

# Mexican Pharmacies and Antibiotic Consumption at the US-Mexico Border

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## Abstract

**Objective:** To study antibiotic dispensing to US and Mexican residents, at Mexican pharmacies at the US-Mexico border, and the pharmacy clerks' capability to promote appropriate use.

**Methods:** The site selected was Ciudad Juarez, Chihuahua (pop. 1.2 million) separated from El Paso, Texas (pop. 800,000) by the Rio Grande River. A convenience sample of 32 pharmacies located near the international bridges, major shopping centers, and interior neighborhoods was selected. Pharmacy clients were interviewed (n=230) and 152 interactions between clients and pharmacy clerks were observed. Information was obtained about education and pharmaceutical training of 113 clerks working in 25 pharmacies. A senior pharmacy clerk in each of the 25 pharmacies was interviewed and asked for their recommendations to clients presenting two clinical scenarios and seven diagnoses.

**Findings:** Professionally trained pharmacists only spend a few hours a week in some pharmacies. Clerks' education levels are very low; some have only completed primary education. There is no required pharmaceutical training and their knowledge about pharmaceuticals comes mostly from representatives of the pharmaceutical industry. Clerks' knowledge of antibiotics, the most frequently sold class of medicines (65% without prescription), is very limited. Clients trust pharmacy clerks and tend to follow their advice.

**Conclusions:** The findings raise concerns about dispensing of antibiotics at Mexican border pharmacies and antibiotic overuse due to lack of control. Because inappropriate antibiotic use contributes to increased resistance, pharmacy clerks should receive independent training to dispense antibiotics and promote their appropriate use.

**Keywords:** antibiotics, pharmacists, pharmacy clerks, US-Mexico border, Mexico

## Introduction

Antibiotic resistance is severely hampering the ability to treat infections [1-4]. Experts suggest that the spread of pan-resistant microbial strains for which there is no treatment is a public health emergency and have proposed to use International Health Regulations. This is a legally binding agreement between 194 nations, to mandate the notification of such illnesses to the World Health Organization (WHO) so that appropriate and concerted actions can be undertaken [5]. The European Council and the government of the United States (US) have set up taskforces to encourage antibiotic research [6-8].

Antibiotic resistance has been correlated with antibiotic use

[9-10]. However, little is known about the circumstances surrounding antibiotic consumption and antibiotic resistance at the US-Mexico border<sup>a</sup>. The US National Antimicrobial Resistance Monitoring System (NARMS) does not report data specific for this region. Mexico also lacks such a system [11] and Texas health officials suggest that antibiotic resistance is higher at the Texas border than in the rest of the state [12].

Early studies showed that tuberculosis patients residing at the border had higher rates of isoniazid and rifampin resistance than non-border patients in both countries [13-15].

<sup>a</sup> La Paz Agreement defined the US-Mexico border as the area contained within 100 Km (or 60 miles) North and South of the line that separates Mexico from the US.

Some [16] speculated that it was due to the misuse of rifaprin (rifampin and trimethoprin). More recent information places the prevalence of multidrug-resistant (MDR) tuberculosis in Mexico at 17% and in the US at 1.2% [11]. Vázquez and Hand [17] documented that 71.3% of 888 cultures collected from 880 patients treated for urinary infection in a public hospital located on the US side of the border were E Coli isolates that had poor sensitivity to ampicillin and tetracycline (about 50%) and relatively low sensitivity (73.5%) to trimethoprim-sulfamethoxazole. Later, Ammons et al [18] obtained 375 nasal swabs from students attending Texas Pan-American University (one hour from the border), of which six were positive for methicillin-resistant *Staphylococcus aureus* (MRSA).

Rivera et al. [19] evaluated the prevalence of MRSA in patients treated at two hospitals in El Paso (USA) and two hospitals in Ciudad Juarez (Mexico) over a period of two years, and contrary to the researchers' hypothesis, MRSA prevalence was highest in El Paso (44.3% vs 7.8%,  $p < 0.0001$ ). According to the authors, Mexico's lower antibiotic use and reliance on cheaper antibiotics with narrower spectrums of action could explain this finding. Broussard et al. [20] compared antibiotic consumption in a birth cohort of 602 children residing in El Paso and Ciudad Juarez who were followed-up for 3.5 years, on average. During this period 79% were prescribed one or more antibiotic courses, and about 31% and 15% of the courses given to Mexican and US children, respectively, were inappropriately administered for conditions such as diarrhea (DD), cold, flu, or stomach infections.

Regional health experts blame antibiotic resistance on inappropriate dispensing of antibiotics without prescriptions in Mexican pharmacies [12, 17-19, 21, 22]. Several authors have documented that antibiotics are among the products most frequently purchased in Mexico [22-24]. Residents in the southern US- border region, many of whom are of Mexican descent and Spanish monolingual or bilingual, have been frequent users of Mexican pharmacies for decades. This is reflected by the many pharmacies near US ports of entry. In Mexico anyone can own a pharmacy, including physicians, and during the last decade pharmacy chains have expanded rapidly. Traditional community pharmacies are unable to compete with the prices and wider range of stocks offered by pharmacy chains and have been closing or diversifying their business in-order to survive [25]. All pharmaceuticals sold in Mexico are prepackaged and there are very few compounding pharmacies.

