RESEARCH ARTICLE

Patterns of prescribing antibiotics in primary healthcare centres in Baghdad

Siham Kadhim Salman[a], Yousif Abdul-Raheem[b], Besmah Muhamed Ali[c]

ABSTRACT

INTRODUCTION: Nowadays, antimicrobial resistance is a global health emergency. It has been associated with antibiotics misuse, especially at primary healthcare centres. The prescription patterns and the antibiotic use rate significantly impact the outcomes of the patient's conditions.

OBJECTIVE: To measure the patterns of prescribing antibiotics at the Primary healthcare centres in Baghdad.

METHODS: A cross-sectional study was conducted at the primary healthcare centres of Baghdad in 2019 by, reviewing the prescriptions dispensed from 1st January to 31st of December 2018. We randomly selected 30 family medicine-based primary health care centres, and a sample of 1800 prescriptions was enrolled in this study. Demographic data of the attendants and the medicines prescribed for them were extracted and entered into a specific line list designed for this purpose. .

RESULTS: Antibiotics were prescribed in 76.1% of the total prescriptions. Upper respiratory tract infections affecting children aged 12 years and younger, treated mainly by amoxicillin was the predominant prescribing pattern (64.1%), while dental conditions affecting adults, treated mainly by metronidazole and usually combined with amoxicillin, formed the second prescribing pattern (49.2%).

CONCLUSION: Antibiotics misuse at primary healthcare centres is common. Children aged 12 years and younger were the main affected group by this misuse.

Key words: Antibiotics, prescribing patterns, primary healthcare centres.

INTRODUCTION

Lives of millions have been saved by the use of antibiotics (ABs).[1] ABs are the commonest drug prescribed by Iraqi doctors of primary health care centres (PHCCs) and hospital outpatient clinics.[2] In Iraq, about 70% of all prescriptions contain ABs, and they are the first drugs to be self-medicated. [3] Globally, 80- 90 % of the ABs use occurs either through primary health care facilities or self-medication,[4,5] making antimicrobial resistance (AMR) a big health problem in Iraq and all over the world.[3] As with any drug, using ABs may lead to side effects, including AMR, especially if ABs are misused, overused or inappropriately used.[1] The excessive use of ABs at PHCCs has rendered those centres a main contributor to AMR, as many studies concluded.[4] Counteracting AMR requires effective interventions to prevent ABs misuse with periodic evaluation of patterns of prescriptions at the primary health care level.[6] The WHO reports stated that developing countries have poor efforts to promote the rational use of ABs; the rising prevalence of infections with resistant bacteria makes addressing this essential issue urgent.[4]

Many factors influence the use of medicines, and countries need to implement various strategies to improve appropriate use. Such strategies may include developing and implementing standard treatment guidelines (STGs) for common conditions and using essential medicine lists (EMLs) to guide procurement and training and help ensure appropriate drug use.

a: MBhB, Community Physician, Directorate of Planning and Development of Resources, Ministry of Health, Baghdad, Iraq.
b: FACMS.CM, Professor of Community Medicine. Department of Family and Community Medicine, Al- Kindy College of Medicine, University of Baghdad, Baghdad, Iraq. *c:* MBChB. Head of Public Health Unit in Ghazi Al-Hariri Hospital for surgical specialties, Baghdad, Iraq.
Corresponding Author: **Siham Kadhim Salman**, E mail: **corsiham@gmail.com**.

[7] EML is a roster of medicines that satisfy a population's priority healthcare needs and treat pressing global health concerns.[8] STGs for primary health care are present in two-thirds of countries, especially public health facilities, but unfortunately, recent updating of these STGs is absent in some of those facilities.[9]

In Iraq, there are generally no guidelines or standards for managing common conditions. If they exist, they are usually not adequately disseminated nor followed.[10]

The term antibiotic include antimicrobials which refer not only to antibacterial but also antiviral and antifungal, according to the microorganism they target.[11] For the purpose of this study, antibiotic or antimicrobial agents will be used as a synonym to include antibacterial agents only.

Overuse and misuse of these medications, as well as a lack of new drug development by the drug industry due to reduced economic incentives and the requirement of routine monitoring, were the contributors to antibiotic resistance.[6] As a result, in 2015 and years since its first use, bacterial infections have once more become a threat.[12]

The percentage of patients prescribed antibiotics is high in all countries.[7] In developing countries, the highest percent of drug sales is that one for antibiotics.[13]

Dentists are thought to be infrequent antibiotic prescribers.[14] Although few indications permit their use to manage oral infections,[15] antibiotics are still prescribed by dentists for numerous clinical and non-clinical indications.[16] Amount or percentage and conditions of antibiotics prescription by dentists are not well documented, probably because of the limited studies carried out for this purpose.[14] Dentists might prescribe more antibiotics than what was thought.[17] Dentists are often prescribed antibiotics inappropriately, not in the choice of the antibiotic itself, but in the dose, duration and frequency of that specific antibiotic.[17]

Standardized and objective method for satisfactorily assessing the quality of diagnostic and medicinal treatment do not yet be exist.[18] In the early nineties, the WHO collaborated with the International Network for Rational Use of Drugs (INRUD) developed a set of "core drug use indicators".[19] These indicators can be used to identify general prescribing and quality of care problems at primary care facilities in developing countries, in their assessments of drugs use.[20]

Prescribing indicators include:[9]	Optimal value
1. The average number of drugs per encounter.	<2
2. Percentage of drugs prescribed by generic name.	100%
3. % of encounters with an antibiotic prescribed.	<30%
4. % of encounters with an injection prescribed.	<20%
5. Percentage of drugs prescribed from the EML.	100%

Misuse of ABs is a significant health problem in Iraq, with very few to nearly no studies regarding the rate of use of ABs and prescription patterns, particularly at the primary healthcare level. Iraq writes a draft of the national action plan to prevent and control AMR, and this study may contribute to achieving one of the key aspects of this plan. ABs misuse at primary health care centres has been listed as one of the research priorities of the Ministry of Health of Iraq in 2019.

