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RESEARCH ARTICLE

Over-the-counter sales of antibiotics from community pharmacies in Abu Dhabi

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Abstract *Objectives* The aim of this study is to investigate over-the-counter sale of antibiotics from community pharmacies in Abu Dhabi city, focusing on the extent, demographic and socioeconomic determinants of this practice. *Setting* The study was conducted in the capital of the United Arab Emirates, Abu Dhabi, and involved 17 randomly selected private pharmacies. *Method* A cross-sectional design using structured observations of 30 clients purchasing antibiotics from a pharmacy staff (either a pharmacist or pharmacy assistant) at each selected pharmacy. A total of 510 interactions were observed. Statistical analysis was performed using SPSS. *Main outcome measure* The extent and types of antibiotics sold over-the-counter in Abu Dhabi city as observed in the selected sample of community pharmacies, and the demographic and socioeconomic factors that contributed to this practice. *Results* Sixty eight percent (68.4%) of the observed antibiotic sales were sold over-the-counter without prescriptions. Injection antibiotics constituted 2.2% of the antibiotics sold, 45.5% of which were sold over-the-counter. Combination of penicillins including β-lactamase inhibitors (34.0%), penicillins with extended spectrum (22.3%) and second generation cephalosporins (11.2%) were the mostly commonly sold antibiotic groups. Respiratory conditions (63.1%) were the most frequent reason for purchasing antibiotics. Over-the-counter sales of antibiotics were related to client ethnicity and age, gender of pharmacy staff and health complaint. *Conclusion* Our study revealed high sales of over-the-counter antibiotics, despite this being illegal. The ineffectiveness of antibiotics in treating respiratory conditions of viral origin and effects of such practice on the emergence of bacterial resistance necessitates prompt action.

Keywords Antibiotic resistance · Antibiotic sale · Community pharmacy · Non-prescription · Observations · Over-the-counter · Pharmacy practice · United Arab Emirates

Impact of findings on practice

- There is illegal dispensing of antibiotics without prescription in the United Arab Emirates (UAE).
- UAE Medicines and Pharmacies Inspectorate should take strict actions to strengthen the control of antibiotics sale and dispensing from private pharmacies.

Introduction

Antibiotic use and consumption are determinants for the emergence of bacterial resistance [1, 2]. Indiscriminate use of antibiotics, especially in densely populated developing countries, contributes towards the spread of antimicrobial resistance globally [3].

The United Arab Emirates (UAE) has been described as a country with worldwide significance in the context of global epidemiology of antimicrobial resistance [4]. The UAE is a Gulf Cooperation Council country of the Middle East that has both characteristics of industrialized nations and countries in transition. UAE citizens are considerably outnumbered by expatriates, e.g. in the capital Abu Dhabi UAE citizens constitute only 22.0% of the population [5]. The country's total expenditure on healthcare as a

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percentage of GDP is 2.6 (2006 estimate). Most of that expenditure is made by the government (72.9%) with 27.1% private; 77.9% of private expenditure on health is out-of-pocket expenditure [6].

Published data on bacterial resistance in the UAE is scarce. High rates of resistance were recently reported for *Escherichia coli*, *Shigella sonnei*, *Campylobacter* spp., and also *Streptococcus pneumoniae* in a tertiary UAE hospital [7]. In another study, 4.1% of *Salmonella spp.* from the UAE was found to be multi-drug resistant, with reduced susceptibility to ciprofloxacin in 7.4% of isolates [4].

Antibiotics, typically prescription only medicines, can be purchased over-the-counter from various drug outlets and private pharmacies in a range of countries around the world [8–21]. Antibiotics are classified as prescription medicines in the UAE and legally according to the UAE Medicine Regulations require a prescription to be dispensed. To date, there are no studies on over-the-counter sale of antibiotics from community pharmacies in the UAE.

