well-designed studies in the developing world on why people use antibiotics as they do. Yet despite the current lack of evidence about determinants, there is a growing need to improve antibiotic use. Unfortunately, implementing programs to change antibiotic practices in the absence of adequate information about motivations and constraints can easily lead to a waste of effort and resources.

One clear lesson from available research is that drug use in non-industrialized countries is strongly influenced by non-biomedical determinants. If programs are to be effective, future research must further explore the cultural 'rationality' in antibiotic usage. The most productive approach is to combine quantitative studies of the patterns of antibiotic use with the rich variety of qualitative methods to investigate why people seek treatment, for which symptoms, which antibiotics they prefer, what is expected from them, and how they are used. An example of best practice research from the current literature is the research conducted by Dutch researcher AnnaLoes van Staa. In her study of the popularity of antimicrobial drugs in treating diarrhea in the Philippines, Staa successfully connects many aspects of her research, such as reviews, surveys, interviews, observations, and group discussions to provide a thorough and accurate account of the management of diarrhea in every day life (Box 1).

Several recommendations for the directions in future research, based on the lessons in the current review, are presented below.

General research themes

Geographic diversity

Antibiotic resistance is a global problem. There is a need for data on both antibiotic use and determinants of use from all regions in the world, if not from all countries. More information is especially needed from NIS countries, China, francophone Africa, Middle Eastern countries, and the Pacific region.

Methodological diversity

Much of the existing body of knowledge about antibiotic use is quantitative. Quantitative research continues to be valuable when it involves comparative study designs. Comparative research may improve understanding of differences and correlations in practices between the different actors involved in antibiotic use.

Social science research methods, such as case simulations, focus group discussions, in-depth interviews, informal interviews, community recording calendars, etc., need to be applied more frequently and intensively. Research methodologies should be combined when possible so that results can be understood from different perspectives.

Several studies found a perception that antibiotics are relatively risk-free agents. Greater understanding of risk perceptions on antibiotics amongst users, dispensers and prescribers would be of importance in changing antibiotic use patterns.

Box 1. Example of best practice research

AnneLoes van Staa, a Dutch researcher, studied the popularity of antimicrobial drugs, particularly metronidazole, in treating diarrhea in the Philippines. She provides a rich medical and socio-cultural account of diarrhea and its management in every day life by weaving together information from literature reviews, surveys, chart reviews, structured questionnaires, informal interviews, direct and indirect observations, and focus group discussions. Special research was carried out on the role of pharmaceutical industries in promoting the use of anti-amoebic drugs, and their relationship with doctors and dispensers in the Philippines.

Van Staa carefully selected her research approaches for specific groups and purposes. For example, the literature review contributed to an overview of the sociocultural context of pharmaceutical use in the Philippines, drug distribution systems, and drug use in diarrhea treatment. Data on attitudes, beliefs, and practices of caretakers in diarrhea case management were collected from secondary sources, such as national household surveys and local research reports. Van Staa collected data from prescribers and dispensers in several settings in Metro Manila, using structured and informal interviews, FGD's, participant observations, and chart reviews. Her emphasis was on describing diarrhea case management, factors that influenced antimicrobial prescribing, and providers' views of the Diarrhea Control Program.

The focus of research among dispensers was on daily activities and client transactions seeking treatment for diarrhea. To investigate these factors, van Staa used unobtrusive observations in a random sample of all registered pharmacies, as well as responses to a fictitious case by pharmacy clerks. The same pharmacies were later surveyed with a structured questionnaire, in order to increase the validity of findings.

By connecting the various kinds of data, van Staa is able to give a complete picture of the role of antimicrobial drugs and the special popularity of metronidazole. She traces this popularity to three different sources: a strong, but mythical, belief in the high frequency of amoebiasis in the country; failures in diagnostic methods unreliable laboratories; and aggressive pharmaceutical marketing.

This work provides a thorough insight into the perceptions and motivations of doctors, pharmacy attendants, and caretakers. Doctors and caretakers firmly believe that diarrhea is infectious and in the need to eradicate all "mikrobyo." These beliefs are reinforced by extensive marketing and by frequent drug samples distributed to doctors by pharmaceutical company representatives.

This study illustrates applied research at its best, where the science is impeccable and results are directly useful in efforts to improve drug use in diarrheal diseases.

From: van Staa, A. 1993.

Economic factors

Economic motivations are important in all societies and professions. More information is needed on the economic motivations and perceptions of prescribers and dispensers. Few studies have explored whether appropriate antibiotic use can be compatible with adequate profits. Studies that have focused on health insurance and cost-sharing pilots may fill part of this gap in understanding.

In some societies spending money is seen as important to obtain quality health care, and higher quality of service is associated with higher price. Research is needed on the role of price in determining perceptions of quality in the decision to purchase expensive antibiotics.