The objectives of this study were to measure the rate and the patterns of AB prescription at 30 PHCCs in Baghdad. And to find out the compliance of those PHCCs with WHO drug use indicators.

METHODS

Setting and study design: In 2019, a cross-sectional study was conducted at 30 family medicine-based PHCCs in Baghdad; 15 PHCCs from Al-Rusafa and 15 from Al-Karkh Health Directorates. Al-Rasafa Health Directorate has 25 PHCCs, and Al-Karkh Health Directorate has 22 Centres.

Ethical consideration: Approval was obtained from Al-Rusafa and Al- Karkh Health Directorates and their eleven PHC sectors. Confidentiality of data was maintained throughout the study, and data were not divulged except for

the study purpose.

Inclusion and exclusion criteria: All prescriptions of the enrolled PHC centres from 1st January to 31st December in 2018 had been reviewed retrospectively. Any prescription for chronic disease, vaccination purposes or antenatal care visit, in addition to prescriptions with missing data such as patient's name, the diagnosis, or prescriber's name were excluded.

Sample size and sampling method: This study adapted WHO established standard criteria for the sample size for drug use; at least 30 prescriptions from each of the 20 healthcare facilities to be selected randomly and retrospectively over one year to encounter seasonal variation.[18] Accordingly, this will yield a minimum of 600 prescriptions.

We selected the required number of prescriptions using multistage random sampling method. We chose 30 family medicine-Based PHCCs instead of 20 to increase the power and generalizability of the study. From each PHCC, 60 prescriptions were selected, yielding a total of 1800 prescriptions.

Data outcomes:

1. The percentage of prescriptions with an antibiotic prescribed.
2. The percentage of antibiotics prescribed by generic name.
3. The percentage of antibiotics prescribed from the essential drug list or formulary
4. The average number of drugs per prescription.
5. Establish the availability of copy of essential drug lists or formulary.
6. To find out particular AB prescribing patterns regarding the patient's age, the type of AB and the disease for which AB had been prescribed.

Diagnosis written on the prescriptions were grouped as follows:

a. Infection-based diagnosis: According to whether the written diagnosis contained infection or not, it was divided into infectious and non-infectious diagnoses.

Infectious diagnosis further sub-classified into:

- Non-specific infection: infection written but unspecified as bacterial or viral infection. For example, tonsillitis, pharyngitis and so on.
- Viral infection: If it was well-known as viral, such as flu, mumps, chicken pox, etc.
- Probable infection: When prescriptions contained symptoms suggestive of infection such as fever, diarrhoea, cough and vaginal discharge rather than a diagnosis or disease name.

Non-infectious: It is diagnosed If infections are obviously ruled out, such as skin allergy, anaemia, trauma, etc.

b. Human body systems based diagnosis: written diagnoses were also classified according to the human body system involved; for example, bronchitis means the respiratory system, urinary tract infection means the genitourinary tract, and so on. Some written diagnoses were not possible to be attributed to a specific system, so they were categorized as unclassified.

Data analysis: Data organization, presentation and analysis were done using SPSS software (version 24) and Microsoft Excel 2013. The main results and outcomes of the study were summarized and presented in tables and graphs. Frequencies and proportions were calculated for the study variables. Chi-square test (X^2) was used to find out if there was any association between the studied variables. A p-value less than 0.05 was considered statistically significant.

RESULTS

Social characteristics of all prescriptions: Out of all prescriptions reviewed, 972(54%) were prescribed for women and 828 (46%) for men. Patients' age ranged from 6 days to 86 years; 890 (49.4%) were children, and 632(35.1%) were adults. And nearly half of the children, 429(48.2%), were school-age, see table 1.

Antibiotics prescription: We found 4126 items prescribed in all prescriptions. The average

Table 1 | Frequency distribution of different age groups among the total and the ABs contained prescriptions.

Age groups	Prescriptions			
	Total		With ABs	
	N	%	N	%
Children ≤ 12 years	890	49.4	665	48.6
Infant ≤1 years	133	14.9	82	12.3
Pre-school >1 – 5 years	328	36.9	254	38.2
School age 6-12 years	429	48.2	329	49.5
Adolescent 13-19 years	213	11.8	167	12.2
Adult 20-59 years	632	35.1	488	35.6
Old ≥ 60 years	65	3.6	49	3.6
Total	1800	100	1369	100

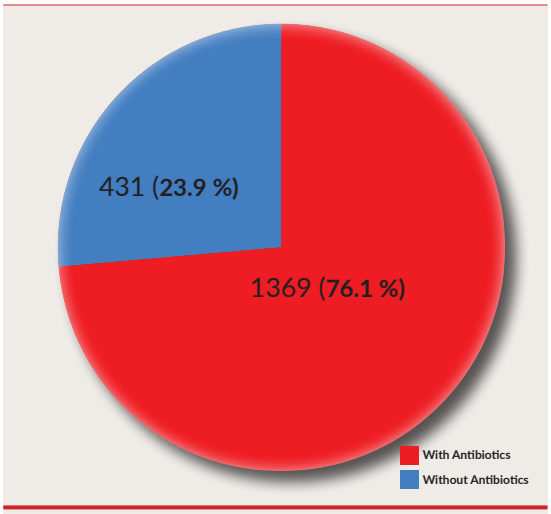

Figure 1 | Percentage of ABs in all reviewed prescription.

number of items per prescription was 2.29. Antibiotics constituted 38% of all items with a ratio of 1:2.6. Antibiotics were prescribed in 1369 (76.1%) prescriptions, figure 1. Of the 431 prescriptions without antibiotics, 29 (6.7%) did not include any item but contained medical appliances such as syringes and gauze.