Aim of the study

The aim of the study was to investigate the sale of antibiotics, particularly over-the-counter from private pharmacies in the capital of the UAE Abu Dhabi. We investigated the extent and type of antibiotics sold, the health condition or complaint leading to purchase, and pharmacy staff and client characteristics that are associated with this practice.

Method

Study design

This study is a cross-sectional study. It used structured observations to assess antibiotic purchases at private pharmacies in Abu Dhabi. An up-to-date list of all pharmacies registered in Abu Dhabi city was obtained from the UAE Ministry of Health to generate a sampling frame. After excluding hospital pharmacies and pharmacies located at primary health centres the list contained 149 private pharmacies. Information about the location of each pharmacy, demographics and positions of pharmacy staff (whether pharmacist or pharmacy assistant) and pharmacy contact details were included in the list. The list was stratified on the basis of pharmacy size and socio-economic status of clients. Floor size of each pharmacy was obtained from the pharmacy's establishment application file lodged at the Ministry. Floor size was divided into small (30–40 m^2), medium (40–60 m^2) and large (>60 m^2). Since pharmacies could be located in the same suburbs, but serve different clientele, six pharmaceutical representatives were asked to classify pharmacies on the basis of clients' socioeconomic status (low, medium and high). Pharmacies included in the study were randomly selected from within each category.

Thirty antibiotic sale interactions between customers and one pharmacy staff member (pharmacist or pharmacy assistant) were observed at each pharmacy. On average, the 30 antibiotic encounters at a single pharmacy took 10 days (range 6–13 days). The observations were conducted from mid-September till the end of December 2005.

Data collection

Ethical approval was obtained from the UAE Ministry of Health in Abu Dhabi and the University of Otago in New Zealand. Details of the observations were recorded on an Antibiotic Dispensing Encounter-Observation Form. The form was adapted from the Prescribing Indicator Form of the WHO's "How to Investigate Drug Use in Health Facilities" [22]. The form included a section about the observed pharmacy staff: nationality, age, gender and whether pharmacist or assistant. The form also included a table with rows for each encounter observed and columns for clients' demographics (age, nationality, gender), health complaint presented, presentation of prescription or not, antibiotic dispensed (name, dose, formulation, quantity, length of supply) and number of medicines sold per encounter. Client was defined as the person for whom the antibiotic was purchased. Clients' nationalities were identified from both their spoken dialects and attire, and then grouped into larger ethnicity groups: UAE nationals, Arab, Asian and other. Clients' age was obtained from prescriptions where presented otherwise estimated, then grouped into infants (0–2), toddlers (3–5), children (6–12), teenagers (13–19), adults (>20) and elders (>65).

Health complaint or indication for antibiotic use was obtained from the prescription if indicated on the presented prescription, otherwise clients' self-report and/or pharmacy staff's diagnosis was recorded. Then grouped into ten categories: respiratory, ear, eye, gastrointestinal, sexually transmitted disease, urinary tract infections, skin, dental, miscellaneous, and unspecified. Any combination of fever and sore throat, runny nose, cough, flu, tonsillitis, sinusitis, bronchitis, pharyngitis, upper/lower respiratory tract infection was included in the respiratory condition category. Skin category included acne, impetigo, wound infection and secondary wart infections. Dental category included tooth and gum infections. The "miscellaneous" category included all complaints that did not fit any of the other categories. The "unspecified" category included encounters where clients did not disclose a health complaint nor was it described in the presented prescriptions.

Antibiotics were coded according to the WHO Collaborating Centre for Drug Statistics Methodology Anatomical Therapeutic Chemical (ATC) Classification System [23]. The defined daily doses (DDD) of antibiotics dispensed were obtained from the same publication. The prescribed daily doses (PDD) were determined by dividing the amount of active ingredient for each antibiotic supplied (in grams) by the days of treatment that were recommended. Systematic antibiotics were then grouped into their main pharmacological and chemical subgroups as per level 3 and 4 of the ATC classification system. An eighth group for non-systemic antibiotics was named group N/S: Non-Systemic.