Specific disease conditions and antibiotics

Antibiotic use is influenced by decisions made throughout the course of the illness process. There is a need to summarize what is known from the literature about disease recognition, care seeking, and antibiotic treatment for specific priority health problems (ARI, diarrhea, STDs, and TB).

Malaria was excluded from this review since it is generally understood as a distinct disease process, most frequently treated without antibiotics. However, it would be revealing to conduct a comparative review of the determinants of antimalarial use to see if common approaches to behavior change are justified for both classes of drugs.

Studies are needed that focus on specific antibiotics with particular problems in use (e.g. streptomycin, ciprofloxacin, or rifampicin).

Research on target groups

Community

There is conflicting information about how physicians' prescribing influences community antibiotic use, and research is needed to understand the extent to which private sector prescribing shapes the practices of dispensers and demand for antibiotics by community members.

Research data point to the important role of knowledge exchange in the community in antibiotic use. How this knowledge enters in the community, and the precise roles of prescribers, dispensers, traditional healers, and community members in the knowledge exchange process, are largely unknown.

Prescribers

Correct knowledge is a prerequisite for good prescribing. It is not generally understood whether prescribers adequately understand the differences between antibiotics, and the advantage and disadvantages of different forms of therapy.

Even if knowledge is adequate, practices may still be inappropriate. Studies are needed to look in more depth at the reasons for this discordance and the extent to which improved knowledge may lead to improved practice.

Diagnostic services are poorly used. Research is needed on whether prescribers do not see the need for such services, whether cost is a deterrent, or whether the time needed for diagnostic procedures is a problem.

It is not well understood how quality of communication with patients can influence antibiotic therapy and whether most patients would be satisfied without receiving antibiotics if they received better explanations about their conditions.

Supervision is often promoted as one way to improve quality use of drugs, including antibiotics. However, little research has been carried out to investigate the potential of supervisory systems in improving antibiotic prescription and use.

Dispensers

Dispensers are typically members of the communities in which they work, and it is not known how their knowledge and cultural notions about antibiotics reflect or differ from the prevailing opinions of their communities.

Customer demand is often mentioned as the main cause of inappropriate antibiotic dispensing. However, it is not clear to what extent it is usually counter attendants or customers making the actual purchasing decisions.

Modeling by dispensers of private physicians' prescribing is likely to be an important determinant of use, but this modeling process has been minimally explored.

Pharmaceutical industry

The pharmaceutical industry is widely felt to be an important force in determining antibiotic prescribing, dispensing, and community use. Little is known about the effects of drug promotion on the antibiotic buying habits of consumers, or on recommendations made by drug sellers and prescribers.

It is not known if personal interactions with pharmaceutical representatives are the primary sources of information about antibiotics for prescribers and dispensers, or whether there are other channels through which they routinely receive drug information.

Studies are needed to determine if companies can participate with other stakeholders in promoting better clinical practice without distorting the messages about appropriate therapy or compromising their marketing.

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*Appendix 1.
Overview of
studies included
in this review*

This review was based on published and unpublished studies that explored factors underlying the use of antibiotics by prescribers, dispensers, and community members in non-industrialized countries. To ensure that the findings were grounded in reality, studies were required to have included original data and used methods that would be considered scientifically adequate.

Relevant materials were identified through searches of several electronic databases of the medical and social science literature, as well as extensive communication with relevant research networks and international organizations. Although there is a large literature on drug use, relatively few studies met the inclusion criteria for this review.

Key characteristics

A total of 37 studies with acceptable methods were included. These studies cover 4 geographical regions, with 21 from Asia, 9 from Africa, 6 from Latin America and one from the Middle East. Most were carried out in the early and mid 1990s. Despite an extensive search, no studies were available from Eurasia, francophone Africa, or the Pacific region.

Several types of researchers conducted these investigations, including medical doctors, epidemiologists, anthropologists, pharmacists, and social scientists. In all, 34 of the 37 studies were descriptive, providing a broad picture of antibiotic use in community and health care settings, while only 3 provided a comparative analysis of findings. About 1/3 of the studies investigated antibiotic use by community members, another 1/3 -third focused on prescribers, 6 targeted dispensers, and 7 gathered information from more than one target group.

Studies were conducted in a variety of settings. Most community studies were carried out in households, while most dispenser studies took place in pharmacies. Studies on antibiotic use by prescribers tended to involve combinations of hospital, primary care, and dispensary settings.

About two-thirds of the investigations had no specific disease focus, studying instead general patterns of antibiotic prescribing, dispensing, and use. The rest explored diseases like diarrhea (7 studies) or ARI (4 studies). It is surprising that so few studies focused on ARI, which is a condition for which antibiotics are widely used. STDs and TB were not a specific focus of the search for materials; because of rapid development of antibiotic resistance, more insight on how antibiotics are used to treat these conditions would be valuable.