In Mexico, only pharmacies that sell controlled substances (which are defined by Article 226 of the General Health Law and include opioids and other products such as tricyclic antidepressants and antipsychotics) are required to hire a pharmacist (known as chemist-pharmacobiologist or QFB) [26]. QFBs are primarily trained to work for the pharmaceutical industry and clinical labs with only a minority working for pharmacies. The presence of the QFB is only required for a few hours per week and his/her activities are strictly administrative. Mexican pharmaceutical regulations list the products that require a prescription [26], which among others include antibiotics and controlled

substances. Only the prescriptions of controlled substances and since August 2010 the prescriptions of antibiotics are retained by the pharmacies. All other prescriptions can be legally used and reused during 12 months, and in practice, as long as the patient keeps them. The State Commission for the Protection of Health Risks (COESPRIS), the state subdivision of the National Regulatory Agency inspects pharmacies and verifies the correct implementation of the law.

Many US border residents purchase medicines in Mexico because prices of some medicines are cheaper than in the US, the system is familiar and the prescriptions may not be necessary [27, 28]. The possibility of buying medications without a prescription is particularly attractive to poor and uninsured US residents, mostly Hispanics, who have limited access to affordable medical consultations. Missing work and consultation co-payments may also deter residents from seeking a US prescription. Another attraction to low income families is convenient access to medical consultations on the Mexican side of the border. Although physicians are prohibited by law from working within the pharmacy, many pharmacies have arrangements with nearby dentists and physicians (often next door), who, for a small fee (about US\$2.00), diagnose and prescribe. More recently, some pharmacy chains have hired physicians, and there is some anecdotal evidence that these physicians are encouraged to prescribe more drugs than needed or more expensive drugs.

According to Families USA, in 1992, 32% of border residents purchased medicines in Mexican pharmacies [29]. The same year, Casner and Guerra [30] found that 81% of a convenience sample of 79 patients, mostly poor and uninsured, seen at a clinic of Texas Tech University in El Paso had purchased medicines in Mexico; 75% without a prescription. Little has changed since those early studies. The Texas Behavioral Risk Factor Survey revealed that in 2007, 38% of Texas Border residents had purchased medicines in Mexico during the previous year [31]. Escobedo and Cardenas [32] and Rivera et al. [33], using representative community survey data from two communities bordering Mexico, documented that 22% of residents in New Mexico's border counties and 33% of El Paso residents had purchased medicines in Mexico during the year prior to the survey. Researchers have reported that these rates are higher among the poor and uninsured [30, 34]. Homedes [35] found that 85% of low income Hispanic residents in El Paso County had purchased medicines in Mexico during the twelve months prior to the survey. Generally, more English speakers have health insurance coverage than Spanish speakers and tend to use Mexican pharmacies to a lesser extent. Guzman et al. [22] surveyed 966 English-speaking patients treated in the emergency department of two hospitals in San Diego County (California), finding that only 7% had purchased medicines in other countries, mainly Mexico.

The aim of this exploratory study was three fold: (1) To document the characteristics, health status and pharmaceutical needs of the clients of Mexican pharmacies; (2) To ascertain the role of the pharmacy clerks in educating consumers during the act of

dispensation; and (3) To document the characteristics of the pharmacy clerks and their knowledge about the use of antibiotics. The information discussed in this article is limited to aspects related to the purchase of antibiotics in Mexican pharmacies, the formal and informal training of the pharmacy clerks and their ability to promote the appropriate use of antibiotics.

## Methods

A mixed methods study was conducted that included: (1) a semi-structured questionnaire for pharmacy clients; (2) observations of the interactions between pharmacy clerks and the clients; and (3) in-depth interviews with pharmacy owners or the highest ranking pharmacy clerk. The first challenge was to determine the number and location of the community pharmacies in Ciudad Juarez. Due to the dynamism of the sector with the closing of community and opening of chain pharmacies it was difficult to obtain an up-to-date census of existing pharmacies in Ciudad Juarez. After discussions with COESPRIS, the Chamber of Commerce and the Association of Pharmacists of Ciudad Juarez, it was decided to plot the municipal list of 306 pharmacies, 208 individually owned (traditional community pharmacies) and the rest owned by pharmacy chains, onto a city map.

A convenience sample of pharmacies accessible to pedestrians crossing the international bridges from El Paso to Ciudad Juarez was selected. Some were close to major shopping centers only accessible to US residents by car, and a few were located in the interior of Ciudad Juarez. Pharmacy owners or the highest ranking local administrator in the case of pharmacy chains were personally approached by one member of the research team. All owners of traditional pharmacies agreed to participate. Permission from pharmacy chains had to be granted from headquarters, and all but two accepted. Since traditional community pharmacies are quickly being replaced by pharmacy chains and these are more accessible to US-residents, the final sample consisted of 32 pharmacies that included nine traditional and 23 pharmacies from five different chains.

### Data collection process and instruments

Two trained nurses from the Mexican Institute of Social Security (Instituto Mexicano de Seguro Social or IMSS covering about 40% of the national population) conducted the client questionnaire and observed the interactions at the pharmacy. A bilingual Mexican physician with a Master in Public Health degree supervised data collection and interviewed the pharmacy clerks. The client questionnaires and the interactions were conducted at different times of the day. All instruments were pilot tested by the principal investigators in three pharmacies.

The pharmacy clients were approached by the two interviewers as they left the selected pharmacies where they purchased medicines. The interviewers explained the nature and objectives of the study, and if the client accepted, then the interview was carried out. Fourteen pharmacy clients who were invited

to participate declined and were replaced by other clients. Interviewees had to be at least 18 years old. The majority (82% of 230) were conducted inside the pharmacy with the remainder on the sidewalk immediately outside; and all but one were conducted in Spanish.

The client questionnaire included socio-demographic and residency information of the client and the end-user (if the drugs were purchased for other persons --as was the case for 41% of the products--) and asked about the health problem and insurance coverage of the intended user. All clients were asked to show the products purchased, and were asked the following information for each medicine: name of the product, quantity, if the client had a prescription, and if there was no prescription, who recommended the product. If the buyer was a US resident, there were questions about the reasons for using Mexican pharmacies and the client's experience with US Customs when crossing into the US with medicines<sup>b</sup>.

