

# Prescription Patterns of Dentists in Primary Care in Bahrain During COVID-19: A Cross Sectional Study.

Gowri Sivaramakrishnan (✉ [gowri.sivaramakrishnan@gmail.com](mailto:gowri.sivaramakrishnan@gmail.com))

Ministry of Health

Muneera Alsobaiei

Ministry of Health

Fatema ALSulaiti

Ministry of Health

Kannan Sridharan

Arabian Gulf University

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## Research Article

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# Abstract

**Background:** Dentists have always been attributed to the ever rising global problem of antibiotic resistance. The recent pandemic due to COVID-19 has caused greater concern and primary dental care practices were suspended in the Ministry of Health in Bahrain between February to August 2020. Dental emergencies were addressed using a triage system and dentists were advised on avoiding invasive and aerosol generating procedures. This means that many dentists opted to prescribe medications without undertaking the necessary dental intervention.

**Aim:** To identify the prescription and drug utilization of primary care dental practitioners during the temporary suspension of routine dental practices due to COVID-19.

**Method:** Anonymized data from out-patient dental prescriptions from February 2020 to August 2020 were collected. Necessary data regarding the number, type and indication for prescription were collected and analyzed using appropriate statistical tests.

**Results:** An average of two medications were prescribed for each patient, that included systemic and local analgesics and anti-microbials. 33.4% of patients were only prescribed medications without any dental intervention. Approximately 35% of the records showed inappropriate diagnosis and their rationale for prescription could not be determined. 100% of the patients with acute or chronic periapical abscess and 41% with gingivitis or periodontitis were prescribed medications without any dental intervention. Amoxicillin and amoxicillin/clavulanic acid amongst the antimicrobial class; and ibuprofen and acetaminophen amongst the analgesics accounted for 90% of prescribed drugs. Chlorhexidine mouth rinse seemed to be on the regular list for any diagnoses, prescribed between 7 and 14 days, twice or thrice daily.

**Conclusion:** Suspension of dental practices can cause more harm in terms of overuse and unindicated prescription practices in primary dental care. The awareness of the recent guidelines is important to prevent unintended use. Effective infection control practices based on guideline should be in place to contain COVID-19 transmission rather than suspension of dental care.

## Introduction

The recent pandemic due to COVID-19 has caused greater concern regarding current practices of infection control in dentistry, around the world. [1] Due to the greater disease transmission and spread attributed to aerosol generating procedures that are commonly undertaken in the dental clinic, primary dental care practices were suspended in the Ministry of Health, Kingdom of Bahrain, between February to August 2020. [2] However, dental emergencies were addressed using a triage system, considering the use of less invasive procedures and avoid aerosol generating procedures. Antibiotics and other medications have revolutionized healthcare by saving lives and increasing the longevity of patients with serious illnesses. However, the overuse of antibiotics cannot be underestimated, leading to the development of antibiotic-resistant bacteria. The rate of antibiotic prescription by dentists has increased to approximately

65% over the years, as observed from recent studies. [3-5] The explanatory themes that were identified from previous studies include unindicated prescriptions for periapical abscess and irreversible pulpitis, treatment with dental implants and their associated complications, slow adoption of recent recommendations and guidelines on antibiotic prescription, more emphasis on cosmetic practices, and substituting the necessary surgical intervention with antibiotics due to lack of skills. [4-9] According to the prescription guidelines by the SDCEP (Scottish Dental Clinical Effectiveness Program), antibiotics in dentistry should be prescribed, when indicated, only in addition to the undertaking the necessary dental intervention such as extraction, debridement, root canal procedures or non-surgical periodontal therapy, except in patients presenting with Ludwig's angina or other life threatening space infections or facial cellulitis, which particularly mandates immediate referral to secondary care. [10] The actual use of antibiotics in dentistry is very limited and appropriate operative dental intervention is necessary. [10] Considering that another second wave of corona virus infection is expected sooner or later, and a second lockdown is imposed in most countries, the present COVID-19 pandemic and the inability to undertake most of the necessary dental interventions for prolonged time period might lead to an alarming increase in drug utilization by primary care dentists to manage dental out-patients. This is in addition to the themes that are already identified from previous studies. Hence the aim of the present study was to identify the prescription and drug utilization of primary care dental practitioners during the temporary suspension of routine dental practices due to COVID-19.

## Methods

The study was conducted in the Ministry of Health, Primary care dental clinics in the Kingdom of Bahrain. The study protocol was approved by the respective Ethics Committee. All dental out-patient prescriptions are entered in the I-Seha database. We obtained anonymized data for all dental prescriptions from February 2020 to August 2020. This was the time period of temporary suspension of primary care dental clinics at the Ministry of Health due to COVID-19. The following data was collected and calculated:

- Average number of drugs per prescription (total number of drugs /number of prescriptions)
- % of prescriptions with antimicrobials (number of prescriptions with antimicrobials/total number of prescriptions x 100)
- Duration of antibiotics and analgesics (Number of days /total number of drugs)
- Cumulative dose (adding the doses received during the entire duration)
- Daily Defined Dose (DDD) (average maintenance dose per day)
- Prescribed Daily Dose (PDD) (Total dose administered per day)
- PDD: DDD ratio
- Drug utilization 90% (DU90%) for antimicrobials/analgesics (ranking the antimicrobials/analgesics in order of their DDDs and estimating the drugs that accounted for 90% of use)
- Percentage of drugs prescribed from WHO (World Health Organization) essential drug list to be used for any indications in dentistry [11] For pediatric population, 7<sup>th</sup> WHO model list of essential

medicines for children [12] was used.

- Percentage of drugs prescribed from Bahrain National Formulary (BNF) [13] for use in dentistry – by dividing the total number of drugs mentioned in the BNF upon total number of drugs prescribed.

### **Statistical analysis:**

Descriptive statistics was used to represent the demographic variables. The distributions of the numerical variables were assessed and either Mann-Whitney U test or Kruskal-Wallis H test was used depending on the number of groups of variables. Bonferroni corrected p-values were considered for statistical significance.

## **Results**

### *4.1. Number of drugs prescribed by primary care dentists:*

Data on three-hundred and ninety-one patients were obtained with mean (SD) age of 32 (18.9) years. Two-hundred and six (52.7%) were males and the remaining were females.

- Seventy-nine (20.2%) belonged to the pediatric age group (0-12 years)
- 54 (13.8%) were adolescents (12-20 years)
- 117 (29.9%) were young adults (20-40 years)
- 123 (31.5%) were middle-aged and older adults (40-65 years)
- 18 (4.6%) were elderly (65 years and older)
- Ninety-three (23.8%) had concomitant medical co-morbidities.

The average number of drugs prescribed was 1.8. Median (range) of total number of drugs prescribed per encounter to the study participants was 2 (1-7). The number of drugs prescribed per prescription was not statistically significant ( $p=0.3$ ) between the sub-populations: Pediatrics – 2 (1-5), adolescents – 1.5 (1-4); young adults – 2 (1-7); middle aged and older adults – 2 (1-6); and Elderly – 1.5 (1-4).

### *4.2. Diagnoses and dental procedures undertaken:*

The proportions of patients that were prescribed medications in addition to dental procedures are depicted in Figure 1. The diagnosis-wise details are listed below:

*Pulpal and peri-apical pathology:* Medications were prescribed for one-hundred and forty-six patients (37.3%) diagnosed with pulpitis with or without associated peri-apical periodontitis, out of which 67 did not receive any dental procedure. 40 patients (10.2%) presented with acute or chronic peri-apical abscess. No dental procedure was undertaken in 87.8% of patients with acute or chronic peri-apical abscess other than prescribing medications. Three out of 12 patients that presented with necrotic pulp received only medications without any dental procedural intervention.

Gingival and periodontal conditions: Antibiotics and analgesics were prescribed to 16 patients with gingivitis and 28 patients with periodontitis. Out of all these, 22 (50%) patients did not receive any dental intervention.

Other diagnoses: Three patients were only prescribed medications, out of the nine with fractured teeth. No procedure was undertaken in 1 patient with peri-coronitis. Thirty-two (8.1%) with dental caries in the enamel and dentin received medications in conjunction with temporary or permanent restorations, except in 7 patients that received only medications. One patient presented with necrotizing periodontal disease and only prescribed medication. Fifty-four patients received medications for other conditions such as dentin hypersensitivity, retained root, tooth wear, aphthous ulcers, oral mucositis, dry socket, temporomandibular disorders, discolored teeth, malocclusion, and traumatic ulcers due to dentures.

Overall, 199 (50.8%) patients diagnosed with the above-mentioned dental diagnoses were given prescriptions and/ or referred for a later date, without undertaking any dental procedure.

Inappropriate diagnoses: 37 (9.4%) records mentioned “dental examination” as their diagnosis. 15 (3.8%) records did not show any diagnosis.

Antibiotics prophylaxis: One young adult on dialysis for renal condition, received 2 g of amoxicillin as a pre-treatment antibiotic prophylaxis prior to scaling; and one pediatric patient diagnosed with chronic periapical abscess received 500mg of amoxicillin as a pre-treatment antibiotic prophylaxis and extraction was undertaken. The underlying medical history for the pediatric patient was not mentioned in the dental record.

#### *4.3. Antimicrobial prescription:*

Median (range) of total number of antimicrobials prescribed was 0 (0-2). One hundred and fifty (80.2%) were prescribed one antimicrobial drug, while 37 (19.8%) with two antimicrobial drugs. Proportion of number of antimicrobials did not differ significantly ( $p=0.2$ ) between age groups (Figure 2). Amoxicillin, amoxicillin/clavulanate, cephalexin, cefuroxime axetil, and metronidazole were prescribed of which amoxicillin, amoxicillin/clavulanate and metronidazole were prescribed more frequently (Figure 3).