Sex has no significant statistical association with prescribing antibiotics, females in 76.2% and males in 75.9%, with a p-value of 0.910. Nearly half, 665 (48.6%), of the antibiotics prescribed were for children ≤ 12 years and 488 (35.6%) were for adults, as in table 1. However, age showed no significant association with antibiotic prescriptions, a p-value of 0.572, except within the age group of children, with a p-value of 0.003. See table 2.

There were 1580 antibiotics prescribed in the 1369 ABs contained prescriptions. They belonged to 11 different classes. The vast majority, 1299(94.9%) Abs belonged to five classes. Among those, the most frequently prescribed ABs were penicillins in 675(47.3%), followed by cephalosporins in 348(25.4%) and metronidazole in 194(14.2%), as shown in figure 2. Other antibiotic classes constituted 5.1% (70 items); these contained six groups: macrolides, tetracycline, aminoglycosides, chloramphenicol, fusidic acid and nitrofurantoin.

Table 2 | Antibiotics prescriptions by age among different age groups.

Age groups	Total	ABs prescription				P value
		Yes		No		
		N	%	N	%	
Children <12 years	890	665	74.7	225	25.3	0.003*
Infant ≤1 year	133	82	61.7	51	38.3	
Preschool >1-5 years	328	254	77.4	74	22.6	
School age 6-12 years	429	329	76.6	100	23.3	
Adolescent 13-19 years	213	167	78.4	46	21.6	0.572†
Adult 20-59 years	632	488	77.2	144	22.8	
Old ≥60 years	65	49	75.4	16	24.6	
Total	1800	1369	76.1	431	23.9	

*: P-value only for the groups of children under 12 years. †: P-value for other age groups

One AB was prescribed in 1159 (85%), generic names in 314(19.9%), and oral route in 1512(95.6%), see table 3. All the antibiotics

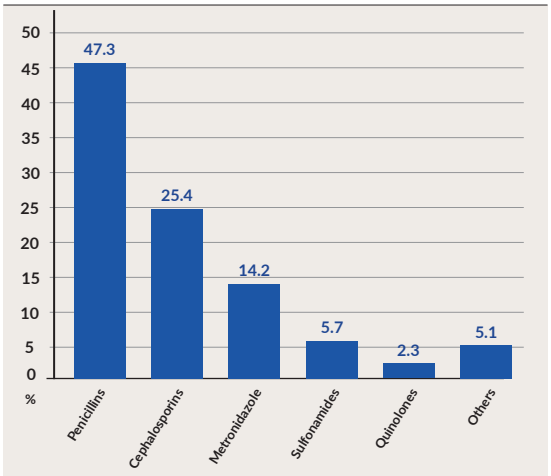

Figure 2 | Types of antibiotics prescribed in PHCCs.

Table 3 | Some characteristics of ABs prescription.

Antibiotics characteristics		N	%
Number per prescription	One	1159	85
	>One	210	15
Mode of writing	Generic	314	19.9
	Not generic	1266	80.1
Routes of administration	Oral	1512	95.6
	Injectable	2.34	37
	Topical	1.96	31

Table 4 | Antibiotics characteristics

Items per prescription*	Total	Antibiotics prescription				P value
		Yes		No		
		N	%	N	%	
One	192	41	21.4	151	78.6	0.001
Two	803	627	78.1	176	21.9	
Three	776	701	90.3	75	9.7	
Total	1800	1369	76.1	431	23.9	

* Prescriptions without any items (n=29) were not included here.

Table 5 | Infections based diagnosis among the ABs contained prescriptions.

Infection based diagnosis	ABs Prescriptions	
	No.	%
Infection	1174	85.8
Non-specific	1100	80.4
Probable	38	2.8
Viral	36	2.65
No infection	195	14.2
Total	1369	100

Table 6 | Association of infections based diagnosis and ABs prescription.

Diagnosis	Total	ABs prescription				P value
		Yes		No		
		N	%	N	%	
Infectious	1329	1174	88.3	155	11.7	0.0001*
Non specific	1152	1100	95.5	52	4.5	0.0001*
Probable	97	38	39.2	59	60.8	
Viral	80	36	45	44	55	
Non-infectious	471	195	41.4	276	58.6	
Total	1800	1369	76.1	431	23.9	

*: P-value between infectious and non-infectious and within types of non-infectious

prescribed were from EML, available in all 30 studied PHCCs. A significant association was found between the number of prescribed medicines and antibiotics per prescription, table 4.

Diagnosis written on the prescriptions: About 129 different diagnoses were found on 1800 prescriptions.

1. Infection-based diagnosis: Among the ABs contained prescriptions, infections were included in 85.8% (1174 out of 1369). The majority were non-specific, 1100 (80.4%); for details, see table 5. ABs were prescribed for 1174 (88.3%) of infections and 195 (41.4%) of non-infections; this difference was statistically significant with a p-value of 0.0001. For other data see table 6.

2. System based diagnosis: Figure 3 shows the distribution of the prescription according to the system of the diagnosis. RT health problem was the most common reported in 641 out of 1369 (46.8%). Table 7 showed that genitourinary health problems were the most common system prescribing ABs, 178/183 (97.3%). The difference was statistically significant, with a p-value of 0.0001.