When conducting the observations of the encounters between the pharmacy clerks and the clients, and to avoid biasing the behavior of the pharmacy clerks, the interviewers positioned themselves in an unobtrusive corner close to the counter. This meant that they could follow the conversation but often could not capture the name of the medicine being dispensed or discussed.

The study aimed to observe 150 exchanges between the pharmacy clerk and the client and developed three forms to gather information when: (1) the client had a prescription; (2) the client requested a particular medicine; and (3) the client requested advice. The in-depth interviews with pharmacy clerks were undertaken, for budgetary reasons, in 25 of the 32 pharmacies. The aim was to interview the owner or most senior person in each pharmacy but the final decision rested with the owner of the pharmacy or the manager of the pharmacy chain. Included in the sample were five pharmacy owners (four from traditional community pharmacies), eight highest ranking pharmacy clerks and 12 pharmacy clerks with several years of experience.

For the staff interviews a semi-structured questionnaire was used to inquire about the history and services offered by the pharmacy; the relationship of the pharmacy with the pharmaceutical industry; and the socio-demographic characteristics, level of education and pharmaceutical training of all the pharmacy employees. There was also an assessment of the respondent's knowledge regarding the use of antibiotics through: (1) the resolution of two frequent conditions (uncomplicated upper respiratory infections and gastrointestinal problems) and seven diagnoses; and (2) several questions on antibiotics that could not be answered with the information provided to assess their knowledge of the most basic microbiological concepts. The interviews were conducted in a quiet area inside the pharmacy and took an average of 45 minutes.

<sup>b</sup> The USA Food and Drug Administration (FDA) usually allows the importation of three months of therapy for personal use. All controlled substances must be declared at the port of entry and the bearers have to have a prescription. Custom agents tend not to enforce the prescription requirement for non-controlled substances that require a prescription in the USA. The behavior of the Custom Agents appears at times to be erratic.

**Data management**

The field supervisor collected and reviewed all questionnaires twice a week and they were kept in a locked filing cabinet. The research supervisor and one of the principal investigators coded all open questions. Health problems were classified using the US Department of Education and Welfare system [36], which allows for classification of symptoms and diagnosis. Data were entered into Excel 2003 and analyzed using SPSS -18. The study was approved by the Institutional Review Board of the University of Texas, Health Science Center in Houston, and the National Institute of Public Health (Mexico) and the fieldwork was conducted between August 2007 and January 2008.

**Results**

Table 1 displays the target recruitment numbers and the number of completed questionnaires. Respondents were classified by place of residence and not by nationality because there are many dual nationals, as well as people who reside on one side of the border and were born or work on the other (both ways).

**Table 1:** Target recruitment numbers and number of completed questionnaires

	Target numbers	Completed surveys
Client questionnaires	230 (115 US residents)	230 (109 US residents)
Observations of client-pharmacy-clerk interactions	150	152
Questionnaires with owner of the pharmacy or highest ranking pharmacy clerk	32	25*

**Note:** due to budgetary constraints we conducted 25 of the 32 projected interviews with pharmacy owners or highest ranking pharmacy clerk.

**Purchasing antibiotics in Mexican pharmacies**

Eleven percent of Mexican residents who purchased medicines obtained them for someone residing across the border in the USA. Antibiotics were the most frequently purchased product (n=54), and only 35% were purchased with a prescription. Table 2 shows the percentages of medicines including antibiotics self-prescribed and purchased with and without a prescription by US and Mexico residents. US residents self-prescribe more and rely less on the clerk's advice than do Mexican residents. They also buy more antibiotics without a prescription, and are less frequently diagnosed by physicians than their Mexican counterparts. This is understandable because as shown in Table 2 a considerably higher percentage of US residents were uninsured.

**Table 2.** Description of the products purchased in Mexican pharmacies and their end users, per residence of the person making the purchase

	USA resident (n=109)	Mexican resident (n=121)
<b>Total number of products purchased</b>	<b>157</b>	<b>154</b>
Average number of medicines purchased per client ± SD	1.4 ± 0.74	1.3 ± 0.55
% products purchased with prescription	29	58
% antibiotics purchased with prescription	25	50
% antibiotics purchased without prescription that were self-prescribed	83	56
% antibiotics purchased without prescription recommended by professional	4	0
% antibiotics purchased without prescription recommended by pharmacy clerk	13	44
<b>Characteristics of the end user of the products purchased</b>	<b>(n=153)</b>	<b>(n=157)</b>
% older than 30 years of age	77	57
% diagnosed by physician	42	57
% uninsured	58	37

**Note:** When a respondent bought a medicine without a prescription they were asked who recommended the medicine, and based on the response the medicine was classified as self-prescribed (if the respondent decided on their own to purchase the medicine), recommended by a health professional (when recommended by a physician or dentist who did not extend a prescription) or recommended by a pharmacy clerk when the respondent was buying the medicine based on the advice of someone working in a pharmacy.

Matching the patients' symptoms with the drugs purchased suggests that antibiotics were frequently used inappropriately, regardless of whether they had been prescribed by a physician. It was found that antibiotics were purchased for all intended users with throat problems, 15 of 19 with acute respiratory infections (ARIs,) and for half of those with diarrheal diseases (DD).