#### *4.4. Duration and rationale of antimicrobial prescription:*

The average duration of antimicrobial prescription was 5.1 days. Average duration of individual antimicrobial drugs is depicted in Figure 4A. Amoxicillin/clavulanic acid, and cephalexin were significantly ( $p=0.0001$  and  $0.016$  respectively) prescribed for longer duration than amoxicillin; and amoxicillin/clavulanic acid was prescribed for significantly ( $p=0.019$ ) longer duration than metronidazole. One patient received cefuroxime axetil prescription for five days. Cumulative amounts of antimicrobial drugs (except for cefuroxime axetil and cephalexin) administered in various age groups is depicted in Figure 5. Thirty (16.04%) of the total 187 antimicrobial prescriptions were assessed to be rational; 81 (43.3%) were irrational; and the remaining 56 (30.66%) could not be evaluated due to lack of complete details on the diagnosis and the dental procedure that was carried out.

#### *4.5. Analgesic prescription:*

259 (80.7%) had one analgesic and 62 (29.3%) had two analgesics. Median (range) number of analgesics prescribed was 1 (0-2) in all age groups, except in the elderly {1 (0-1)}. Ibuprofen, acetaminophen, diclofenac, mefenamic acid and acetaminophen-orphenedrine combination were prescribed. Significantly fewer number of analgesics were prescribed to elderly ( $p=0.03$ ) and adolescents ( $p=0.02$ ) compared to pediatrics. The average duration of analgesic prescription was 4.8 days. The average durations of prescription of individual analgesic drugs is depicted in Figure 4B. Ibuprofen was prescribed for a significantly ( $p=0.02$ ) shorter duration compared to other analgesics.

#### *4.6. Local mouthwashes and topical administration:*

One hundred and fifteen (29.4%) 12-65-year-old patients were prescribed chlorhexidine local antiseptic mouthwash for all the diagnoses mentioned above. Twenty-four (3-15ml; 2-7ml; 19-10ml) prescriptions mentioned the dose of mouthwash to be used. The duration varied between 7 to 14 days, twice or three times daily. None of the record showed prescription details on fluoride or any other type of mouth rinses other than chlorhexidine. Ten (2.6%) patients (5-oral mucositis and aphthous ulcer; 1-chronic apical periodontitis; 1-acute periapical abscess; 3-diagnosis not mentioned) were prescribed a topical preparation containing deproteinized calves blood extract 5% haemodialysate and polidocanol 1%.

#### *4.7. Daily defined dose and prescribed daily dose:*

The WHO DDDs for the drugs prescribed were as follows: amoxicillin (1500 mg); amoxicillin/clavulanic acid (1500 mg); cephalexin (2000 mg); cefuroxime axetil (500 mg); and metronidazole (2000 mg). The mean  $\pm$  SD PDD for the above drugs were as follows: amoxicillin ( $1268.2 \pm 386.1$  mg); amoxicillin/clavulanic acid ( $1514.2 \pm 618.5$  mg); cephalexin ( $1375 \pm 250$  mg); and metronidazole ( $1056 \pm 271.3$  mg). The PDD: DDD ratio for various age groups is represented in Figure 6 and pediatric patients had significantly lower ratios compared to other groups. Metronidazole was under-dosed while amoxicillin/clavulanic acid was over-dosed in all the age groups.

The DDD for analgesic group of drugs were as follows: diclofenac sodium (100 mg); ibuprofen (1200 mg); mefenamic acid (1000 mg); and acetaminophen (3000 mg). The mean  $\pm$  SD PDD for the above drugs in the study participants were as follows: diclofenac sodium (100 mg); ibuprofen ( $1206 \pm 354.9$  mg); mefenamic acid ( $1394.7 \pm 209.4$  mg); and acetaminophen ( $1890.3 \pm 865.6$  mg).

#### *4.8. Prescribed drugs in WHO essential list and BNF:*

Amongst the three analgesic drugs, acetaminophen and ibuprofen are listed in both WHO Model list and BNF. Similarly, metronidazole, and cefuroxime axetil are not listed in both the compendia of essential medicine. On the other hand, mefenamic acid, chlorhexidine (0.2%), a topical preparation containing deproteinized calves blood extract 5% haemodialysate and polidocanol 1%, fixed dose combination of acetaminophen with orphenadrine, diclofenac sodium, and cephalexin are listed only in BNF but not in WHO. If numbers of drug items are considered, 608 (67.8%) were listed in both WHO and BNF, 104

(11.6%) were not listed in both, and 185 (20.6%) were listed only in BNF. All the drugs except amoxicillin/clavulanic acid and acetaminophen/orphenadrine combination were prescribed in generic names.

#### 4.9. Drug utilization 90% (DU 90%):

Amoxicillin and amoxicillin/clavulanic acid accounted for 90% of the total antimicrobial drugs used (Figure 7A). Similarly, ibuprofen and acetaminophen accounted for 90% of the analgesics prescribed to the patients (Figure 7B).

## Discussion

We carried out the present study on prescription and drug utilization by the Ministry of Health, primary care dentists in 391 patients. The results indicate an average of two medications were prescribed for each patient, that included systemic and local analgesics and anti-microbials. 33.4% of patients were only prescribed medications without any dental intervention. Approximately 35% of the records showed inappropriate diagnosis and their rationale for prescription could not be determined. 100% of the patients who presented with acute or chronic periapical abscess were prescribed medications without any dental intervention. 41% of patients with gingivitis or periodontitis did not receive any form of periodontal therapy and only medications were prescribed. Amoxicillin and amoxicillin/clavulanic acid amongst the antimicrobial class; and ibuprofen and acetaminophen amongst the analgesics accounted for 90% of prescribed drugs. Chlorhexidine mouth rinse seemed to be on the regular list for any diagnoses, prescribed between 7 and 14 days, twice or thrice daily.

Antibiotics act by eradication of the infection by causing destruction or deactivation of the organism. [14, 15] However, dentists have been attributed to the misuse of this discovery and contributed immensely to the rising calamity of antibiotic resistance. [15-17] The development of antibiotic resistant strains leads to increased healthcare cost, increased mortality rates and unpredictable treatment outcomes. [15]

According to recent AHA (American Heart Association) guidelines, prophylactic antibiotics, are only indicated in certain patients with increased risk of Infective endocarditis and an invasive dental procedure is being planned. [18] There are detailed and updated guidelines on the prophylactic and treatment use of antibiotics published by the SDCEP [19], FGDP (Faculty of General Dental Practice) [20], NICE (The National Institute for Health and Care Excellence). [21] However dentists across the world, often, presented with very poor knowledge regarding the existing guidelines. [22-24] The SDCEP and the FGDP guidelines are freely available online resources that every dentist must follow to prevent over-use or misuse of medications. Awareness of these guidelines will lead to significant change of inappropriate prescription patterns as identified by Zahabiyoun *et al.* [25]

In the present study, the increased medication use can be attributed to the suspension of all aerosol generating procedures in the dental clinic due to COVID-19. The World has seen the worst of the epidemics and pandemics such as influenza, SARS, MERS, tuberculosis, Ebola virus infections, dengue.

Considering the evolving nature of micro-organisms, epidemics and pandemics can occur from time to time. Dentists are at increased risk of acquiring and transmitting the disease due to the close contact between the dentist and the patient during any dental treatment. Also, most dental procedures are aerosol generating, producing droplets and splatter, leading to direct and contact transmission. Effective infection control protocol must be the prime requisite to prevent transmission and spread.

Considering the effects of temporary suspension of aerosol generating procedures on the burden of antimicrobial use, emphasis must be placed on infection control rather than suspension of dental procedures. Pre-treatment triage of all patients, use of personal protective equipment, rubber dam, high volume evacuation devices, air filters, water line disinfection, pre-procedural mouth rinses are available to contain possible disease transmission. [2,26-28] The pre-treatment triage checklist that is used in the Ministry of Health, primary care dental clinics is presented in Figure 8. These measures will help prevent dentists using medications to manage their out-patients.

In conclusion, within the limitations of the study, suspension of dental procedures can cause more harm in terms of overuse of medications in primary care dental practices. The awareness of the recent guidelines is the key. Effective infection control practices based on guideline should be in place to contain COVID-19 transmission.

## Declarations

**Ethics approval and consent to participate:** The study has received ethics approval from the Ethics Committee, Ministry of Health, Bahrain

**Consent for publication:** All authors consent to publication

**Conflict of interest:** None.

**Funding:** None.

**Acknowledgement:** None

**Data availability and materials:** All the data will be available only with the corresponding author, who is the principal investigator of the study. It can be accessed by contacting the corresponding author directly.