Statistical analysis

SPSS 15/PASW 18 for Windows was used for descriptive and inferential statistics. Outcome variables were: whether the antibiotic was supplied with a prescription; whether a brand or generic was supplied, number of DDDs supplied, number of PDDs, and class of antibiotic. Predictor variables were clients' ethnicity, gender, age group and health complaint presented, along with pharmacy staff characteristics position, ethnicity and gender. Chi square (χ^2) was used for discrete variables, and ANOVA with Student–Newman–Keuls post hoc for continuous variables.

Results

We aimed to sample 20 pharmacies, but only 17 agreed to participate within the time frame of the study. The response rate for pharmacies was 37.7% (17/45).

Demographics of clients and pharmacy staff

Demographic characteristics of observed clients are summarised in Table 1. Clients were more likely to be male, Arab, and in the adult age group. Staff were more likely to be male, Arab, and pharmacists rather than pharmacy staff (Table 2).

Of the total 510 observed encounters, 349 (68.4%) involved antibiotics being sold over-the-counter. As summarised in Table 1, just under half of all antibiotic sales to UAE-nationals without prescription, with rates for other ethnicities closer to three quarters. Antibiotics intended for younger were more likely to be sold with prescription, compared to teenagers and adults. Similar patterns were seen with branded versus generic dispensing, with younger children and UAE citizens more likely to receive branded antibiotics. Males received marginally more DDDs than females. Toddlers and infants received fewer DDDs, but this would be expected based on factors such as lower body weight. The mean number of medicines dispensed (including the antibiotics) saw UAE citizens receiving the highest number of medicines, and a less clear pattern of differences relating to age.

Overall both female and male pharmacy staff sold high proportions of antibiotics over-the-counter (Table 2). Female staff, however, sold a significantly lower proportion of antibiotics over-the-counter compared to their male counterparts, and also sold a lower average number of medicines in each encounter compared to male staff. The percentage of antibiotics sold over-the-counter was significantly higher for Asian compared to Arab staff. Asian staff also sold a slightly higher mean number of DDDs compared to Arab staff. Finally, pharmacy assistants sold more antibiotics over-the-counter compared to pharmacists.

Health complaints presented

A summary of the conditions observed is depicted in Table 3. Clients' health complaints had a significant effect on the presentation of a prescription ($\chi^2(9) = 79.6$, $P < 0.001$). Respiratory conditions were the most frequent indication for purchasing antibiotics overall. The majority of those complaining of respiratory conditions bought antibiotics over-the-counter from the pharmacies observed. The "unspecified" condition category was the only category which had more antibiotics dispensed with prescription. Nevertheless, 4% of those purchasing antibiotics over-the-counter did not disclose or specify a health complaint.

Antibiotics sold

A total of 31 different antibiotics were sold at the observed pharmacies. Table 4 lists the six most common antibiotics sold overall, and with and without a prescription. The vast majority sold were systemic antibiotics, with a small number of ophthalmological and dermatological antibiotics. Overall, combination of penicillins including β-lactamase inhibitors namely amoxicillin and enzyme inhibitor, penicillins with extended spectrum and second generation cephalosporins were the most common antibiotic subgroups sold. Injection antibiotics constituted 2.2% of the antibiotics sold, 45.5% of which were sold over-the-counter.