Investigators used a variety of data collection methods, and many combined more than one method. In general, methods that generate quantitative data were used about twice as often as more challenging, but potentially richer, qualitative methods. Structured questionnaires with reviews of patient records were common in studies focused on prescribers, while interviews using semi-structured questionnaires or case simulations were frequently used in dispenser studies. Several studies used focus group discussions, or observations of clinical or pharmacy practice. Other potentially useful methods like informal interviews, in-depth interviews, or calendar recording of illness episodes were rare.

Community studies

A total of 8 studies focused on use of antibiotics in households; only one dealt with customers at pharmacies. Depending on the study, community members included heads of households, housewives, family members caring for a sick child, or customers at drug stores. Most community studies focused on antibiotic use in general, but 3 targeted ARI and 2 targeted diarrhea. Community studies relied mainly on semi-structured or structured questionnaires, while informal interviews, focus group discussions and calendar recording were each used in 2 studies, and in-depth interviews in one study.

Prescriber studies

Three studies that investigated antibiotic prescribing were conducted in hospitals, 4 in primary care settings, and 6 in both settings. Target prescribers included physicians and medical specialists in hospitals, and physicians, nurses, community health workers, and midwives in primary care settings.

As with community research, most studies focused on the general practice of antibiotic prescribing, while 3 investigated diarrhea treatment and 1 focused on ARI treatment. Review of patient records was the most commonly used method in hospital studies, and structured questionnaires were used a few times. In-depth interviews and prescription reviews were each used twice, while observation of clinical practice, case simulation, and focus group discussions were each used in one study only.

Antibiotic prescribing rates varied greatly, ranging from 19% in a primary care setting in India (80) to 97% for ARI patients in a Chinese study (36). These large variations help to illustrate that few common conclusions can be drawn on antibiotic prescribing in non-industrialized countries. Most studies agree that antibiotics are frequently over-prescribed, and that unnecessarily expensive antibiotics are frequently chosen. This seems to apply to all different types of prescribers, from community health worker in a rural village to specialist physicians in referral hospitals, and in studies that examine several types of prescribers, differences in practices are not pronounced.

Dispenser studies

Only 7 studies focused on antibiotic use and drug dispensers. Dispensers were variously classified as 'chemists,' 'drug retailers,' or 'pharmacy personnel/workers,' and settings included pharmacies, drug stores, and medicine shops. Again, general antibiotic dispensing practices were the primary focus of the majority of studies; 2 studies concentrated on ARI, 2 on diarrhea, and 1 on cystitis. All studies used case simulation, and some investigators came back later to interview personnel of the pharmacy or drug store.

Studies that targeted more than one group

Eight studies focused on more than one target group, i.e., community, prescribers, or dispensers. These studies usually present more comprehensive information on the antibiotic use cycle, since they examine interactions between different actors, e.g., dispensers and community members. These studies also tend to use multiple data collection methods, which provide an opportunity to compare and contrast findings from different methods.

*Appendix 2.
Potential
determinants
of antibiotic use*

Lists of the possible determinants of antibiotic use that have been discussed in the literature are presented below, together with the studies in this review that provide information on them. Numbers refer to the list of references.

Determinants related to prescribers	Studies	Total
• lack of knowledge on antibiotics and therapeutics	(9, 25, 36, 41, 42, 61, 62, 86)	8
• lack of trust in or delayed lab results	(9, 42, 51, 68)	4
• desire to meet patient demand	(25, 62, 86)	3
• fear of clinical failure, desire to stay on safe side	(9, 62, 86)	3
• economic incentives	(19, 25, 86)	3
• unstable or inadequate drug supply	(27, 53, 80)	3
• inappropriate peer norms, poor modelling by seniors	(41, 62, 71)	3
• marketing influences	(86)	1
• folk beliefs and traditions on antibiotic use	(41)	1
• diagnostic uncertainty	—	0
• inadequate supervisory systems	—	0
• inadequate infection control systems	—	0
• limited communication skills	—	0
Determinants related to dispensers		
• desire to meet customer demand	(21, 37, 40, 86, 90)	5
• economic incentives	(5, 21, 37)	3
• lack of regulation and enforcement	(21, 40)	2
• lack of knowledge on antibiotics and therapeutics	(37, 90)	2
• marketing influences	(86, 90)	2
• unclear role as health providers	(86)	1
• modelling practices of local physicians	(90)	1
• folk beliefs and traditions on antibiotic use	—	0
• fear of clinical failure and desire to stay on safe side	—	0
• inadequate supervision	—	0
• limited communication skills	—	0
Determinants related to community members		
• use of trained and untrained sources of advice	(6, 9, 13, 21, 22, 26, 29, 32, 35, 44, 50, 58, 71, 78, 88)	15
• folk beliefs and traditions on antibiotic use	(21, 22, 26, 57, 29, 18)	6
• economic considerations	(50, 29)	2
• lack of knowledge on antibiotics and therapeutics	(22)	1
• gender preferences	(21)	1
• marketing influences	—	0
• lack of access to appropriate health care	—	0

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