Table 8 shows the percentages of infectious and non-infectious diagnoses among different body systems. Upper and lower respiratory and genitourinary tracts usually have an infectious diagnosis reported in 99.5%(575), 97.2%(141) and 94%(172), respectively; the difference was statistically significant with a p-value of 0.001. Although the infectious diagnoses are relatively low in dental and gastro-intestinal systems (table 8), 356/449 (79.3%) and 83/140 (59.3%) were prescribed ABs (table 7). Figure 4 shows the ABs used in the treatment of the common-

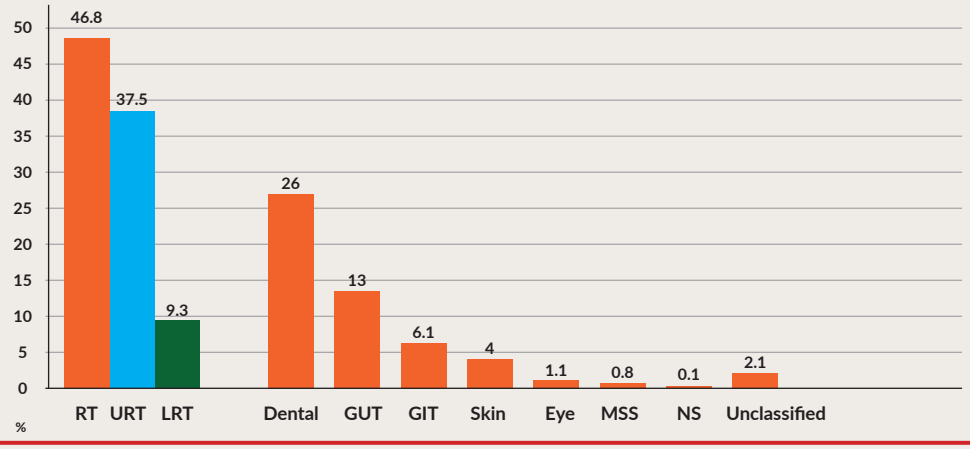

Figure 3 | Frequency distribution of systematic diagnosis among the ABs contained prescriptions.

RT: REspiratory tract, **URT**: Upper Respiratory Tract, **LRT**: Lower respiratory tract, **GUT**: Genitourinary tract, **GIT**: Gastero-intestinal tract, **MSS**: Musculoskeletal tract, **NS**: Nervous system

Table 7 | Association of systematic diagnosis and antibiotics prescription.

System-based diagnosis	Total	Prescriptions contained ABs				P value
		Yes		No		
		N	%	N	%	
Respiratory tract	723	641	88.7	82	11.3	
Upper Respiratory tract	578	513	88.8	65	11.2	0.871*
Lower Respiratory tract	145	128	88.3	17	11.7	
Dental	449	356	79.3	93	20.7	0.0001†
Genitourinary tract	183	178	97.3	5	2.7	
Gastro-intestinal tract	140	83	59.3	57	40.7	

*: P-value only within the respiratory groups. †: P-value among other groups

Table 8 | Association of system-based diagnosis with infection diagnosis

System based diagnosis	Infection based diagnosis				P value
	Infectious Diagnosis		Non-infectious Diagnosis		
	N	%	N	%	
Upper Respiratory tract	575	99.5	3	0.5	0.001
Lower Respiratory tract	141	97.2	4	2.8	
Dental	236	52.6	213	47.4	
Genitourinary tract	172	94	11	6	
Gastro-intestinal tract	84	60	56	40	

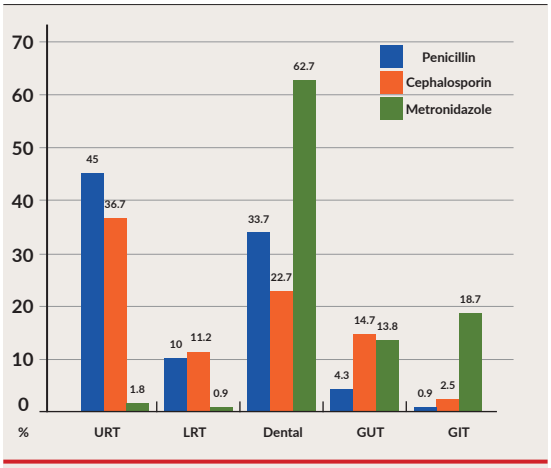

Figure 4 | Frequency distribution of the main three prescribed antibiotics according to the main four involved body systems.

Table 9 | Association between the diagnosis and ABs prescription.

Diagnosis		Total	ABs prescription				P value
			Yes		No		
			N	%	N	%	
Infectious	URT	575	513	89.2	62	10.8	0.001
	LRT	141	126	89.4	15	10.6	
	Dental	236	226	95.8	10	4.2	
	GUT	172	171	99.4	1	0.6	
	GIT	84	65	77.4	19	22.6	
Non infectious	URT	3	0	0	3	100	0.001
	LRT	4	2	50	2	50	
	Dental	213	130	61	83	39	
	GUT	11	7	63.6	4	36.4	
	GIT	56	18	32.1	38	67.9	

URT: Upper Respiratory tract, **LRT:** Lower Respiratory tract, **GUT:** Genitourinary tract, **GIT:** Gastro-intestinal tract, **ABs**: Antibiotics.

est five body systems. Among ABs containing prescriptions, 329 (64.1%) of the URTIs mainly affected children ≤ 12 years of age, while dental health problems were mainly affecting adults between 20-59 years old, 175 (49.2%), as shown in table 10.

DISCUSSION

Percentage of ABs' prescription: Nowadays, antimicrobial resistance is a global health emergency and a major public health concern. PHCCs were recognized as a main contributor to the AMR due to ABs prescription or overprescription.[3,6] ABs over-prescription was detected in this study, as 76.1% of the total reviewed prescriptions contained ABs. It exceeded the WHO standard of ≤30%.[18] Although it is out of this study's scope to judge whether the prescribed antibiotic was appropriate, ABs over-

Table 10 | ABs prescribing patterns among age groups according to the body systems involvement.