**Author Contributions:**

- Concept and design – GS, FS, MA, KS
- Acquisition of data- GS, FS, MA
- Analysis and interpretation of data – GS, KA
- Drafting and revision of the manuscript - GS, FS, MA, KS

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## Figures

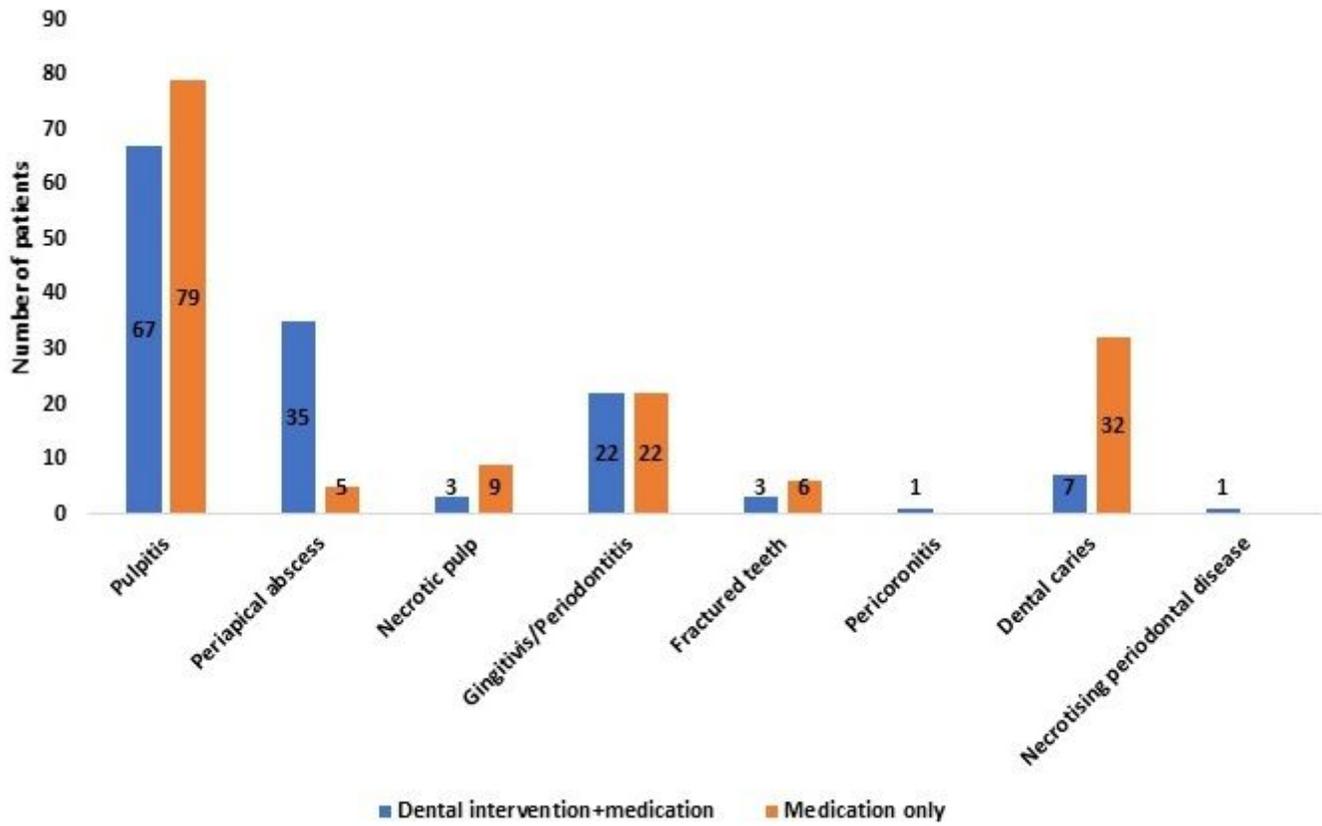


Figure 1

Diagnoses, dental intervention and prescription.

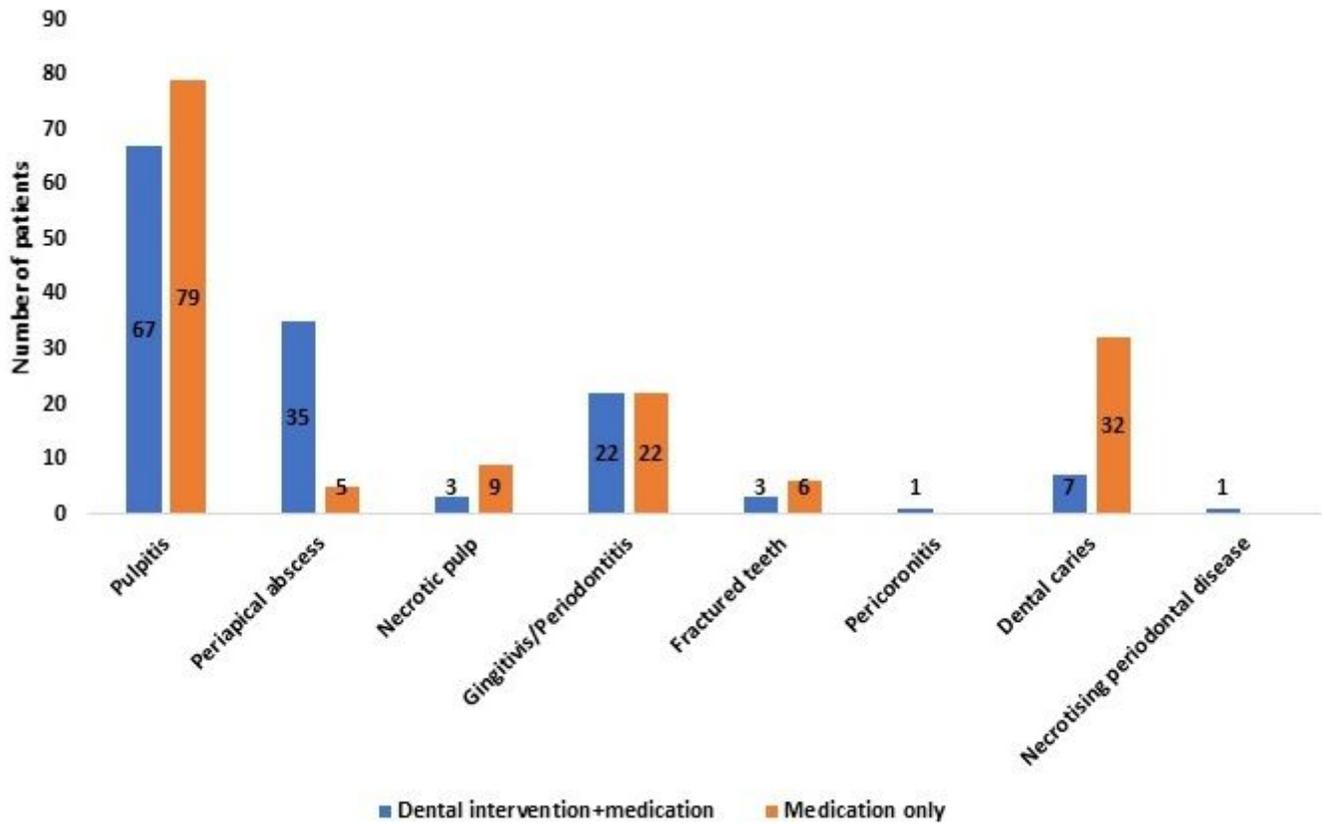


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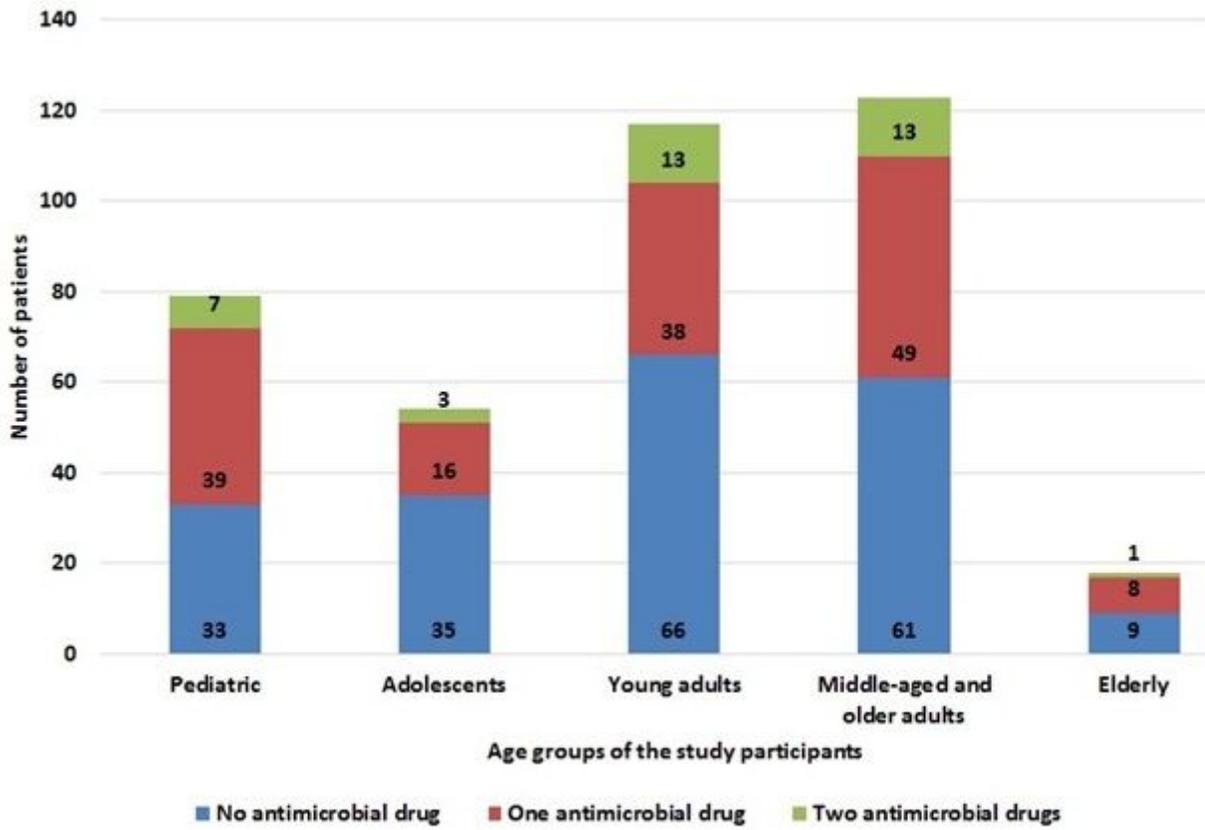


Figure 2

Number of antimicrobial prescriptions.