### Interactions between the clients and pharmacy clerks

Table 3 summarizes the exchange of information between the pharmacy clerks and their clients in the three different scenarios. When the client presented a prescription (n=53) the clerk offered an alternative brand name or generic in 23% of the cases and asked clients if they knew how to use the medicines in 47% of transactions. Clients only asked about how to use the medicines during 9% of transactions.

**Table 3:** Interactions between clients and pharmacy clerks in three different scenarios

	Patient has a prescription	Patient requests a pharmaceutical	Patient requests advice
Total number of interactions observed per type of scenario	53	80	19
% of interactions where the clerk offers a different product	23	35	n.a.
% of cases where client purchases the product indicated by clerk	29	69	95
% of cases where the clerk offers verbal information about the medicine dispensed	57	68	89

Of the 80 patients requesting a pharmaceutical for which they did not have a prescription, the majority (92%) knew the name of the medicine they wanted. The pharmacy clerks offered more advice to them than to those who had a prescription and never referred patients to a physician or refused to dispense the requested medicine. Only 19 clients requested advice, eight mentioned a diagnosis (42.1%) and the remainder (57.9%) the symptoms. The observers judged that in 75% of the encounters the clerk expressed their recommendations with professional authority even - as will be seen in Table 4 - the large majority did not have education beyond high school and all but one client requesting advice purchased the medicines recommended by the clerk. In all cases, clerks working in traditional community pharmacies interacted more with the clients than those working in pharmacy chains.

### The dispensing and recommendation of antibiotics

Thirty-four years was the average age of the clerks (range 18-64), and 9% had some formal training on pharmaceuticals. For, two this was at the university level, 103 were trained by their

co-workers and 8 took short courses covering administrative and salesmanship topics (See Table 4). The employees of one pharmacy chain had taken the 20 hour course offered by COESPRIS that covered mainly administrative issues and the management of controlled substances. Forty-four percent said that they had received some continuing education courses, mainly presentations by pharmaceutical industry representatives.

A high level manager of a pharmacy chain said

*"... because the constant contact that we have with drug industry representatives, we asked them to provide 'courses' about their products. Every Friday they offer a session in our headquarters and we tend to have 10-15 employees in attendance."* [PC 11]

**Table 4.** Characteristics of pharmacy clerks

	Total (n=113)
Average age (years) ± SD?	34.4 ± 11.71
Gender (% males)	48.7
<b>Highest educational attainment (%)</b>	
Primary school only	7
Secondary School	82
Technical/university	11
<b>% who learned about medicines through</b>	
Practice	91
Courses	7
University	2
Years of pharmacy experience ± SD	8.5 ± 10.23
Ability to communicate in English (%)	44

There is a significant level of self-reported interaction between pharmacy clerks and pharmaceutical industry representatives (See Table 5). Five respondents (20%) felt pressured by the representatives to purchase from certain wholesalers and nine (36%) felt pressured to buy the representative's products.

**Table 5.** Interaction (in%) between pharmacies (n=25) and the pharmaceutical industry

	Total (n=113)
Pharmacies that see less than one drug representative per week	28
Pharmacies that see at least one representative per week	72
Pharmacies that see between 7-10 drug representatives per week	32
Pharmacy clerks who find these visits useful	84
Pharmacy clerks who trust the information provided by the drug representative	72
Pharmacy clerks who would like to have more interaction with industry	32

Thus the pharmacy clerks, with low levels of education and little clinical training, work largely unsupervised, do not have a pharmacist with whom to consult, and depend on information provided by representatives from the pharmaceutical industry. Despite this lack of formal training, all pharmacy clerks except the employees of three traditional community pharmacies wore white coats to give the appearance of being highly professional. The interviewees revealed that the salary of some pharmacy clerks is tied to the amount and type of medicines they sell and a pharmacy owner acknowledged that often, along with the products, they sell the corresponding pre-signed prescription. In addition, some pharmacies contract with physicians to provide consultations physically near the pharmacy. One chain has the clinical consultations next door. Another pharmacy chain advertises the availability of medical consultations and prescriptions to avoid problems with US customs.

**Recommendations of pharmacy clerks in two hypothetical scenarios to assess knowledge about correct use of antibiotics**

Pharmacy clerks and owners of pharmacies were asked how they would handle two case scenarios. In the first case a mother sought care for her four-year old child who was coughing, had a runny nose (green mucus), a 98oF temperature and breathed normally. The second case was a 20 year old who complained of having diarrhea and a stomachache for 24 hours.

As seen in Table 6, in the first case, 56% (n=14) of pharmacy clerks recommend medicines to the hypothetical client. Regardless of the response to this question, participants were queried about the type of medicines they would recommend. All respondents provided the name of at least one product (mean 2.3) and two thirds (68%) mentioned antibiotics. In the second case scenario, one respondent did not know what to recommend, and over half of the remaining clerks (n=13, 54%) recommended medicines. When independently of the response to this question they were asked about the medicines they would recommend, all but one named products (mean 2), and three-

fourths (75%) included antibiotics. In the two case scenarios, respondents working in pharmacy chains recommended a higher number of medicines, including antibiotics, than those working in traditional pharmacies (See Table 6).

