

Original Research Paper

# Suspension of Certain Dental Procedures Due to COVID-19: A Source of Over-Prescription?

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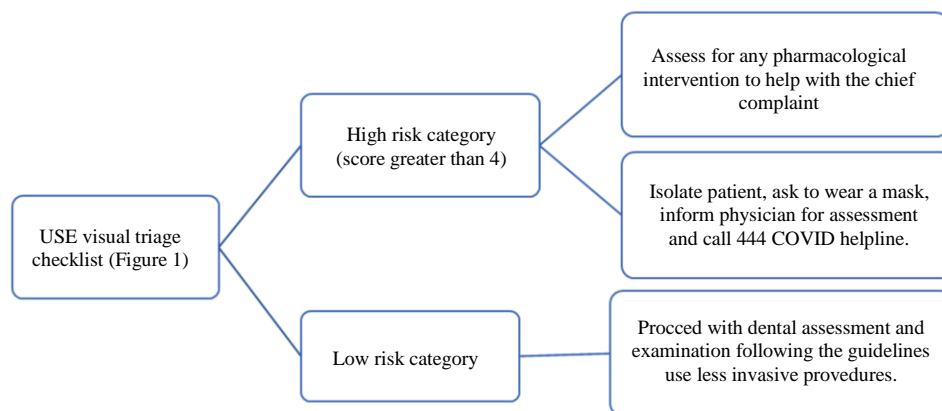
**Abstract:** Dentists have always been attributed to the ever rising global problem of antibiotic resistance. The recent pandemic due to COVID-19 has caused greater concern and primary dental care practices temporarily suspended all aerosol generating and invasive procedures in the Ministry of Health in Bahrain, between February to August 2020. Dental emergencies were addressed using a triage system and low exposure procedures were undertaken. To identify the prescription and drug utilization of primary care dental practitioners during the period of suspension of aerosol generating dental practices due to COVID-19. 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. 35.1% of patients were only prescribed medications without any dental intervention. 43.3% were irrational and 30.66% could not be evaluated for rationality of prescription due to lack of details on the diagnoses and the dental procedure that was carried out. 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. Suspension of invasive and aerosol generating procedures may drive dentists to sort to prescriptions to manage their out-patients in primary care. Future antibiotic stewardship programs across the World must consider this additional factor and propose their recommendations.

**Keywords:** Antimicrobials, Medications, Dental Prescription, Antibiotic Resistance, Corona Virus

## Introduction

The recent pandemic due to COVID-19 has caused greater concern regarding current practices of infection control in dentistry (Barabari and Moharamzadeh, 2020). 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 at the Ministry of Health, Kingdom of Bahrain, suspended all aerosol generating and invasive procedures between February to August 2020 (Nagraj *et al.*, 2020). However, dental emergencies were addressed using a triage system, considering the use of less invasive procedures. The procedures that were undertaken were extractions,

restorations using Atraumatic Restorative Treatment (ART) technique, hand scaling, dental prosthetic work like complete dentures, that did not involve the use of high speed handpiece. Pre-procedural chlorhexidine mouth rinses and appropriate use of Personal Protective Equipment (PPE) were emphasized. Dentists were advised on using the slow speed hand piece for any procedure, whenever possible. All these were undertaken after the initial visual triage using the visual triage checklist, (Fig. 1) and patients were categorized into low risk of high risk group as shown below. This protocol was used for all patients, including the low risk category, because the number of cases reported were maximum during this period and appropriate COVID test kits were not available in Bahrain.



**Fig. 1:** Pre-treatment Visual Triage of all patients

### Antibiotic Prescription Rates of Dentists

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 by approximately 65% over the years, as observed from recent studies (Stein *et al.*, 2018; Marra *et al.*, 2016; Segura-Egea *et al.*, 2017). It is now a known fact and there is greater evidence to confirm the irrational prescription patterns of dentists (Stein *et al.*, 2018; Marra *et al.*, 2016; Segura-Egea *et al.*, 2017; Zahabiyoun *et al.*, 2015). 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 (Marra *et al.*, 2016; Segura-Egea *et al.*, 2017; Zahabiyoun *et al.*, 2015; Jayadev *et al.*, 2014; Nabavizadeh *et al.*, 2011; Gowri *et al.*, 2015). According to the prescription guidelines by the World Health Organization (WHO) and Scottish Dental Clinical Effectiveness Program (SDCEP), antibiotics in dentistry should be prescribed, when indicated, only in addition to necessary dental interventions 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 (DPD, 2016; WHO, 2020). The actual use of antibiotics in dentistry is very limited and appropriate operative dental intervention is necessary (DPD, 2016; WHO, 2020).