Age groups		URT ABs		LRT ABs		Dental ABs		GUT ABs		GIT ABs	
		N	%	N		N	%	N	%	N	%
Children	≤12 years	329	64.1	65	50.8	129	36.2	44	24.7	46	55.4
	≤1 year	44	13.4	9	13.8	2	1.6	5	11.4	9	19.6
	>1 year-5years	165	50.2	24	36.9	20	15.5	14	31.8	16	34.8
	6-12 years	120	36.5	32	49.2	107	82.9	25	56.8	21	45.7
Adolescent	13-19 years	50	9.7	18	14.1	36	10.1	30	16.9	13	15.7
Adult	20-59 years	126	24.6	35	27.3	175	49.2	97	54.5	22	26.5
Old	≥60 years	8	1.6	10	7.8	16	4.5	7	3.9	2	2.4
	Total	513	100	128	100	356	100	178	100	83	100

URT: Upper Respiratory tract, **LRT:** Lower Respiratory tract, **GUT:** Genitourinary tract, **GIT:** Gastro-intestinal tract, **ABs**: Antibiotics.

use is an example of inappropriate use of drugs in developing and developed countries,[20] especially in healthcare facilities.[21] ABs over prescription, in our study, may be due to the absence of effective monitoring and regulations of ABs prescription in our country, the patterns and burden of infectious diseases in Baghdad, lack of specific laboratory investigations at the PHCCs, and patients' insistence on having ABs. This study finding is much higher than that reported from Bahrain (26.2%)[22] and (45.8%),[23] Kuwait (39.1%),[24] Saudi Arabia (32.2%),[25] Egypt (39.2%),[26] WHO African region (46.8%),[19] and Cameroon (36.71%).[4] It was close to studies conducted in Ethiopia (70.6%)[27] and China (75.9%).[21]

WHO indicates a reference value of less than two medicines per prescription.[18] More than two means polypharmacy, another example of irrational use of medicines[14] that can lead to medicines wastage, possible adverse drug effects and additional costs to the national health system.[22] Our study's Average number of medicines per prescription was 2.29. It might be due to the misperception of the caregivers and the patients' misperception of the MoH's instructions about allowing a physician to write three items per prescription as a maximum. Items per prescription were reported to be 2.6 in Bahrain,[22] 2.9 in Kuwait,[24] 2.4 in Saudi Arabia,[25] 2.5 in Egypt,[26] 3.1 in WHO African region[19] and 2.3 in Ethiopia.[27]

Also, WHO highly recommends writing medicines in generic in all cases[18] to allow clear identification of drugs among prescribers.[28] We found only 19.9% of the antibiotics were written in generic names, which is much lower than the reference value of WHO. In general, generic names are long and complex. In contrast, the brand ones are short, attractive and easy to retain,[24] making it preferable, especially in overcrowding situations. Generic drugs are cheaper than brand ones,[29,30] and cost 80-85% less than brand drugs; however, they are still underused.[31] In Iraq, PHCCs medicines are dispensed to patients for free, thus it may make no difference to prescribe medicines in generics or brand names; in addition, writing medicine from the private sector is not allowed by the MoH at the PHCCs. Despite all these instructions, many primary healthcare providers write the brand names. Our findings were lower than that in Saudi Arabia (61.2%),[25] Egypt (95.4%),[26] WHO African region (68%),[19]Ethiopia (96.8%),[27] and Cameroon (98.36%).[4] But higher than that of Bahrain (14.3%)[22] and Kuwait (17.7%).[24]

Prescribing medicines from EML builds a basis for rational prescribing because drugs on this list are well-known, already confirmed in practice, with a proven clinical use and usually cost less than the newer drugs. WHO recommended prescribing medicines 100 % from the EML.[18] In this study, a copy of the National Master List of Drugs (equivalent to EML) was present in all studied PHCCs though not necessary at the prescribing or consultation rooms. Healthcare providers prescribed ABs from this list in 100% of the cases, unsurprising results as medications are provided exclusively by the MoH according to the National Master List of Drugs. Although the nearby countries are highly confined to their drugs prescription to EML, this study's finding was higher than theirs. The results from other countries are 88%, 89%, 95.4%, 98.36 %, 99.2% and 99.8% in WHO African region,[19] Ethiopia,[27] Egypt,[26] Saudi Arabia,[25] Cameron,[4] and Bahrain.[22]

Antibiotics prescribing patterns: This study revealed a predominance of orally prescribed ABs in 95.6%. Up to the researcher's knowledge, no reference value is present, but WHO recommends that injectable medicines, not only ABs, should not exceed 20%.[18] Injectable ABs in this study constituted only 2.34%. This low percentage of injectable ABs might be due to a very little supply in an injectable form. In other studies, injectable medicines were 8.3% in Bahrain in 2003,[22] 9.1% in Kuwait in 2010,[24] 2 % in Saudi Arabia in 2010,[25] 9.9 % in Egypt in 2010,[26] and 25 % in the WHO African region in 1995-2015.[19]

We found that 85% of the antibiotics were prescribed uncombined, and 15 % contained more than one ABs, with an average number of 1.15 ABs per prescription. In Iraq, it is acceptable to add a second AB, especially metronidazole, in the treatment of some infections; this is

why we found metronidazole a second antibiotic in 82.6 %. Similarly, Elvis et al. in 2014-2015 found that the average number of ABs per prescription was 1.14.[4] Shamsuddin et al. in Malaysia[32] found a combination of more than one AB in 10.4 %, and Wang et al. found it in 55 %.[21]

In general, at the PHCCs, the aim is to treat simple, uncomplicated infection with ABs from the EML; this may be the reason why we found amoxicillin the main prescribed AB (47.3%) followed by cephalexin (25.4%) and metronidazole (14.2%). These ABs are relatively more available at the PHCCs compared to others. Amoxicillin is the commonest AB reported by many studies, though, with different percentages,[4,30,32] other ABs like cephalosporin, co-trimoxazole, erythromycin and metronidazole are reported in these studies in variable percentages. These variations may depend on the local availabilities and regulations of prescription in the countries where these studies are conducted.