**Table 6.** Pharmacy clerks recommendations to resolve two clinical case scenarios

	Total	Traditional	Pharmacy chain
<b>1st case:</b> A woman goes to the pharmacy requesting advice because her four years old child is coughing, has a running nose (green mucus), a temperature of 98o F and breaths normally.	N=25	N=9	N=16
<b>What would you recommend?</b>			
Lifestyle (liquids etc)	2	2	0
Refers to physician	8	4	4
Sell Medicines	12	1	11
Refers to physician +Lifestyle	1	1	0
Refers to physician + Sell meds	2	1	1
<b>What type of medicines would you recommend?</b>			
Average number of medicines per patient	2.3	1.7	2.6
Analgesics (acetaminophen, aspirin)	48%	56%*	44%
Antibiotics**	68%	22%	94%
Systemic antihistaminic	36%	33%	38%
Topical antihistaminic	4%	11%	0%
Cough medicine	32%	11%	44%
<b>2nd case:</b> A 20 year goes to the pharmacy complaining about having had diarrhea and stomachache for 24 hours	N=24	N=9	N=14
<b>What would you recommend?</b>			
Lifestyle (liquids etc)	7	3	4
Refers to physician	2	2	0
Sell Medicines	11	1	10
Refers to physician +Lifestyle	2	2	0
Refers to physician + Sell meds	2	1	1
Does not know	1	0	1
<b>What type of medicines would you recommend?</b>			
Average number of medicines per patient***	2	1.7	2.1
Antibiotics****	75%	67%	86%
Antidiarrheal	87.5%	78%	100%
Antispasmodic	42%	44%	43%
Lactobacillus	17%	22%	14%

\* One interviewee recommended aspirin  
 \*\* Seven prescribed two antibiotics. Most prescribed antibiotics (15 out of 20) belonged to the group of penicillin's, two recommended a cephalosporin, two clavulanic acid, and one azitromycin.  
 \*\*\* One interviewee from pharmacy chain did not want to answer and one employee from a traditional pharmacy did not recommend any medicines  
 \*\*\*\* Seven recommended sulfamethoxazole, 4 neomycin, 3 ampicillin/ amoxicillin, 2 tetracycline, one chloramphenicol and one trimethoprim

Participants were asked whether a list of seven diagnoses required treatment with antibiotics and if so, the type of antibiotic they would recommend. The diagnoses were named and none of the respondents requested additional information.

Table 7 shows the tendency to overprescribe antibiotics, especially by the clerks in the pharmacy chains, and the wide range of antibiotics recommended.

**Table 7.** Antibiotic recommendations by pharmacy clerks

Diagnosis	N	Requires antibiotics?			If Yes, which antibiotic would you recommend? (n)	Additional comments
		Yes	No	Only if (n)		
Pneumonia	21	15	5	Long evolution (1)	Penicillins (3) Cephalosporins (7) Aminoglycosides (1) Macrolides (5)	71% of respondents in traditional pharmacies and 78% in pharmacy chains would provide antibiotics.*
Bronchitis	20	13	6	Fever (1)	Penicillins (7) Cephalosporins (3) Macrolides (2) β-lactamase inhibitors (2)	100% of respondents in traditional pharmacies and 62% in pharmacy chains would provide antibiotics.
Cough with phlegm	24	6	14	Fever (2) Phlegm is yellow (1) There is no phlegm-(1)	Penicillins (8) Cephalosporins (2)	22% of respondents in traditional pharmacies and 50% in pharmacy chains would provide antibiotics.
Cold	25	3	20	Fever (1) Breathing difficulties (1)	Penicillins (4) Cephalosporins (1)	0% of respondents in traditional pharmacies and 31% in pharmacy chains would provide antibiotics
Flu	24	5	17	Phlegm and difficulties breathing (1) Fever (1)	Penicillins (6) Macrolides (1)	13% of respondents in traditional pharmacies and 38% in pharmacy chains would provide antibiotics
Ear infection	24	20	4		Penicillins (7) Cephalosporins (3) Aminoglycosides (7) Macrolides (3) Sulfonamides (1)	75% of respondents in traditional pharmacies and 88% in pharmacy chains would provide antibiotics
Diarrhea	25	14	7	Abdominal pain (1) Fever (1) Mucus&blood in stool (2)	Penicillins (2) Sulfonamides (10) Tetracyclines (2) Aminoglycosides (2) Quinolones (2)	44% of respondents in traditional pharmacies and 88% in pharmacy chains would provide antibiotics

\* One interviewee said to discontinue the antibiotic if the patient improved  
 N=number of persons who responded to whether a particular diagnosis required antibiotics  
 n=number of persons who qualified when they would prescribe an antibiotic, or who suggested a particular antibiotic

Most pharmacy respondents (64%) agreed that antibiotics are over-used, and all of them said that the most important contributor to antibiotic resistance was patients' self-medication. Only one was aware that their recommendation for use has the potential to contribute to antibiotic resistance at the community level. When asked the advice that they would give to patients who use antibiotics and suggestions on how to control antibiotic resistance, clerks offered the responses listed in Table 8.

Finally, several questions were asked for which no correct answer can be given without more detailed information about the patient and/or their condition. The purpose of this exercise was to show how much or how little the clerks knew about antibiotics. For instance, *which is the best antibiotic?* Thirty-

two percent responded that it depended on the problem and the rest mentioned the name of an antibiotic. To the question *which is the strongest antibiotic?* Twenty-four percent said that it depended upon the health problem and the rest named an antibiotic. In addition, to the question "*which is your favorite antibiotic?*," 84% volunteered the name of an antibiotic; 80% said that injected antibiotics are better than those orally administered because they act faster; and 60% said that generic and brand antibiotics are of equal quality. In answering these questions, the respondents of traditional community pharmacies demonstrated a lower level of knowledge than those working in pharmacy chains.