### COVID-19 and Suspension of Dental Procedures

The current pandemic of COVID-19 and their associated fatalities led to suspension of most dental procedures undertaken by dentists across the World. Based on the risk assessment by the WHO, dentists were reported to be at the highest risk and strongly recommended airborne precautions for all dental settings in which Aerosol Generating Procedures (AGP) are performed (WHO, 2020). This led several countries to temporarily suspend all elective dental procedures. Dental professional organizations like the Centers for Disease Control (CDC) and American Dental Association (ADA) proposed infection control protocols and recommendations to postpone elective procedures, invasive surgeries and non-urgent dental visits (ADA, 2020; CDC, 2020). Considering that most dental procedures involve the use of high speed hand piece and hence the inability to undertake most dental procedures, dentists are compelled to depend on prescriptions often times to treat their patients. The second wave of the pandemic and the mutated corona virus infection is expected to cause greater havoc sooner or later and a second lockdown will probably be imposed in most countries. This inability to undertake most of the necessary dental interventions for such prolonged time period might lead to an alarming increase in drug utilization by primary care dentists to manage dental out-patients, in addition to the existing themes already identified.

### Method

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 Ethics Committee at the Ministry of Health, Bahrain. 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. The data regarding any medications prescribed were collected and analyzed.

## 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

### *Number of Patients*

A total of 991 patients attended the primary care dental clinics during the data collection period. The 596 patients who did not receive prescription underwent procedures such as extractions (74%), examination and referral to a later date (10%), temporary and permanent restorations using ART (10.7%), denture repair (1%) hand scaling (2%), access opening using slow speed handpiece (2.3%).

### *Characteristics of Prescriptions*

395 (39.8%) patients were prescribed medications The mean (SD) age of patients that were prescribed medications was 32 (18.9) years. Two-hundred and six (52.7%) were males and the remaining were females:

- 79 (20.2%) belonged to the pediatric age group ( $\leq 12$  years)
- 54 (13.8%) were adolescents ( $\leq 20$  years)
- 117 (29.9%) were young adults ( $\leq 40$  years)
- 123 (31.5%) were middle-aged and older adults ( $\leq 65$  years)
- 18 (4.6%) were elderly (older than 65 years)
- 93 (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 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).

### *Diagnoses and Dental Procedures Undertaken*

The proportions of patients that were prescribed medications in addition to dental intervention for each diagnoses are depicted in Fig. 3. 37 (9.4%) records mentioned "dental examination" as their diagnosis. 15 (3.8%) records did not show any diagnoses, however there were records on prescription.

### *Pulpal Conditions*

Medications were prescribed for one-hundred and forty-six patients (37.3%) diagnosed with pulpitis with or without

associated peri-apical periodontitis or abscess. 56.1% of patients did not receive any dental intervention. 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*

Thirty-two (8.1%) with dental caries in the enamel and dentin received medications in conjunction with temporary or permanent restorations. Fifty-four patients received medications with or without interventions for other conditions such as dentin hypersensitivity, retained root, tooth wear, aphthous ulcers, oral mucositis, dry socket, temporo-mandibular disorders, discolored teeth, malocclusion and traumatic ulcers due to dentures.

### *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 500 mg 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.

### *Antimicrobial Prescription*

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.

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. Amoxicillin, amoxicillin/clavulanate and metronidazole were prescribed more frequently (Fig. 2). The average duration of antimicrobial prescription was 5.1 days. Average duration of individual antimicrobial drugs is depicted in Fig. 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 Fig. 5.

### Analgesic prescription

Median (range) number of analgesics prescribed was 1 (0-2) in all age groups, except in the elderly {1 (0-1)}. 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 Fig. 4B. Ibuprofen was prescribed for a significantly ( $p = 0.02$ ) shorter duration compared to other analgesics (Fig. 6).