The median duration of antibiotic treatments was 5 days (the duration of antibiotic supply was not disclosed in 9.2% of the observed encounters). For treatments 10 days or shorter, the mean duration of antibiotics sold with and without prescription was not different (M = 5.6 days, SD = 1.8 and M = 5.7, SD = 1.7 respectively, $F(1, 451) = 0.205$, ns). For adults, the mean ratio of prescribed daily dose (PDD) to defined daily dose (DDD) of antibiotics dispensed over-the-counter was slightly higher than the ratio of PDD to DDD of those dispensed with prescription, 1.26 compared to

Table 1 Demographic characteristics of clients ($n = 510$), and associations with outcome variables

	Total Observations (%)	No prescription (%)	Brand (%)	Number of medicines	Number of PDD	Number of DDD
Gender		$\chi^2(1) = 3.2^{\dagger}$	$\chi^2(1) = 0.8$	F(1,508) = 2.62	F(1,453) = 3.02†	F(1,494) = 2.80†
Male	64.7	71.3	54.1	2.01	1.08	6.67
Female	35.3	63.8	58.2	2.14	0.98	6.11
Ethnicity		$\chi^2(3) = 25.2$***	$\chi^2(3) = 51.7$***	F(3,506) = 8.65***	F(3,451) = 4.18***	F(3,492) = 1.24
UAE	21.8	49.5	81.1	2.39a[b]	0.94b	6.34
Arab	40.6	71.0	54.6	2.03b	1.12a	6.80
Asian	30.6	75.6	37.2	1.94b	1.17a	6.06
Other	7.0	80.6	63.9	1.67c	1.15a	6.60
Age group		$\chi^2(4) = 77.2$***	$\chi^2(4) = 17.7$***	F(4,505) = 2.50*	F(4,450) = 27,75***	F(4,491) = 18.51***
Adult (20+)[a]	74.5	77.6	50.5	2.01ab	1.22a	7.12a
Teenagers (13–19)	3.1	75.0	56.3	1.75b	1.04ab	7.03a
Children (6–12)	7.3	51.4	73.0	2.32a	0.95b	5.56a
Toddlers (3–5)	9.2	38.3	72.3	2.11ab	0.70c	3.8b
Infants (0– 2)	5.9	16.7	73.3	2.37a	0.49c	2.88b

† $P < .10$; * $P < .05$; ** $P < .01$; *** $P < .001$

[a] Includes 3 participants aged over 65

[b] Means not sharing the same letter differ at $P < .05$ on Student–Newman–Keuls post hoc test

Table 2 Demographic characteristics of pharmacy staff ($n = 17$) and associations with outcome variables

Pharmacy staff characteristics	*n*	No prescription (%)	Brand (%)	Number of medicines	Number of PDD	Number of DDD
Gender		$\chi^2(1) = 6.9$**	$\chi^2(1) = 0.2$	F(1,15) = 6.29*	F(1,15) = 0.01	F(1,15) = 0.16
Male	11	72.4	56.4	1.87	1.12	6.40
Female	6	61.1	54.4	2.16	1.13	6.58
Ethnicity		$\chi^2(1) = 30.8$***	$\chi^2(1) = 2.01$	F(1,15) = 0.03	F(1,15) = 2.05	F(1,15) = 4.16†
Arab	11	60.0	53.3	2.05	1.09	6.18
Asian	6	83.9	60.0	2.07	1.19	6.98
Position		$\chi^2(1) = 36.7$***	$\chi^2(1) = 0.2$	F(1,15) = 0.18	F(1,15) = 0.96	F(1,15) = 2.48
Pharmacist	10	58.0	56.3	2.03	1.10	6.23
Pharmacy assistant	7	83.3	54.8	2.09	1.16	6.83

† $P < .10$; * $P < .05$; ** $P < .01$; *** $P < .001$

1.12 (F(1, 332) = 5.60, $P = 0.019$). That is, clients purchasing antibiotics over the counter were on higher doses than those buying antibiotics with prescription.