**Table 8.** Recommendations made by 25 Mexican pharmacy clerks on how to use antibiotics and avoid antibiotic resistance

Recommendations to people in treatment with antibiotics (up to three responses per clerk)	Number of clerks
Observe if you develop allergies	14
Finish the treatment	13
Take the antibiotics with food	11
Comply with the administration schedule	5
Take the recommended dosage	4
If you do not improve see a doctor	4
Do not take alcohol during the treatment	3
Do not eat pork during the treatment	3
Observe if you develop adverse reactions	2
Other	4
To control antibiotic resistance (up to three responses per clerk)	
Limit the OTC sale of antibiotics	4
Discourage people from self-medicating with antibiotics	4
Always use only one or two antibiotics	3
Do not produce new antibiotics	3
Emphasize prevention so that people do not get sick	3
Nothing can be done	3
Ensure that patients always complete their antibiotic treatment	2
Train physicians and pharmacy clerks on the appropriate use of antibiotics	2
Develop new antibiotics	2
Other	2

## Discussion

Most prescription-only products are available without a prescription in Mexican pharmacies, allowing the uninsured and low-income (including residents on the US-side of the US-Mexico border) to access needed medicines. However, this exploratory study has uncovered contextual and systemic issues in the organization of the pharmacies and in the training pharmacy clerks that are leading to the overuse of medicines, including antibiotics, potentially exposing clients to unnecessary risks (adverse events and drug interactions) and are likely to be contributing to antibiotic resistance. Most pharmacy clerks have only received “on the job training”, have incentives to prescribe and dispense medications, and are frequently exposed to information and incentives offered by pharmaceutical industry representatives. Some pharmacies have established business relationships with physicians and encourage them to over prescribe.

Allowing chain pharmacies to contract adjacent physicians is a practice that should be questioned in view of the conflict of interests and potential for overprescribing, particularly antibiotics. Quiroz [37] reported that a physician working for a pharmacy chain was being pressured to prescribe medicines regardless of need. It is also reported that in Ciudad Juarez, physicians close to pharmacies are consulted by uninsured US residents who require immediate attention [35]. More importantly, it has

been reported that the number of physicians collaborating with pharmacies has increased since the government prohibited the sales of antibiotics without a prescription in 2010 and now even have consultation rooms within the pharmacy [38].

The compensation of clerks based on sales is inadvisable even if it is common in other countries of the region [39]. It fosters over-dispensing and changes of prescribed medications. The lack of training of pharmacy clerks, their dependency on the pharmaceutical industry to learn about drugs, and the absence of university trained QFBs with whom to consult is equally troubling. Given the large number of traditional pharmacies, the scarcity of QFBs in Mexico [40], and the relatively small amount of income generated by pharmaceutical sales, mandating the presence of a pharmacist in these stores is unlikely. But the presence of a university trained QFB in pharmacy chains should be required at all times.

Based on the geographical proximity of sister cities along the US-Mexico border, the cultural and economic ties, and the millions of daily crossings, antibiotic misuse and antibiotic resistance is a problem that requires the implementation of solutions by health authorities on both sides of the border. Stakeholders interested in promoting the appropriate use of antibiotics might develop bilingual information – similar to US drug package inserts – to be distributed along with the dispensed products. These pamphlets should be designed by communication experts and only contain independent, evidence-based information.



The creation of a two-year technical degree could be an acceptable transitional measure, and could minimise the pharmacy clerks' knowledge gaps and the risks associated with the purchase of antibiotics from them. On a temporary basis, while Mexico builds pharmaceutical training programs, US junior colleges in border cities might be permitted to offer technical courses/degrees recognized in Mexico. Funding the program would need to be studied, but findings from this study indicate that better trained Mexican pharmacy clerks would be of benefit to US citizens as well as those from Mexico.

Self-medication amongst US residents may decrease as insurance coverage broadens with the proposed Affordable Health Care Act (HR 3962). However, the chronic shortage of physicians on the US side of the border leads us to project that access to health services will continue to be restricted and border residents will continue to rely on Mexican pharmacies. Even if self-medication decreases, physicians have the potential to overprescribe antibiotics, often in response to patients' demand [41-46]. Therefore, education efforts have to be directed at prescribers, pharmacy clerks and the community at large. To that effect, The Centers for Disease Control have developed the program "Get Smart: know when antibiotics work." This program, complemented by other activities addressing the dangers of self-medication, could be more broadly disseminated among professionals and communities on both sides of the US-Mexico Border. In addition, to provide guidance for appropriate infection control and treatment, establishing surveillance systems to monitor antibiotic use and antimicrobial resistance is essential. Other critical components of a comprehensive program include formulary restrictions, and preauthorization for the prescription of certain types of antimicrobials [42, 47, 48].

If improving the human use of antibiotics is a daunting task, tackling other determinants of antibiotic resistance present at the US-Mexico border such as the microbial contamination of the land and water resulting from municipal waste, agricultural activities and the large cattle farms situated along the border is even more challenging [49-54]. Pharmacies can effectively contribute to improve the human use of antibiotics, while the others fall out their reach.

## Conclusions

This study has unveiled how the organization and staffing of Mexican pharmacies is likely to contribute to the over and inappropriate use of antibiotics at the US-Mexico Border. The authors posit that the enforcement of the recently approved Mexican law requiring that all antibiotics be dispensed with a prescription will be insufficient to correct the situation unless prescriptions are retained, physicians improve prescribing habits, and systems are established to facilitate and monitor the appropriate prescription of antibiotics.

The above changes will require the approval of legislation outlawing the hiring of physicians by pharmacies, and regulating the provision of prescriptions by pharmacies. Health authorities on both sides of the US-Mexico border need to coordinate efforts

to improve the human use of antibiotics, which will require investments in education (health professionals, pharmacy clerks, community at large); investments in infrastructure (antibiotic use and antibiotic resistance surveillance systems) to steer the development of prescription guidelines and formularies; and the professionalization of antibiotic dispensing in Mexican pharmacies.