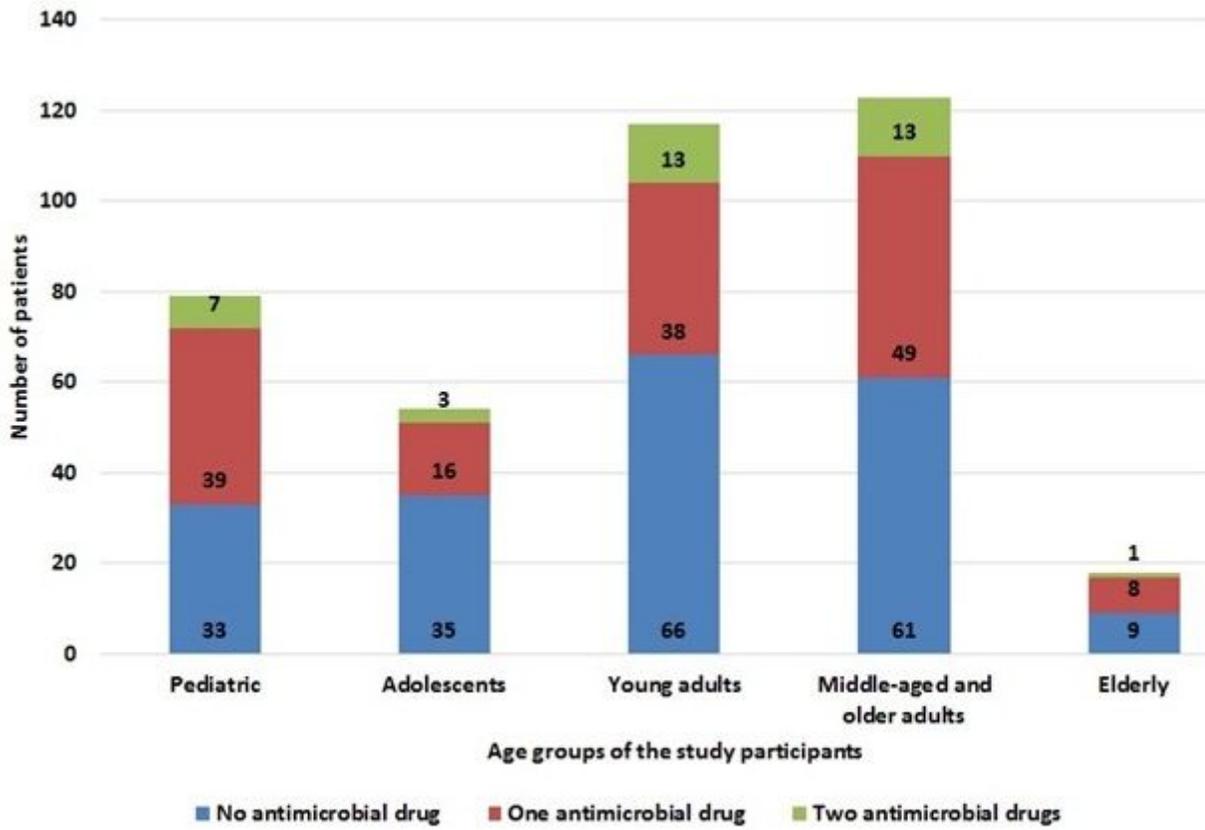


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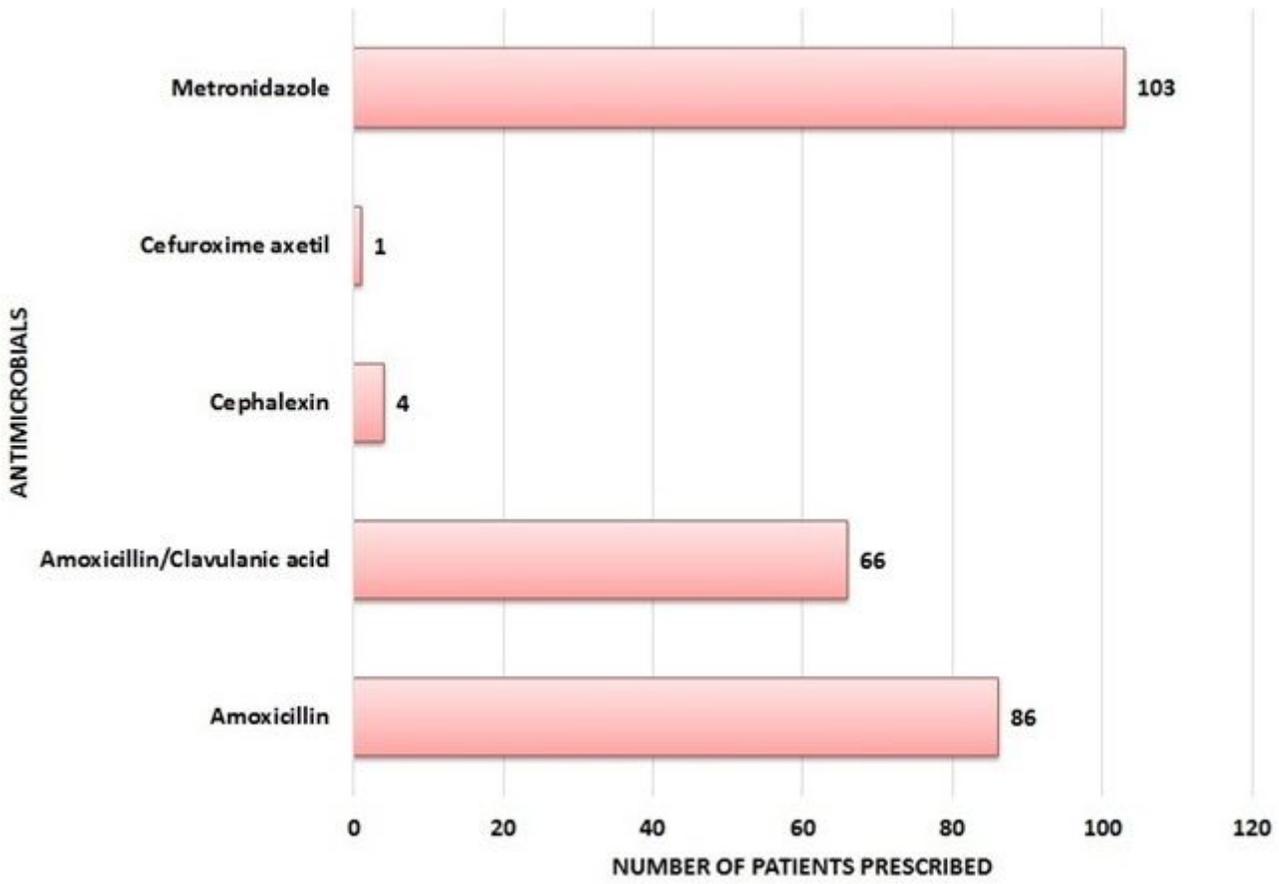


Figure 3

Prescribed antimicrobials.