Brand antibiotics were sold slightly more often (60.2%) with prescription than without a prescription (53.6%), but this did not reach significance ($\chi^2(1) = 0.16$, ns). The total proportion of antibiotics dispensed in each pharmacological class, differed as a function of prescription ($\chi^2(7) = 32.3$, $P < 0.001$). Class C (β-Lactams and Penicillins) antibiotics were the most common class of antibiotics sold in all the pharmacies observed, with two Class C antibiotics, amoxicillin–clavulanate and amoxicillin the two most common antibiotics sold (33.9 and 21.4% of all sales respectively). 63.0% of antibiotics sold over-the-counter were β-Lactams and Penicillins versus 43.0% with prescription. Amoxicillin was sold more frequently over-the-counter (25.8%) than with prescription (11.8%), with a similar but weaker trend for amoxicillin–clavulanate (36.1% versus 29.2%). In contrast, Class D antibiotics (other β-Lactams) were sold significantly more with prescription than without, 26.1 and 14.3% respectively. Similarly, Class F antibiotics (Macrolides) were sold significantly more with prescription than without, 12.4 and 5.2% respectively. Class E (Sulfonamides and Trimethoprim) were only sold over-the-counter.

Discussion

To our knowledge, this is the first study examining antibiotic sales in private pharmacies in the UAE. The high rate of over-the-counter antibiotic sales illustrates obvious non-adherence to UAE Federal Law that prohibits the sale of

Table 3 Summary of the conditions presented during the observations

Condition	*n* (%)	Male (%)	Non-Rx (%)	B[a] (%)	Number of medicines (95% CI)[b]
Respiratory	322 (63.1)	208 (64.6)	249 (77.3)	189 (59.3)	2.05 (1.96, 2.15)
Ear	6 (1.2)	4 (66.6)	3 (50.0)	6 (100.0)	2.50 (1.80, 3.20)
Eye	12 (2.4)	8 (66.6)	10 (83.3)	0 (0.0)	1.67 (1.17, 2.16)
Gastrointestinal	5 (1.0)	4 (80)	3 (60.0)	5 (100.0)	2.80 (2.03, 3.57)
Sexually transmitted disease	2 (0.4)	0 (0.0)	1 (50.0)	0 (0.0)	1.00 (−0.22, 2.22)
Urinary tract infections	33 (6.5)	14 (42.4)	21 (63.6)	23 (69.7)	1.94 (1.53, 2.15)
Skin	15 (2.9)	11 (73.3)	12 (80.0)	13 (86.7)	1.87 (1.42, 2.31)
Dental	41 (8.0)	20 (47.8)	28 (68.3)	10 (24.4)	1.93 (1.66, 2.20)
Miscellaneous	10 (2.0)	6 (60)	8 (80.0)	5 (50.0)	1.60 (0.67, 3.33)
Unspecified	64 (12.5)	39 (60.9)	14 (21.9)	32 (50.0)	2.34 (2.13, 2.56)

[a] Brand antibiotic

[b] Number of medicines supplied, mean (confidence interval)

Table 4 List of the most sold antibiotics: overall, without prescription, and with prescription only

Overall ($N = 510$)			Without Rx ($N = 349$)			With Rx ($N = 161$)		
ATC code	Group[a]	*n* (%)	ATC code	Group[a]	*n* (%)	ATC code	Group[a]	*n* (%)
J01CR02	Combination of penicillins incl. β-lactamase inhibitors	173 (33.96)	J01CR02	Combination of penicillins incl. β-lactamase inhibitors	126 (36.10)	J01CR02	Combination of penicillins incl. β-lactamase inhibitors	47 (29.19)
J01CA01 J01CA04	Penicillins with extended spectrum	114 (22.34)	J01CA01 J01CA04	Penicillins with extended spectrum	94 (26.90)	J01CA01 J01CA04	Penicillins with extended spectrum	20 (12.40)
J01DC02 J01DC04 J01DC10	Second-generation cephalosporins	57 (11.16)	J01DC02 J01DC04 J01DC10	Second-generation cephalosporins	38 (10.87)	J01DD04 J01DD08 J01DD15	Third-generation cephalosporins	20 (12.40)
J01MA01 J01MA02 J01MA06 J01MA12	Fluoroquinolones	54 (10.6)	J01MA01 J01MA02 J01MA06 J01MA12	Fluoroquinolones	34 (9.70)	J01MA01 J01MA02 J01MA06 J01MA12	Fluoroquinolones	20 (12.40)
J01FA01 J01FA09 J01FA10	Macrolides	31 (6.12)	J01FA01 J01FA09 J01FA10	Macrolides	11 (3.18)	J01FA01 J01FA09 J01FA10	Macrolides	20 (12.40)
J01DD04 J01DD08 J01DD15	Third-generation cephalosporins	26 (5.08)	S01AA01 S01AA12	Opthalmological antibiotics	9 (2.60)	J01DC02 J01DC04 J01DC10	Second-generation cephalosporins	19 (11.80)