We found that children ≤ 12 years were the age group most commonly exposed to ABs (48.6%), followed by adults between 20-59 years (35.6%). Elvis et al. also found that children ≤ 10 years of age were exposed to ABs in 44%, followed by adults between 21-30 years in 40%.[4] This result was also supported by a study conducted in England and Wales in 1996, where more than 50% of children under five years were exposed to ABs.[33]

In the current study, URTIs were the main health conditions encountered at PHCCs; 46.2% were diagnosed in children ≤ 12 years. ABs were prescribed for 89.2%, amoxicillin for 45% and cephalexin for 36.7%. Similarly, Many studies found that URTIs or RTIs, in general, are the main infections reported to the PHCCs and antibiotics were inappropriately used for treatment. Of these studies: Al-Khaldi et al. in 2003 found that 25% of PHCC attendants were diagnosed with acute respiratory infections (common cold in 42%), 60 % were in children < 15 years, and ABs were prescribed for 45% of these cases.[34] A study in India found that ABs were prescribed for 79.9% of children with acute respiratory infections and acute watery diarrhoea, and penicillin was prescribed for 43.9%.[35] A Saudi Arabian study showed that over half of the prescriptions were for URTI, and ABs were prescribed for 26%.[36] Elvis et al. showed RTIs were the main indication to prescribe ABs (21.27%),[4] and Wang et al. concluded that ABs were mainly prescribed for colds, pharyngitis, acute bronchitis and UTIs. Excluding UTI, these prescriptions were mostly inappropriate.[21] Shamsuddin et al. found that amoxicillin was inappropriately prescribed for 18.4% of patients with URTIs such as tonsillitis and pharyngitis.[32] And Andrajati stated that acute pharyngitis and nonspecific respiratory infections were the most frequent health problems at the PHCCs.[37] Overprescription of ABs for RTIs though they resolve spontaneously and do not need ABs treatment was not fully explained; it may be due to prognostic ambiguity, diagnostic difficulty, patient expectations and demand, and weak physician-patient interaction.[34-35,38] This attitude of prescription is also seen in children on assumption to prevent secondary bacterial infections despite the fact that ABs are neither prevent nor decrease the severity of secondary bacterial infections in viral URTIs.[38-40]

Dental health problems constituted 45.2% of the non-infectious diagnoses in the studied prescriptions; ABs were prescribed for 61%. Metronidazole was the most frequently prescribed AB (62.7%), followed by amoxicillin (33.7%), a trend that was reported in another study.[15,17] Use of ABs prescription in dentistry might be due to patient's illness, expectations, desire, and rejection of other treatments. In addition to vague or indefinite diagnosis, the ineffectiveness of other treatments, anaesthesia failure, and lack of culture and sensitivity.[15] All these factors may result in using ABs empirically for some dental conditions that may not be indicated.[17]

Viral infection was diagnosed in 80 prescriptions (4.4%), and nearly half were prescribed ABs. A low level of viral diagnosis may not reflect the actual prevalence of viral infection in the PHCCs because it might be misdiagnosed as bacterial infections or non-specific illnesses. Vaccheri et al. stated that many viral infections were treated with antibacterial agents[41] de-

spite being ineffective.[35]

Limitations of the study: Although it was challenging to collect data from 30 PHCCs and to study 1800 prescriptions, limitations to this study were present too. Firstly, data were collected retrospectively from the prescription forms, among which empty prescriptions were not kept; thus, analysis of these data might result in an overestimation of the prescription of antibiotics and polypharmacy. Secondly, this study's results would be more valuable if they were compared with previous data from Iraq that were unavailable at the time of conducting this study. Finally, this study was not designed to explore or document the inappropriateness of prescribing antibiotics; thus, future studies are required to investigate this issue.

CONCLUSION

ABs were overprescribed with some elements of misuse, and polypharmacy was documented.

Writing ABs in brand names was predominant and restricting prescribing to EMLs was the rule. The predominant prescribing patterns of ABs were two patterns:- single oral amoxicillin for children ≤ 12 years of age with URTIs, and oral metronidazole mainly combined to oral amoxicillin for adult age group (between 20-59 years old) with dental health problems.