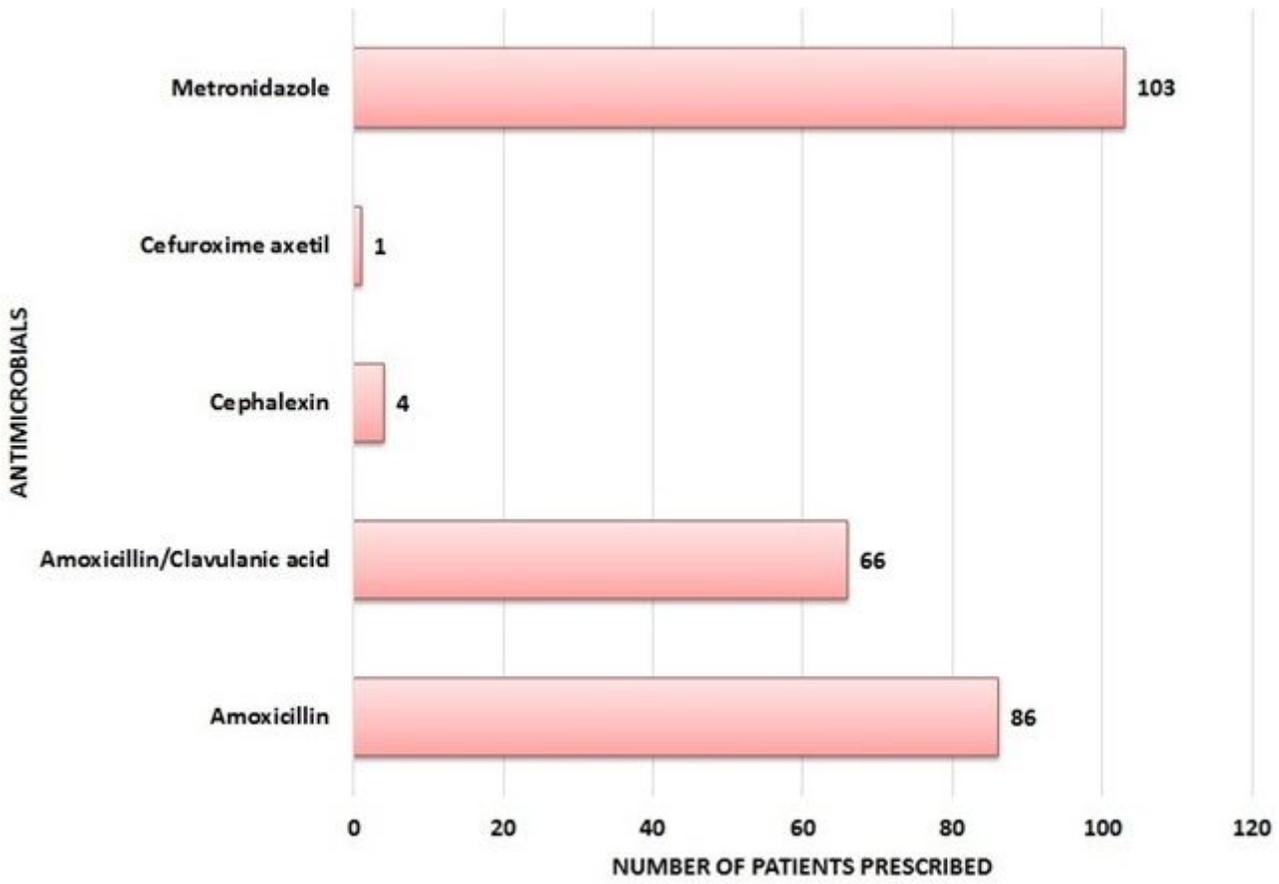
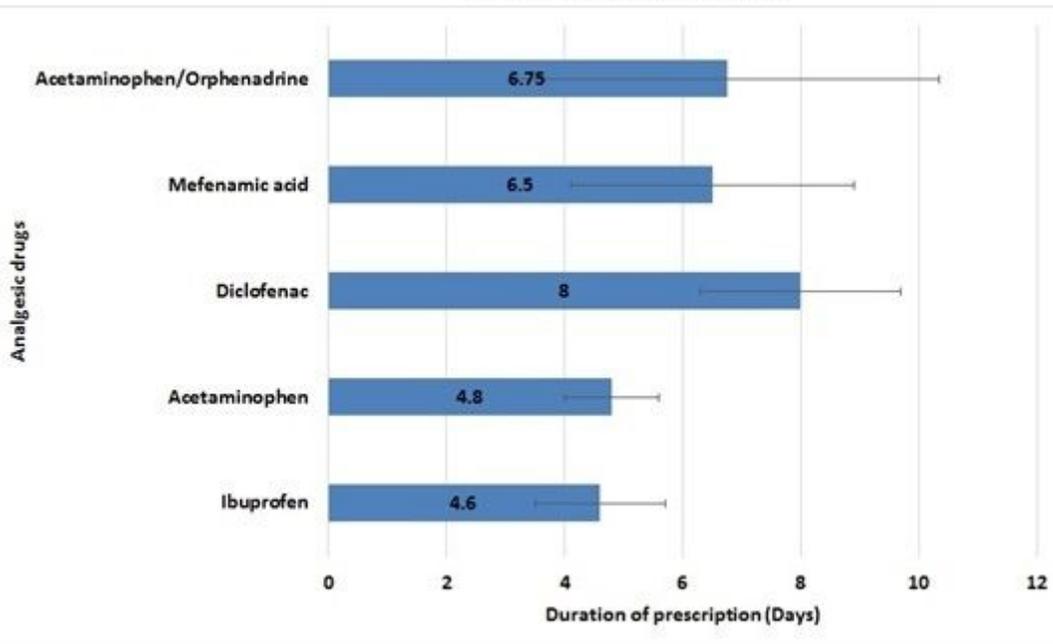
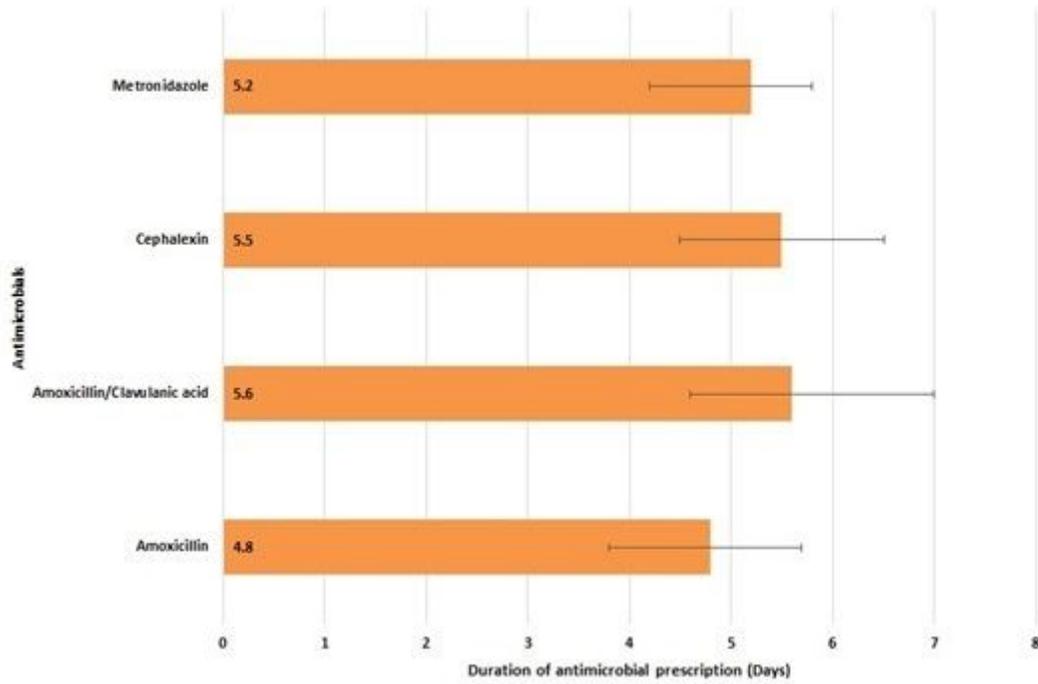


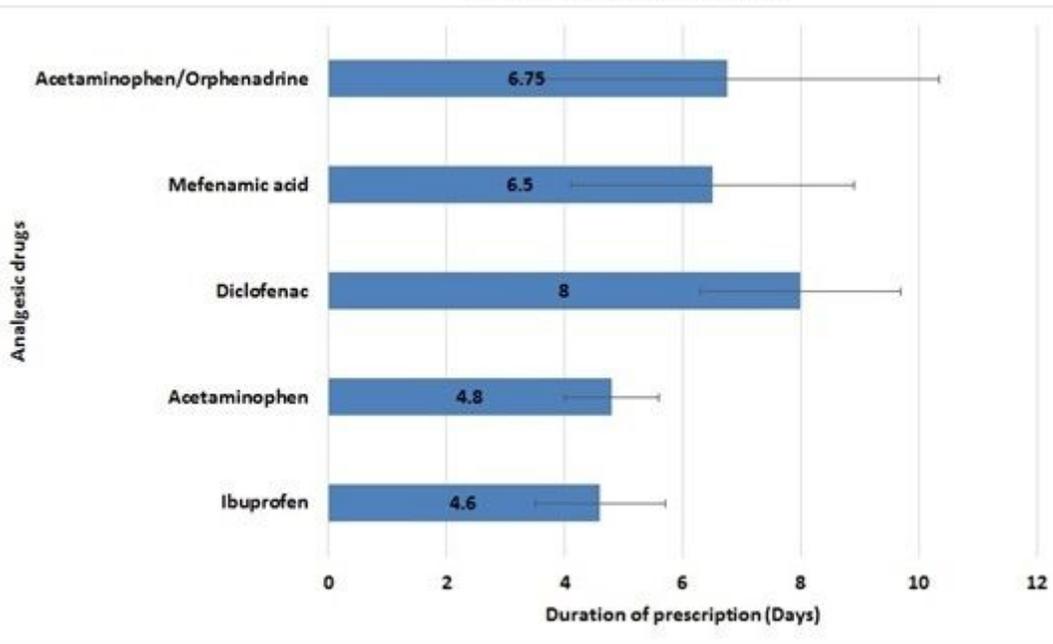
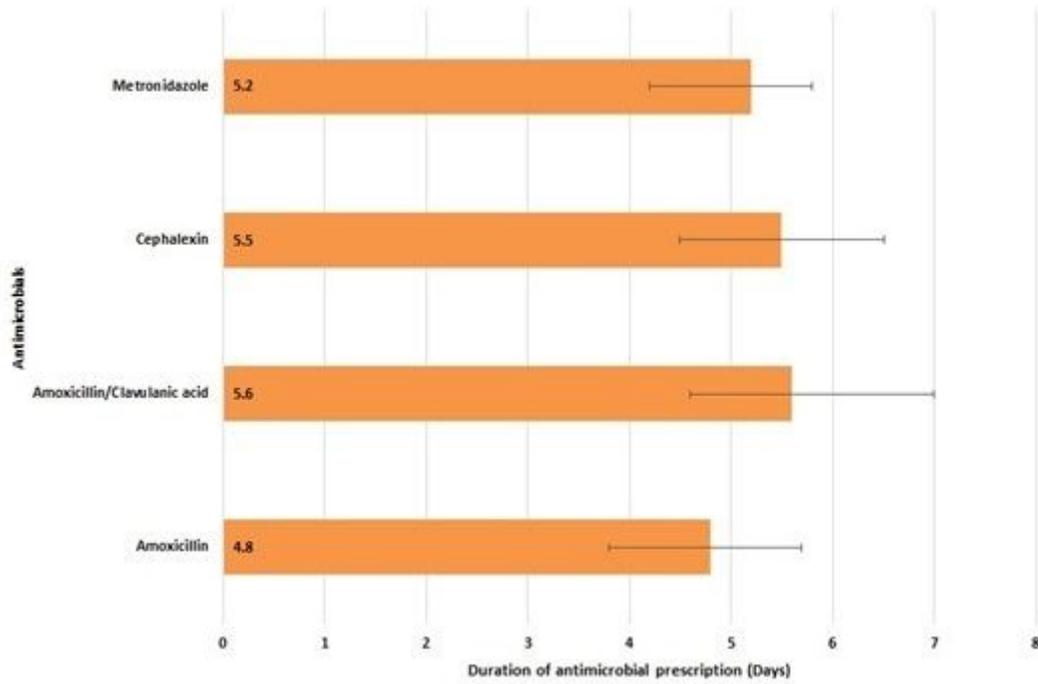
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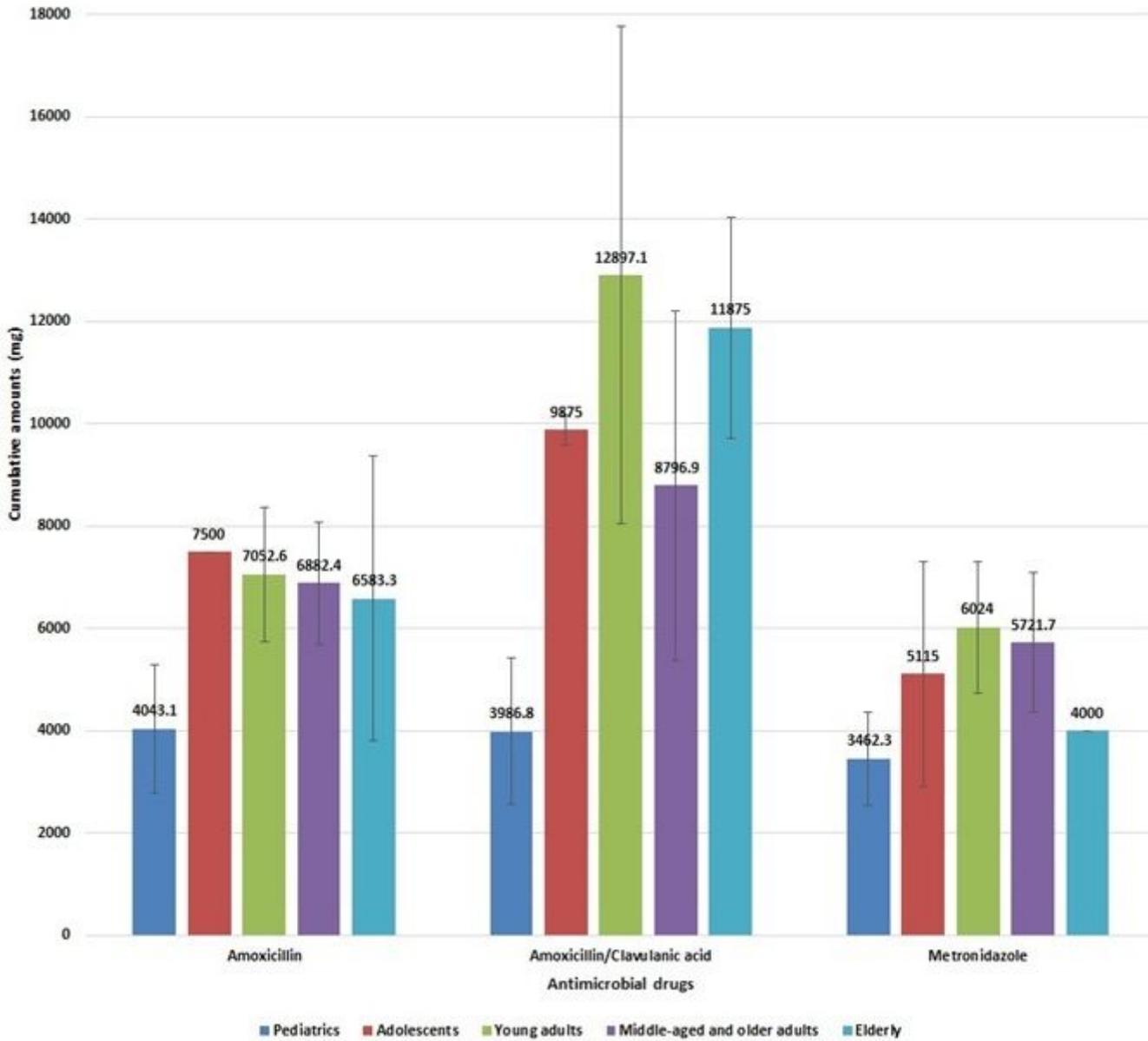
**Figure 4**