Rx prescription

[a] Chemical subgroup based on WHO Collaborating Centre for Drug Statistics Methodology Anatomical Therapeutic Chemical (ATC) Classification 2007

prescription medicines, including antibiotics, without prescription. Our results indicate that for this particular issue, the regulatory framework of the UAE is not effectively enforced.

Antibiotic availability over-the-counter has been reported in many countries in Asia [9, 11–15], Africa [24, 25], the Middle East [16, 17, 26, 27], Latin America [18, 28, 29], Southern and Eastern Europe [19, 30–33], and America [20, 21, 34]. The high level of over-the-counter antibiotic sales is certainly not unique to the UAE. Several studies from the region and beyond reported similar and even higher rates. In the Eastern province of Saudi Arabia, 82.0% of pharmacies visited by simulated clients presenting cases of uncomplicated urinary tract infection were dispensed antibiotics over-the-counter [35]. Two studies from Sudan reported 73.9% and 79.5% of antibiotic/antimalarial use was without prescription [17, 36]. In Alexandria, Egypt, it was found that 19.8% of all dispensed drugs were anti-infective products. Of these, only 35.8% were prescribed by doctors,

13.8% were recommended by pharmacists and about half (50.4%) were sold on customers' request without prescription or advice from the pharmacist [16]. In two provinces of Lao People's Democratic Republic, 91% of respondents purchased non-prescription antibiotics from private pharmacies to treat reproductive tract infections and sexually transmitted diseases [15]. Some of the established reasons for the sale and use of antibiotics without prescription include privacy and a preference for remaining anonymous [37], high patient demand [38], and lack of public awareness and misconceptions about the efficacy of antibiotics [39]. Other reasons such as the cost of medical consultations and low satisfaction with medical practitioners [40], local production and low price of pharmaceuticals [41], and easy availability of antibiotics from pharmacies [13] have also been stated. The lack of means to enforce pharmacy regulations, commercial pressure on community pharmacists [39], and the level of peer influence and professionalism within the pharmacist community [42] are also believed to influence antibiotic sale without prescription.

Amoxicillin–clavulanate and amoxicillin were the two antibiotics most dispensed over-the-counter (59.9% of non prescription and 37.7% of prescriptions respectively). Other studies have shown higher consumption of amoxicillin compared to our study [17, 26, 41]. Another interesting finding was that in general the list of antibiotics most commonly sold over-the-counter was very similar to the list of those most commonly sold with prescription, with the exception of third and second generation cephalosporins. This may be due to patients and/or staff opting for previously prescribed antibiotics [39].

Demographic characteristics and socioeconomic variables also influenced the use of antibiotics with or without prescription in our study. Adults and teenagers were more likely to have their antibiotics purchased without prescription compared to younger patients. The average proportion of antibiotics used by the young patients (infants, toddlers and children) without prescription was 35.4%. This finding is consistent with another study which showed a 35.7% rate of antibiotics used without prescription among children and juveniles in a Chinese city [14]. There is a worldwide trend towards more cautious and lower rates of antibiotic prescribing for children because of higher fear of undesirable outcomes that could harm children (e.g. Streptomycin deafness and tetracycline teeth).