REFERENCES

1. CDC. Antibiotic Use Questions and Answers, What Everyone Should Know. [Internet]. 2018 [cited 2018 21st December]. Available from: https://www.cdc.gov/antibiotic-use/community/about/should-know.html
2. Jasim AL, Fadhil TA, Taher SS. Self Medication Practice among Iraqi Patients in Baghdad City. *Am J Pharmacol Sci* [Internet]. 2014 Feb 4 [cited 2018 Dec 16];2(1):18–23. Available from: http://pubs.sciepub.com/ajps/2/1/4/index.html
3. WHO EMRO. Iraq develops national action plan to address antimicrobial resistance, Iraq-news.Iraq [Internet]. [cited 2018 17th October]. Available from: http://www.emro.who.int/irq/iraq-news/moh-in-collaboration-with-who-develops-national-action-plan-tackling-antimicrobial-resistance-in-iraq.html
4. Chem ED, Anong DN, Akoachere J-FKT. Prescribing patterns and associated factors of antibiotic prescription in primary health care facilities of Kumbo East and Kumbo West Health Districts, North West Cameroon. *PLoS One* [Internet]. 2018 [cited 2018 Oct 18];13(3):e0193353. Available from: http://www.ncbi.nlm.nih.gov/pubmed/29505584
5. Saust LT, Bjerrum L, Arpi M, Hansen MP. Quality indicators for the diagnosis and antibiotic treatment of acute respiratory tract infections in general practice: a RAND Appropriateness Method. *Scand J Prim Health Care* [Internet]. 2017 Jun [cited 2018 Oct 24];35(2):192–200. Available from: http://www.ncbi.nlm.nih.gov/pubmed/28574299
6. WHO. The evolving threat of antimicrobial resistance Options for action [Internet]. 2012 [cited 2018 18th October]. Available from: www.who.int/patientsafety/en/
7. WHO. Using indicators to measure country pharmaceutical situations: Fact book on WHO Level I and Level II monitoring indicators. World Health. 2006;111.
8. WHO. WHO 10 facts on essential medicines. WHO [Internet]. 2014 [cited 2018 4th December]; Available from: http://www.who.int/features/factfiles/essential_medicines/en/
9. WHO. Guide to Drug Financing Mechanisms: Chapter 4. Prescribing: Objective of prescribing: Reduce economic costs of irrational prescribing [Internet]. 1998 [cited 2018 10th November]. Available from: http://apps.who.int/medicinedocs/en/d/Jh2928e/7.1.2.html#Jh2928e.7.1.2
10. Regional Health System Observatory. WHO-EMRO. Health System Profile- Iraq. 2006;
11. Etebu E, Arikekpar I. Antibiotics: Classification and mechanisms of action with emphasis on molecular perspectives. *Int J Appl Microbiol Biotechnol Res* [Internet].2016;4(September):90–101. Availablefrom: https://pdfs.semanticscholar.org/aebc/840138529c147e54552205bf26ec8aa3ca2e.pdf
12. Ventola CL. The antibiotic resistance crisis: part 1: causes and threats. *Pharmacy & Therapeutic* [Internet]. 2015 Apr [cited 2018 Sep 25];40(4):277–83. Available from: http://www.ncbi.nlm.nih.gov/pubmed/25859123
13. Darwish DA, Abdelmalek S, Abu Dayyih W, Hamadi S. Awareness of antibiotic use and antimicrobial resistance in the Iraqi community in Jordan. *J Infect Dev Ctries* [Internet]. 2014 May 14 [cited 2018 Oct 23];8(5):616–23. Available from: http://www.ncbi.nlm.nih.gov/pubmed/24820466
14. Preus HR, Fredriksen KW, Vogsland AE, Sandvik L, Grytten JI. Antibiotic-prescribing habits among Norwegian dentists: a survey over 25 years (1990–2015). *Eur J Oral Sci*. 2017 1st August;125(4):280–7.
15. Sturrock A, Landes D, Robson T, Bird L, Ojelabi A, Ling J. An audit of antimicrobial prescribing by dental practitioners in the north east of England and Cumbria. *BMC Oral Health*. 2018 Dec 10;18(1).
16. Stein K, Farmer J, Singhal S, Marra F, Sutherland S, Quiñonez C. The use and misuse of antibiotics in dentistry: A scoping review. *J Am Dent Assoc*. 2018 Oct 1;149(10):869-884.e5.
17. Sweeny LC, Dave J, Chambers PA, Heritage J. Antibiotic resistance in general dental practice - A cause for concern? *Journal of Antimicrobial Chemotherapy*. 2004;53:567–76.
18. WHO. WHO How to Investigate Drug Use in Health Facilities: Selected Drug Use Indicators. 2015 [cited 2018 27th October]; Available from: http://www.who.int/medicines/publications/how-to-investigate_drug-use/en/
19. Ofori-Asenso R. A closer look at the World Health Organization's prescribing indicators. *J Pharmacol Pharmacother* [Internet]. 2016;7(1):51. Available from: http://www.jpharmacol.com/

text.asp?2016/7/1/51/179352

20. Holloway K, Van Dijk L. The World Medicines Situation 2011 - Rational Use of Medicines [Internet]. Geneva 2011. 2011 [cited 2018 27th October]. p. 24. Available from: http://apps.who.int/medicinedocs/en/m/abstract/Js18064en/

21. Wang J, Wang P, Wang X, Zheng Y, Xiao Y. Use and Prescription of Antibiotics in Primary Health Care Settings in China. *JAMA Intern Med* [Internet]. 2014 1st December [cited 2018 27th September];174(12):1914. Available from: http://archinte.jamanetwork.com/article.aspx?doi=10.1001/jamainternmed.2014.5214

22. Naseeb TA, Nasser MA. Drug prescribing indicators in primary health care centers in Bahrain. *Saudi Med J* [Internet]. 2005 Sep [cited 2019 2nd December];26(9):1436–8. Available from: http://www.ncbi.nlm.nih.gov/pubmed/16155664

23. Otoom S, Culligan K, Al Assoomi B, Al Ansari T. Analysis of drug prescriptions in primary health care centres in Bahrain. *East Mediterr Heal J*. 2010 1st May;16(05):511–5.

24. Awad A, Al-Saffar N. Evaluation of drug use practices at primary healthcare centers of Kuwait. *Eur J Clin Pharmacol*. 2010 Dec;66(12):1247–55.

25. Mahalli AA El. WHO / INRUD drug prescribing indicators at primary health care centres in Eastern province , Saudi Arabia. *East Mediterr Heal J*. 2010;18(11):1091–6.