Duration of antimicrobials and analgesics prescribed. Simple bar chart showing comparison of duration of antimicrobial drugs (4A) and analgesics (4B). The error bars represent 2 SD from the mean duration.



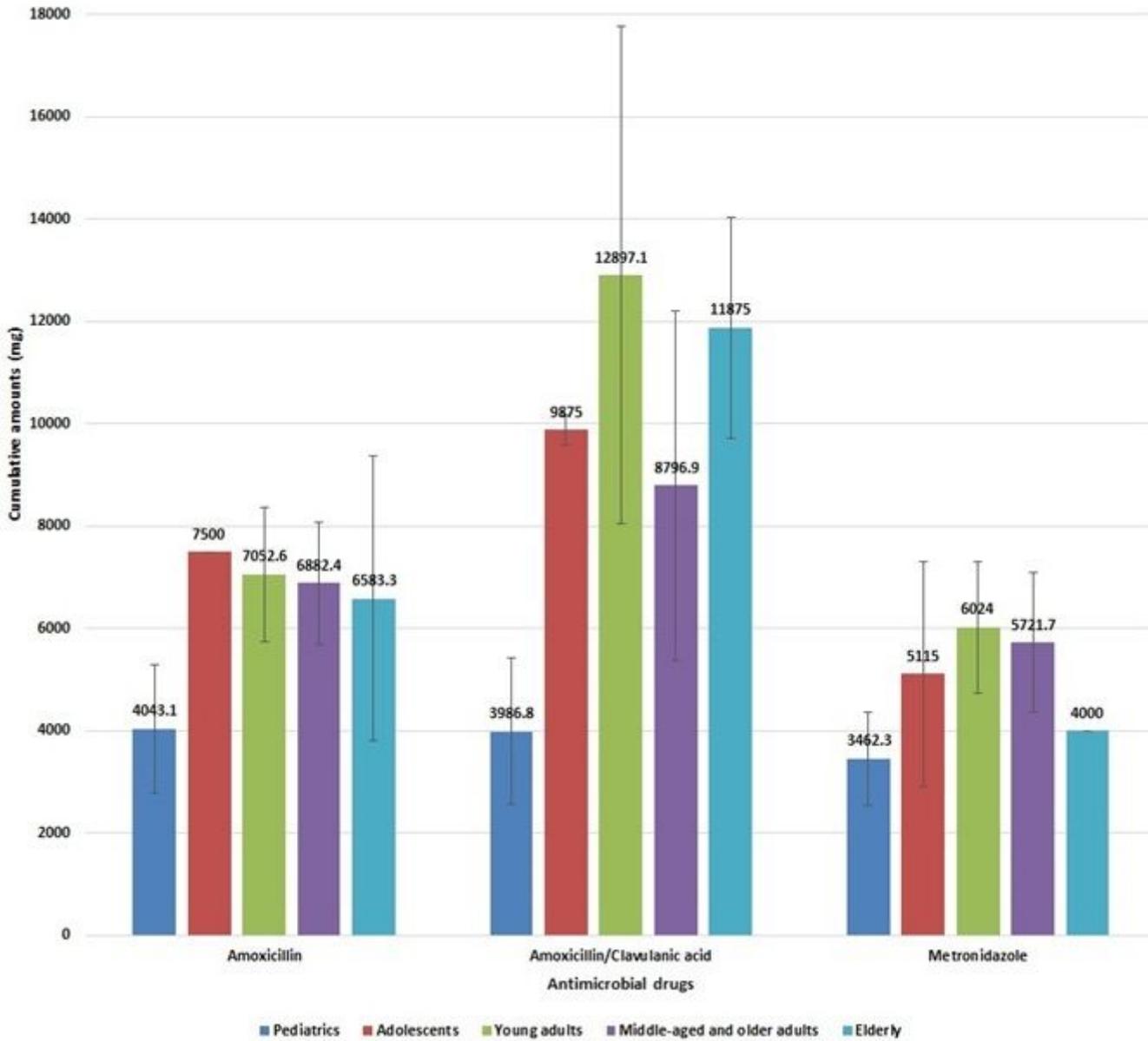
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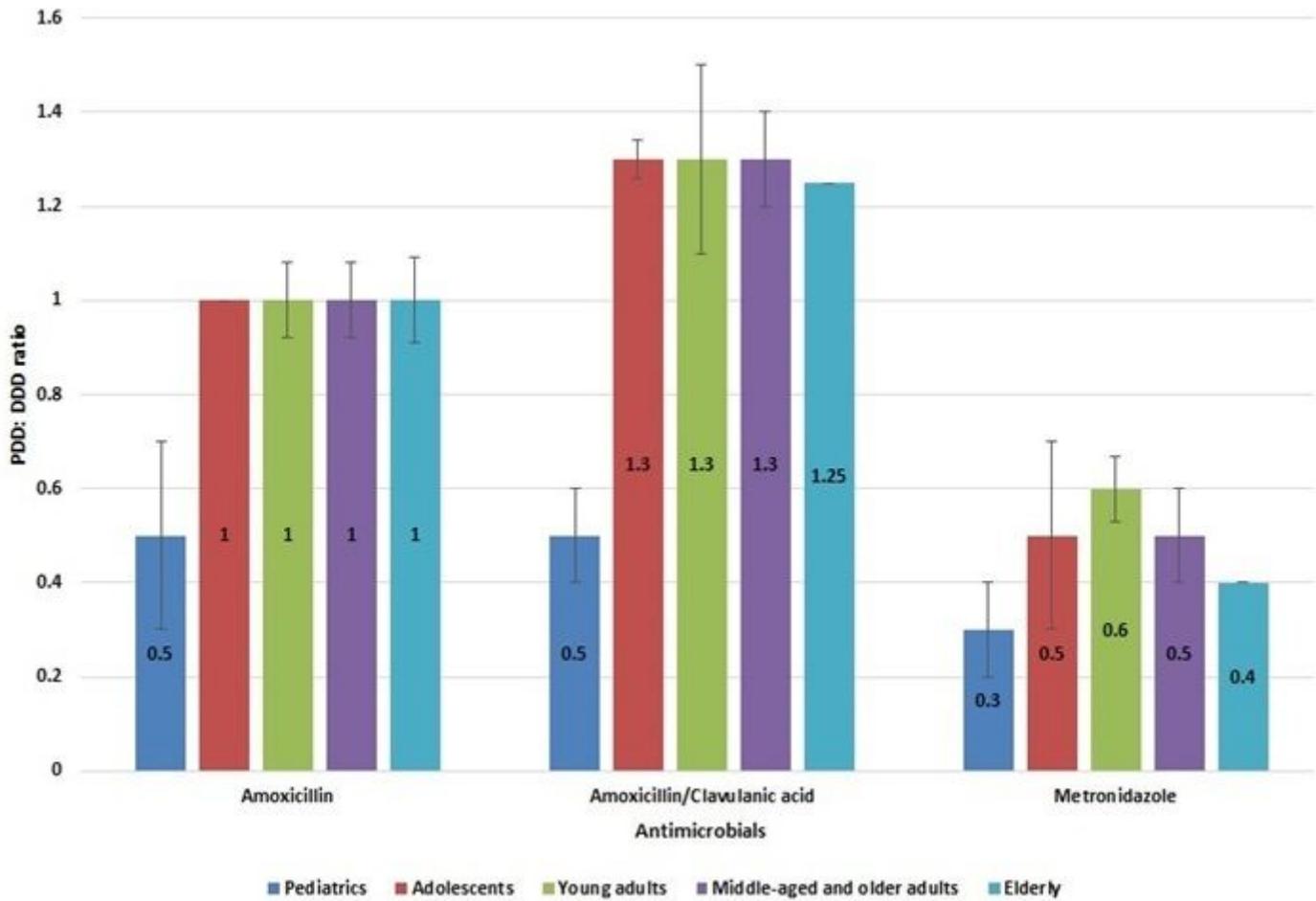
**Figure 5**