Client ethnicity influenced prescription presentation. Asian and other clients were least likely to present a prescription whereas UAE nationals and other Arabs were the most likely. This may reflect income differences, with UAE nationals have higher income levels, and Asians the lowest in the UAE. Previous studies have found differing results regarding income levels and non-prescription antibiotic use. Some found that higher income people used non-prescription antibiotics more [26], whereas a higher prevalence of self-medication with non prescription antibiotics among lower income groups has been found [17]. Ethnicity as a reflection of income level could explain the greater average number of medicines dispensed per person and higher rates of brand antibiotic dispensing among UAE nationals. The higher level of prescription use among UAE nationals is likely to be a reflection of their greater access to doctors, hence prescriptions, because of their entitlement to free health care. Studies have shown that low confidence in doctors and in the ability to get medical care when needed and poor quality of healthcare contribute to antibiotic non-compliance and self-medication [40, 43].

In contrast to the situation in the UAE, a European study found that higher GPD and country's wealth were associated with lower self-medication with antibiotics [44]. This is likely because in those European countries better health systems including antibiotic dispensing regulations and prescription reimbursements are in place. The study showed that people who self-medicated with antibiotics were less likely to receive complete reimbursement for prescribed antibiotics and more likely to get no reimbursement at all [44]. The Government of Abu Dhabi recently introduced mandatory health insurance upon employers of expatriates in 2006. The effect of this move on the supply of prescription medicines including antibiotics from community pharmacies is yet to be determined.

No gender difference was found in antibiotic sales with and without prescription. Antibiotics are purchased more frequently for male patients in India, reflecting cultural higher favouring of males in that culture [12]. In contrast, others found that non-prescription antibiotics were used more commonly by females [17, 36].

Three quarters of the complaints for which antibiotics were purchased over-the-counter were for respiratory tract infections, which are known to be mostly of viral origin. Perceived severity or seriousness of health complaints has been well established as one of the reasons for patients seeking medical consultation [39]. Patients believe that minor uncomplicated conditions can be treated in less expensive ways which do not involve visiting doctors, instead directly purchasing previously prescribed medicines that cured the same complaint or taking the recommendations of pharmacy staff as seen in our study [21].

Our study had some limitations. Pharmacy staff may have restricted selling antibiotics without prescription during the observation period. Therefore the aim of the study was described in general terms without highlighting the focus on antibiotic sales or prescription status, and the duration of the observations were long enough to minimise this effect. Also, anonymity and confidentiality were guaranteed. Another limitation may be in the estimation of clients' health complaint. We relied predominantly on clients' self-report or

pharmacy staff's diagnosis, as the number of prescriptions that were presented was low furthermore prescriptions stating the indication for antibiotic use were rare. Also, no contact with the pharmacies' clients was sought in order not to disrupt their interaction with the pharmacy staff. More accurate representation of clients' demographics could have been obtained by directly asking the observed clients for their nationalities, age etc; however this is not guaranteed as clients might not consent to disclose such information or participate in the study. Bias inherent in using estimated demographic information was limited by using a single researcher who had lived in the Emirates for many years, and was thus very familiar with the cultural and demographic background of the country and its population. Where uncertainty in identifying the client's nationality or age was experienced the researcher's perception was cross-checked by asking the pharmacy staff. The use of broad ethnic and age categories also means that the number of mis-classified observations is low as a proportion of the overall sample and is therefore unlikely to have had a strong biasing effect.

Conclusion

Our observations revealed high rates of antibiotic use over-the-counter especially for conditions that were probably of viral origin. The results suggest a strong need for an explicit policy statement and enforcement strategy regarding antibiotic sale in UAE private pharmacies. Emphasis on identifying and addressing the causes of purchasing antibiotics over-the-counter and introducing education campaigns targeting the public and pharmacy staff about the grave consequences of this malpractice is imperative. Continuing professional development of pharmacists and pharmacy assistants in order to promote the prudent use of antibiotics especially to clients with common respiratory infection complaints is necessary.

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Conflict of interest No conflict of interest to declare.

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