## Authors' Contributions

Nuria Homedes and Antonio Ugalde conceived and designed the study. Nuria Homedes supervised the fieldwork, analyzed the data and drafted the manuscript. Antonio Ugalde critically reviewed and edited the manuscript.

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## Conflicts of Interests

The authors do not have any conflict of interest in relation to the issues discussed in this article.

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## References

1. Nicogossian A et al. Anti-microbial drug resistance: A human disaster in the making. *World Medical & Health Policy* 2011; 3(2): Article 1. DOI:10.2202/1948-4682.1172. <http://www.psocommons.org/wmhp/vol3/iss2/art1/> (Accessed 24 September 2011)
2. Neuman W, Sayari S. Egyptian seeds linked to European E. Coli outbreaks. *The New York Times*, June 29, 2011. <http://www.nytimes.com/2011/06/30/world/middleeast/30ecoli.html> (Accessed 24 September 2011)
3. Kristof ND. The spread of superbugs. *The New York Times*, March 7, 2010. <http://www.nytimes.com/2010/03/07/opinion/07kristof.html> (Accessed 24 September 2011)
4. Institute of Medicine. Antibiotic Resistance: Implications for global health and novel intervention strategies: workshop summary. Washington DC: The National Academy Press 2010.
5. Wernli D et al. A call to action: the application of the International Health Regulations to the global threat of antimicrobial resistance. *PLoS Medicine* 2011; 8 (4): e1001022
6. Monssialos E et al. Policies and incentives for promoting innovation in antibiotic research. Geneva; WHO on behalf of the European Observatory of Health Systems and Policies, 2010.
7. European Center for Disease Prevention and Control, and European Medicines Agency. The bacterial challenge: time to react. Stockholm: EMEA, EMEA/576176/2009. 2009.
8. Paddock C. The antibiotics crisis: how did we get here and where do we go next? *Medical News Today*, January 10, 2011. <http://www.medicalnewstoday.com/articles/213193.php> (Accessed 24 September 2011)

9. Tenover FC, Hughes JM. The challenges of emerging infectious diseases. Development and spread of multiple-resistant bacterial pathogens. *JAMA* 1996; 275: 300-3004.
10. Bronzwaer SL et al. A European study on the relationship between antimicrobial use and antimicrobial resistance. *Emerg Infect Dis* 2002; 8:278-82.
11. Amábile-Cuevas CF. Antibiotic resistance in Mexico: a brief overview of the current status and its causes. *J Infect Dev Ctries* 2010; 4(3): 126-131.
12. Combs S. Visiting la Farmacia. In Texas Comptroller. State Government. *Bordering the Future*. July 1998. <http://www.window.state.tx.us/border/border.html> (Accessed 24 September 2011)
13. Taylor JP et al. Epidemiology of Drug-resistant tuberculosis in Texas. *American Journal of Epidemiology* 1999; 149 (4): 359-365.
14. Centers for Disease Control and Prevention (CDC). Population-based survey for drug resistance tuberculosis-Mexico, 1997. *MMWR* 1998; 47:371-375.
15. Escobedo M, Cosio FG. Tuberculosis and the United States-Mexico border. *J Border Health* 1997; 2:40-47.
16. Taylor JP, Suarez L. Prevalence and risk factors of drug-resistant tuberculosis along the Mexico-Texas Border. *AJPH* 2000; 90(2):271-273.
17. Vasquez Y, Hand WL. Antibiotic susceptibility patterns of community-acquired urinary tract infection isolates from female patients on the US (Texas)-Mexico Border. *the Journal of Applied Research* 2004; 4(2): 321-326. <http://www.jarcet.com/articles/Vol4Iss2/Vasquez-Jar-spring.pdf> (Accessed 24 September 2011)
18. Ammons DR et al. An exploratory study of methicillin-resistant *Staphylococcus aureus* and SCCmec elements obtained from a community setting along the Texas Border with Mexico. *Curr Microbiol* 2010; 60(5): 321-326. DOI 10.1007/s00284-009-9544-2. <http://www.springerlink.com/content/r3x62j8056207h7v/> (Accessed 24 September 2011)
19. Rivera JO et al. Study of methicillin-resistant *Staphylococcus aureus* on the US-Mexico Border. *Travel Medicine and Infectious Disease* 2009; 7:30-34.
20. Broussard CS et al. Exposure to antibiotics in a United States-Mexico Border birth cohort. *Pediatrics* 2010; 125:e1468.
21. Pylpa J. Self-medication practices in two California-Mexican communities. *J Immigr Health* 2001; 3(2): 59-75.
22. De Guzman GC et al. A survey of the use of foreign-purchased medications in a border community emergency department patient population. *J Emerg Med* 2007; 33(2): 213-221.
23. Lunday S. When purchasing medicine in Mexico, buyer beware. *The New York Times*, April 17, 2001. <http://www.nytimes.com/2001/04/17/health/when-purchasing-medicine-in-mexico-buyer-beware.html> (Accessed September 24, 2011)
24. Calvillo JP, Lal L. Pilot study of a survey of US residents purchasing medications in Mexico: demographics, reasons and types of medications purchased. *Clin Ther* 2003; 25(2): 561-577.
25. Wirtz V et al. [Organization and operation of the Mexican pharmacies]. In Homedes N Ugalde A eds. [Pharmacies, pharmacists and the appropriate use of pharmaceuticals in Latin America] Buenos Aires: Editorial Lugar 2011. pp 59-82 [In Spanish].
26. Dreser A et al. [Mexican pharmacies: regulation and policies]. In Homedes N Ugalde A eds. [Pharmacies, pharmacists and the appropriate use of pharmaceuticals in Latin America] Buenos Aires: Editorial Lugar 2011, pp 27-57. [In Spanish]
27. Manious AG et al. Factors affecting Latin adults' use of antibiotics for self-medication. *JABFM* 2008; 21(2): 128-134.
28. Planta MB. The role of poverty in antimicrobial resistance. *J Am Board Fam Med* 2007; 20:533-539.
29. Families USA Foundation. *Crossing to Mexico. Priced out of American Health Care*. Washington DC. Families USA Foundation 1992.
30. Casner PR, Guerra LG. Purchasing prescription medication in Mexico without a prescription. The experience at the border. *West J Med* 1992; 156: 512-16.
31. Texas Department of State Health Services. Office of Border Health. 2007 Health Risk Factors in the Texas-Mexico Border. Austin: Texas Department of State Health Services, no date.
32. Escobedo L, Cardenas VM. Utilization and purchase of medical care services in Mexico by residents in the United States of America 1998-1999. *Rev Panam Salud Pública* 2006; 19(5): 300-305.
33. Rivera JO et al. Cross-border purchase of medications and health care in a sample of residents of El Paso, Texas, and Ciudad Juarez, Mexico. *J Natl Med Assoc* 2009; 101(2):167-173.
34. Coffman MJ et al. Self-prescription practices in recent Latino Immigrants. *Public Health Nurs* 2008; 25(3): 203-211.
35. Homedes N. The Health Seeking Behavior of Undocumented Immigrants in El Paso County. Report for the Center for Border Health Research, 145 pages. 2008.
36. US Department of Health, Education and Welfare. A reason for visit classification for ambulatory care. Hyattsville, MD: DHEW Publication number (PHS) 79-1352, 1979.
37. Quiroz T. [Mexico: how some pharmacies operate]. *Boletín Fármacos* 2011; 14 (1). <http://www.saludyfarmacos.org/boletin-farmacos/boletines/feb2011/Mexico-funcionamiento-de-algunas-farmacias/> (Accessed September 24, 2011)
38. Escutia Gutiérrez MFR. Situación actual de los Servicios Farmacéuticos en México. Instituto Paliá- Secretaría de Salud Jalisco, Ex delegado de O.F.I.L., México [http://www.foroibercisalud.com/docs/articulos/Situacion\\_FarmacuticosMexico.pdf](http://www.foroibercisalud.com/docs/articulos/Situacion_FarmacuticosMexico.pdf)
39. Volpato DE et al. Use of antibiotics without medical prescription. *Braz J Infect Dis*.2005;9(4):288-91.
40. World Health Organization. *World Health Statistics*. Geneva: WHO 2011. p 120. [http://www.who.int/whosis/whostat/EN\\_WHS2011\\_Full.pdf](http://www.who.int/whosis/whostat/EN_WHS2011_Full.pdf) (Accessed September 24, 2011)
41. Wirtz VJ et al. Trends in antibiotic utilization in eight Latin American countries 1997-2007. *Rev Panam Salud Pública* 2010; 27(3): 219-225.
42. Arnold SR, Strauss SE. Interventions to improve antibiotic prescribing practices in ambulatory care. *Cochrane Database of Systematic Reviews* 2005; 4: CD003539.
43. Bennett D et al. Competing doctors, antibiotic use, and antibiotic resistance in Taiwan. January 7, 2009. <http://chess.uchicago.edu.ezproxyhost.library.tmc.edu/events/hew/fall08/bennett.pdf> (Accessed September 24, 2011)