26. Akl OA, El Mahalli AA, Elkahky AA, Salem AM. WHO/INRUD drug use indicators at primary healthcare centers in Alexandria, Egypt. *J Taibah Univ Med Sci* [Internet]. 2014 Mar 1 [cited 2018 Oct 28];9(1):54–64. Available from: https://www.sciencedirect.com/science/article/pii/S1658361213000498

27. Mariam A, Raghavendra Y, Mulisa E. Evaluating rational drug use with the help of World Health Organization's core indicators in Bule Hora Hospital, Southern Ethiopia. *Gaziantep Med J* [Internet]. 2015;21(2):108. Available from: http://www.eurjther.com/sayilar/5/buyuk/133.pdf

28. Kopp-Kubel S. International Nonproprietary Names (INN) for pharmaceutical substances. *Bull World Health Organ* [Internet]. 1995;73(3):275–9. [cited 2019 Dec 11] Available from: http://www.ncbi.nlm.nih.gov/pubmed/7614659

29. Melissa Stoppler MD. Generic drugs vs brand name drugs by MedicineNet.com [Internet]. web page. 2017 [cited 2019 31st December]. Available from: https://www.medicinenet.com/generic_drugs_are_they_as_good_as_brand-names/views.htm

30. Kees de Joncheere A. Drugs and Money - Prices, Affordability and Cost Containment: Part II: Selected experiences with policy options: Chapter 11: Experiences with generics [Internet]. 2003 [cited 2020 1st January]. Available from: https://apps.who.int/medicinedocs/en/d/Js4912e/3.6.html

31. Shrank WH, Cox ER, Fischer MA, Mehta J, Choudhry NK. Patients' perceptions of generic medications. *Health Aff*. 2009 Mar;28(2):546–56.

32. Shamsuddin S, Akkawi ME, Zaidi STR, Ming LC, Manan MM. Antimicrobial drug use in primary healthcare clinics: a retrospective evaluation. *Int J Infect Dis* [Internet]. 2016 1st November;52:16–22. [Cited 2018 28th October] Available from: https://www.sciencedirect.com/science/article/pii/S1201971216311705

33. Majeed A, Moser K. Age- and sex-specific antibiotic prescribing patterns in general practice in England and Wales in 1996. *Br J Gen Pract* [Internet]. 1999 Sep X:735–6. [Cited 2019 Dec 27] Available from: http://www.ncbi.nlm.nih.gov/pubmed/10756619

34. Al-Khaldi YM, Diab MMAA, Al-Gelban KS, Al-Asmari AS, Al-Amin S, Al-Shahrani MS. Prescribing patterns for acute respiratory infections in primary health care, aseer region, saudi arabia. *J Family Community Med* [Internet]. 2005 Sep;12(3):121–6. [Cited 2019 Dec 27] Available from: http://www.ncbi.nlm.nih.gov/pubmed/23012089

35. Bharathiraja R, Sridharan S, Chelliah LR, Suresh S, Senguttuvan M. Factors affecting antibiotic prescribing pattern in pediatric practice. *Indian J Pediatr* [Internet]. 2005 Oct;72(10):877–9. [Cited 2018 Oct 28], Available from: http://www.ncbi.nlm.nih.gov/pubmed/16272664

36. Al-Faris EA, Taweel A Al. Audit of Prescribing Patterns in Saudi Primary Health Care: What Lessons Can be Learned? *Ann Saudi Med* [Internet]. 1999 Jul;19(4):317–21. [Cited 2019 Dec 26] Available from: http://www.annsaudimed.net/doi/10.5144/0256-4947.1999.317

37. Andrajati R, Tilaqza A, Supardi S. Factors related to rational antibiotic prescriptions in community health centers in Depok City, Indonesia. *J Infect Public Health* [Internet]. 2017 Jan;10(1):41–8. [Cited 2018 Oct 28] Available from: https://linkinghub.elsevier.com/retrieve/pii/S187603411600037X

38. O'Connor R, O'Doherty J, O'Regan A, Dunne C. Antibiotic use for acute respiratory tract infections (ARTI) in primary care; what factors affect prescribing and why is it important? A narrative review. *Ir J Med Sci.* 2018 Nov;187(4):969-986. doi: 10.1007/s11845-018-1774-5. Epub 2018 Mar 12. PMID: 29532292; PMCID: PMC6209023.

39. Acute respiratory infections: the forgotten pandemic. Communiqué from the International Conference on Acute Respiratory Infections, held in Canberra, Australia, 7-10 July 1997. *Int J Tuberc Lung Dis*. 1998 Jan;2(1):2-4. PMID: 9562104.

40. Mangione-Smith R, McGlynn EA, Elliott MN, McDonald L, Franz CE, Kravitz RL. Parent expectations for antibiotics, physician-parent communication, and satisfaction. *Arch Pediatr Adolesc Med*. 2001;155(7):800–6.

41. Wu Y, Yang C, Xi H, Zhang Y, Zhou Z, Hu Y. Prescription of antibacterial agents for acute upper respiratory tract infections in Beijing, 2010–2012. *Eur J Clin Pharmacol* [Internet]. 2016 Mar 26;72(3):359–64. [Cited 2019 Dec 17] Available from: http://link.springer.com/10.1007/s00228-015-1997-6

Abbreviations list: Antibiotics (**ABs**), Antimicrobial resistance (**AMR**), Essential medicine lists (**EMLs**), Gastero-intestinal tract (**GIT**), Genitourinary tract (**GUT**), International Network for Rational Use of Drugs (**INRUD**), Lower respiratory tract (**LRT**), Ministry of Health (**MoH**), Musculoskeletal tract (**MSS**), Nervous system (**NS**), Primary healthcare centres (**PHCCs**), Respiratory tract (**RT**), Standard treatment guidelines (**STGs**), Statistical Packages for Social Sciences (**SPSS**), Upper Respiratory Tract (**URT**), Upper respiratory tract infections (**URTIs**), Urinary tract infection (**UTI**), World Health Organization (**WHO**).

Conflict of interest: Authors have nothing to declare.

Funding: Authors received no funds to complete this study.