Cumulative amounts of antimicrobial drugs. Simple bar chart showing cumulative amounts of antimicrobial drugs in various age groups. The error bars represent 2 SD from the mean amount.



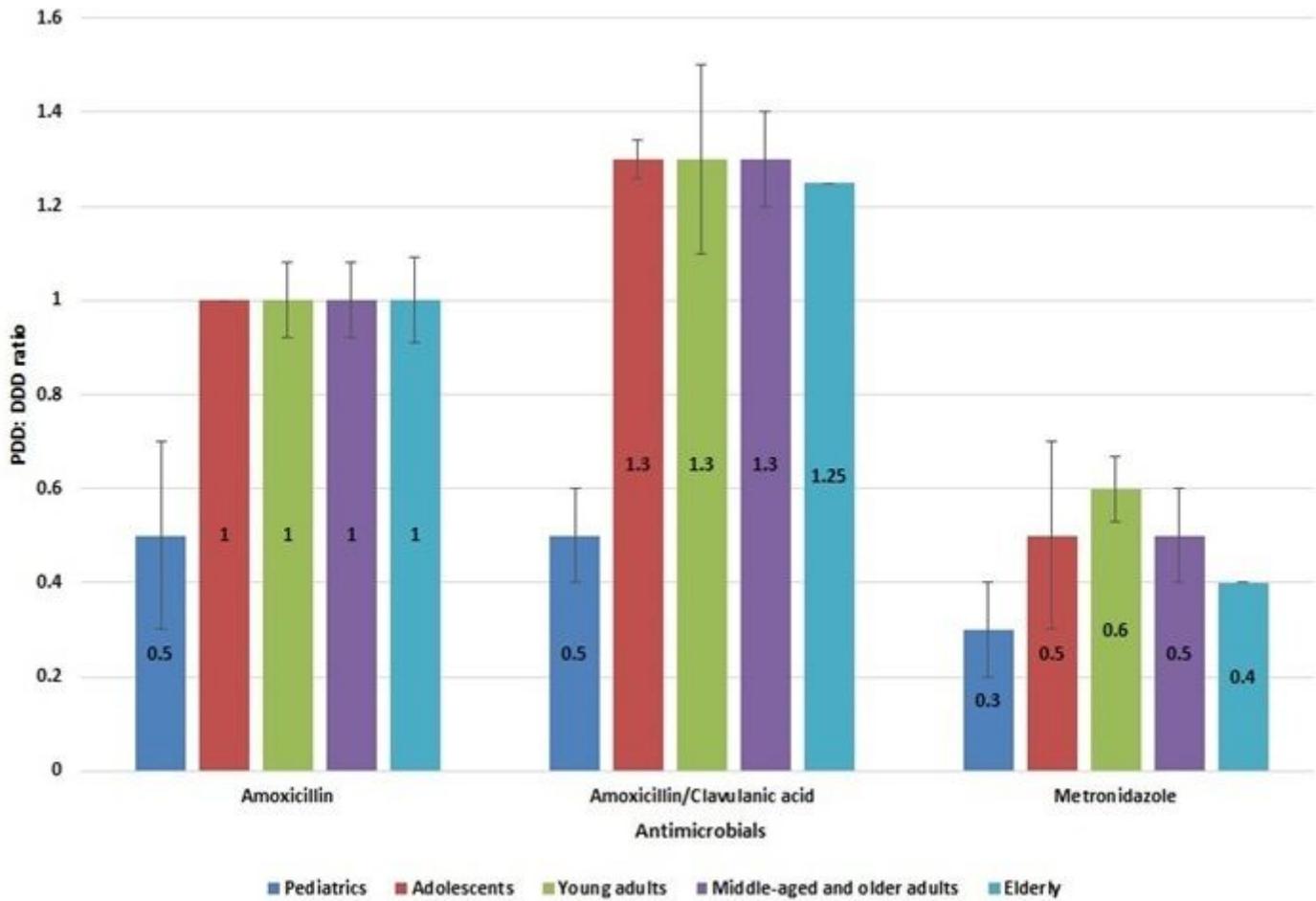
**Figure 5**

Cumulative amounts of antimicrobial drugs. Simple bar chart showing cumulative amounts of antimicrobial drugs in various age groups. The error bars represent 2 SD from the mean amount.



**Figure 6**

Comparison of PDD: DDD ratios of antimicrobial drugs. Simple bar chart depicting the mean PDD: DDD ratios of antimicrobial drugs in various age groups. The error bars represent 2 SD from the mean ratio.



**Figure 6**

Comparison of PDD: DDD ratios of antimicrobial drugs. Simple bar chart depicting the mean PDD: DDD ratios of antimicrobial drugs in various age groups. The error bars represent 2 SD from the mean ratio.

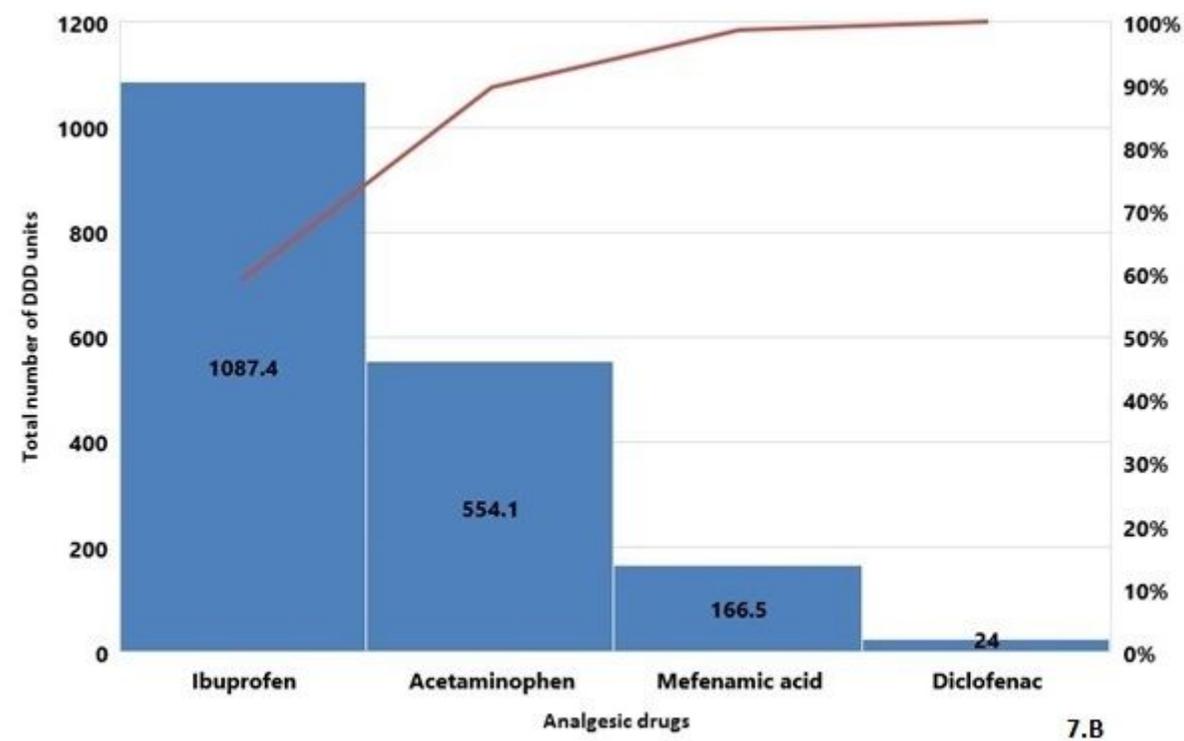
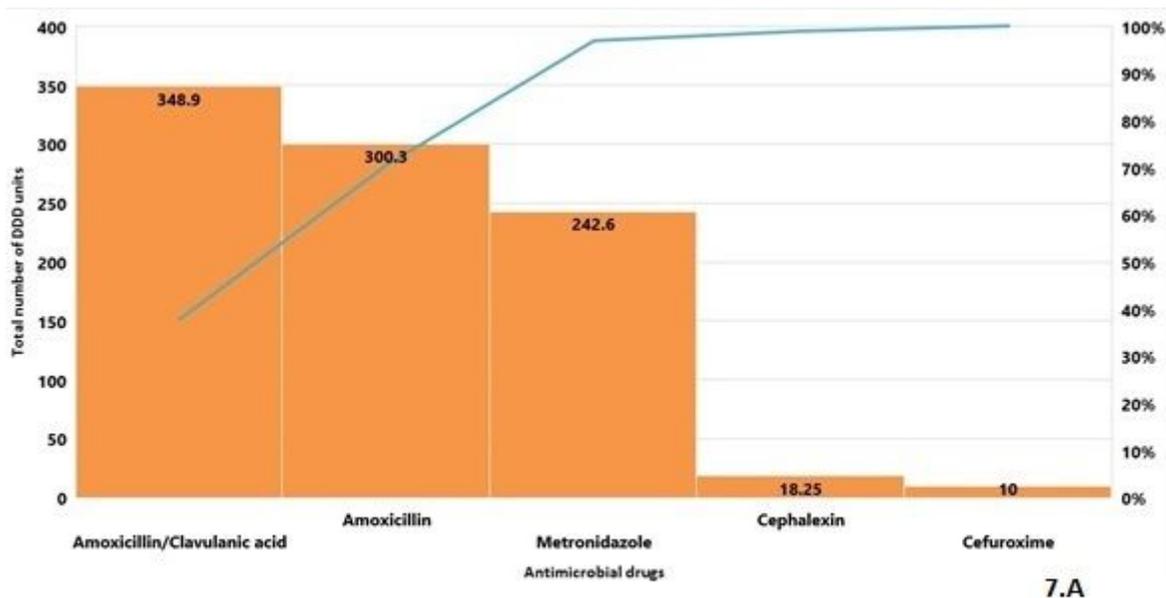