44. Resi D, Milnadruì M, More ML and the Emilia Romagna Study Group on the use of antibiotic in children. Antibiotic prescriptions in children. *J Antimicrob Chemother* 2003; 52: 282-286. DOI: 10.1093/jac/dkg302 . <http://jac.oxfordjournals.org/content/52/2/282.full.pdf+html> (Accessed September 24, 2011)
45. Masiero MG, Ferech M, Goossens H. Determinants of outpatient antibiotic consumption in Europe: bacterial resistance and drug prescribers. *Quaderno N 07-02*. 2007. <http://ideas.repec.org/p/lug/wpaper/0702.html> (Accessed September 24, 2011)
46. Steinman MA et al. Variation in outpatient antibiotic prescribing in the United States. *Am J Manag Care* 2009; 15 (12): 861-868.
47. Manious AG, Hueston WJ. Controlling antibiotic resistance: will we someday see limited prescribing autonomy? *Am Fam Physician* 2001; 63(6):1034-1039.
48. Ranji SR et al. Interventions to reduce unnecessary antibiotic prescribing: a systematic review and quantitative analysis. *Med Care* 2008; 46 (8):847-862.
49. Mroz RC Jr, Pillai SD. Bacterial population in the groundwater on the US-Mexico border in El Paso County. *Texas South Med Journal* 1994; 87:214-7.
50. Pillai SD et al. Antibiotic resistance profiles of *Escherichia coli* isolated from rural and urban environments. *J Environ Sci Health* 1997; 32:1665-75.
51. International Boundary and Water Commission. *Water Bulletin #63: Flow of the Rio Grande and related data*. El Paso (Texas):The Commission, 1993, p 132.
52. Scandura JE, Sobsey MD. Viral and bacterial contamination of groundwater from on-site sewage treatment systems. *Water Sci Technol* 1997; 35:141-46.
53. Roe MT et al. Antimicrobial resistance markers of class 1 and class 2 integron-bearing *Escherichia coli* from irrigation water and sediments. *Emerg Infect Diseases* 2003; 9(7): 822-826.
54. Ryu H et al. An assessment of water quality and microbial risk in Rio Grande basin in the United States-Mexican border region. *Journal of Water and Health* 2005; 3(2): 209-218.

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