Figure 7

DU 90% of antimicrobials and analgesics. 7A depicts the utilization of each of the antimicrobial drugs and 7B depicts the same for analgesic drugs.

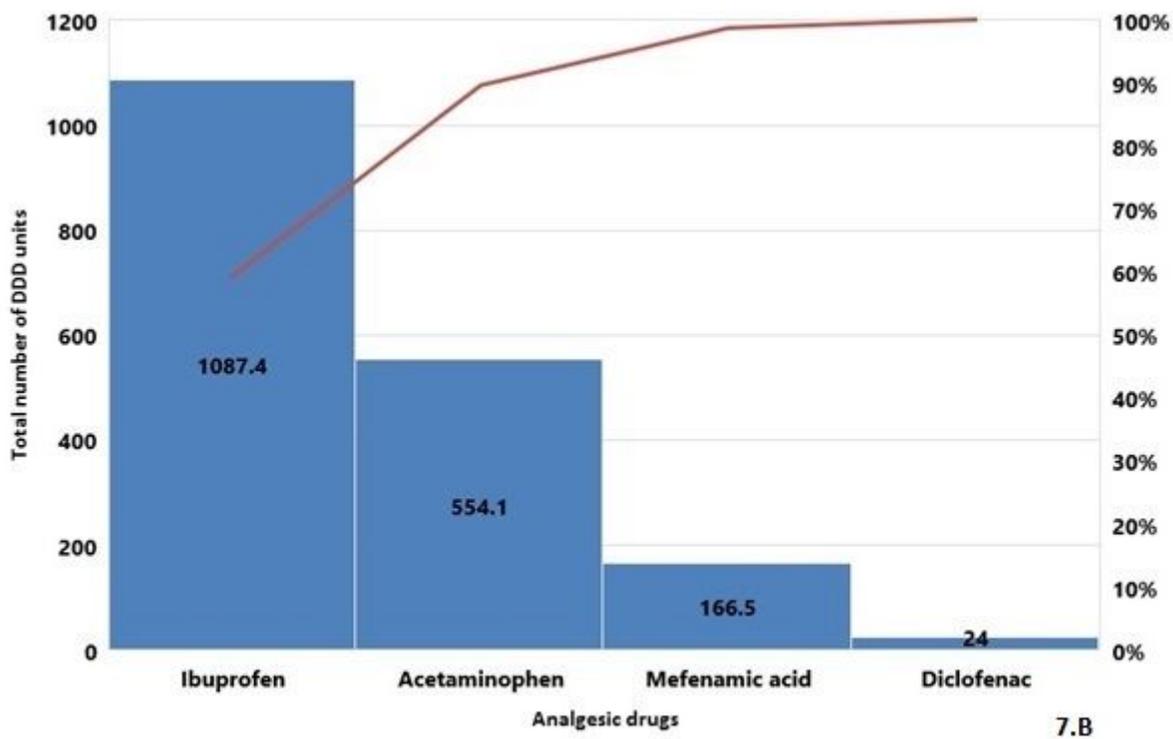
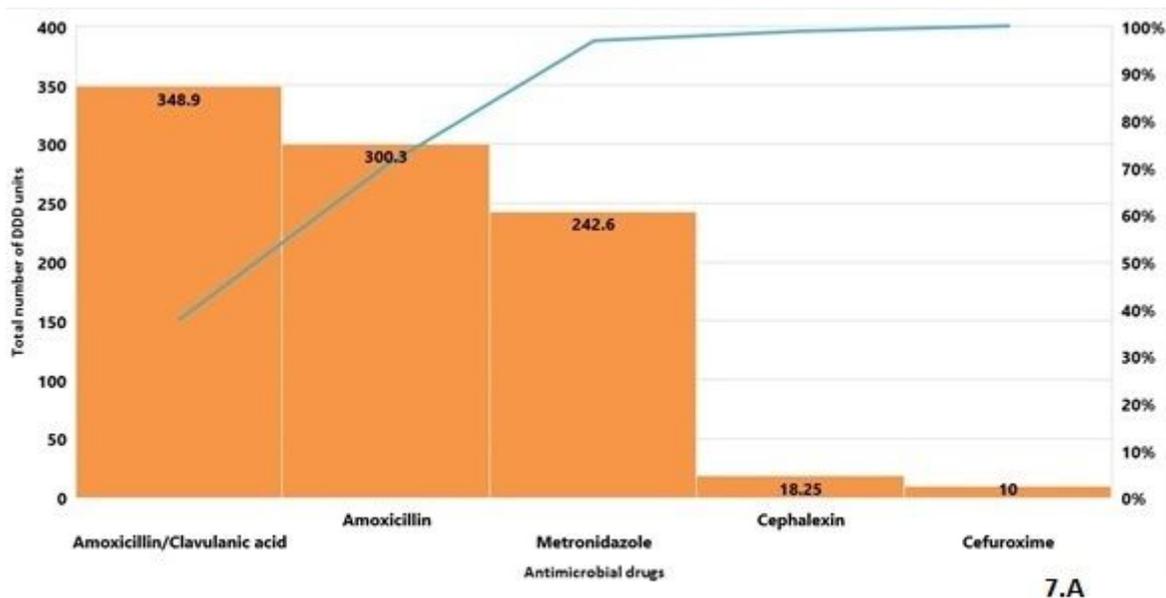


Figure 7

DU 90% of antimicrobials and analgesics. 7A depicts the utilization of each of the antimicrobial drugs and 7B depicts the same for analgesic drugs.



**VISUAL TRIAGE CHECKLIST BEFORE COMMENCING ANY DENTAL PROCEDURE:**

Name of the patient:

Name of the dentist:

CPR:

Name of the health center:

Age:

Clinic number:

<b>A. Exposure Risk</b>	<b>Score</b>
Contact with a confirmed case of COVID19 or CLI* in the last 14days prior to symptoms onset OR Lived or worked in a facility known to be experiencing an outbreak of COVID-19 or CLI* in the last 14days prior to onset of symptoms	<b>3</b>
<b>B .Clinical signs and symptoms</b>	
Fever or recent history of fever	<b>4</b>
Cough (new or worsening)	<b>4</b>
Shortness of breath (new or worsening)	<b>4</b>
Headache, sore throat or rhinorrhea	<b>1</b>
Nausea, vomiting and/or diarrhea	<b>1</b>
Chronic renal failure, Chronic heart disease, immunocompromised patient	<b>1</b>
Total score A+B	

If score of  $\geq 4$ , isolate patient, ask to wear a mask, inform physician for assessment and call 444.

\*COVID like illness

Developed by The National Taskforce for Combating the Coronavirus (COVID-19), Kingdom of Bahrain.

**Figure 8**

Pre-treatment Triage Checklist.



**VISUAL TRIAGE CHECKLIST BEFORE COMMENCING ANY DENTAL PROCEDURE:**

Name of the patient: \_\_\_\_\_ Name of the dentist: \_\_\_\_\_  
 CPR: \_\_\_\_\_ Name of the health center: \_\_\_\_\_  
 Age: \_\_\_\_\_ Clinic number: \_\_\_\_\_

<b>A. Exposure Risk</b>	<b>Score</b>
Contact with a confirmed case of COVID19 or CLI* in the last 14days prior to symptoms onset OR Lived or worked in a facility known to be experiencing an outbreak of COVID-19 or CLI* in the last 14days prior to onset of symptoms	<b>3</b>
<b>B .Clinical signs and symptoms</b>	
Fever or recent history of fever	<b>4</b>
Cough (new or worsening)	<b>4</b>
Shortness of breath (new or worsening)	<b>4</b>
Headache, sore throat or rhinorrhea	<b>1</b>
Nausea, vomiting and/or diarrhea	<b>1</b>
Chronic renal failure, Chronic heart disease, immunocompromised patient	<b>1</b>
Total score A+B	

If score of  $\geq 4$ , isolate patient, ask to wear a mask, inform physician for assessment and call 444.

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Pre-treatment Triage Checklist.