### Local Mouthwashes and Topical Administration

Only 7.7% (24/309) (3-15; 2-7; 19-10 mL) 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 records 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%. (Fig. 6)

### Daily Defined Dose (DDD) and Prescribed Daily Dose (PDD)

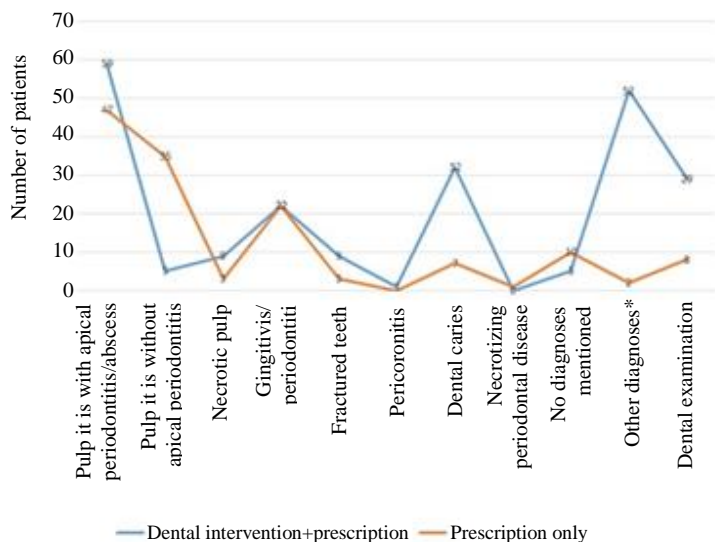
The WHO DDDs (14-16) for the drugs prescribed were as follows: Amoxicillin (1500 mg); amoxicillin/clavulanic acid (1500 mg); cephalexin (2000 mg); cefuroxime axetil (500 mg); and metronidazole (2000 mg). The mean + SD PDD for the above drugs were as follows: Amoxicillin (1268.2+386.1 mg); amoxicillin/clavulanic acid (1514.2+618.5 mg); cephalexin (1375+250 mg); and

metronidazole (1056+271.3 mg). The PDD: DDD ratio for various age groups is represented in Fig. 7 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.

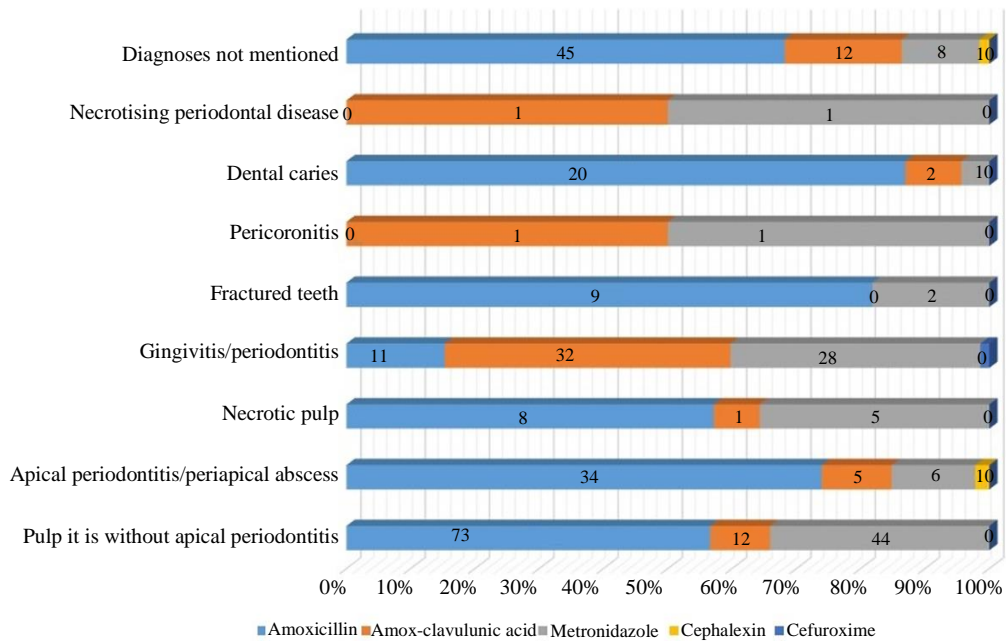
The DDD for analgesic group of drugs were as follows: Diclofenac sodium (100 mg); ibuprofen (1200 mg); mefenamic acid (1000 mg); and acetaminophen (3000 mg). The mean  $\pm$  SD PDD for the above drugs in the study participants were as follows: Diclofenac sodium (100 mg); ibuprofen (1206 $\pm$ 354.9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

### Prescribed Drugs in WHO Essential List and Bahrain National Formulary (BNF)

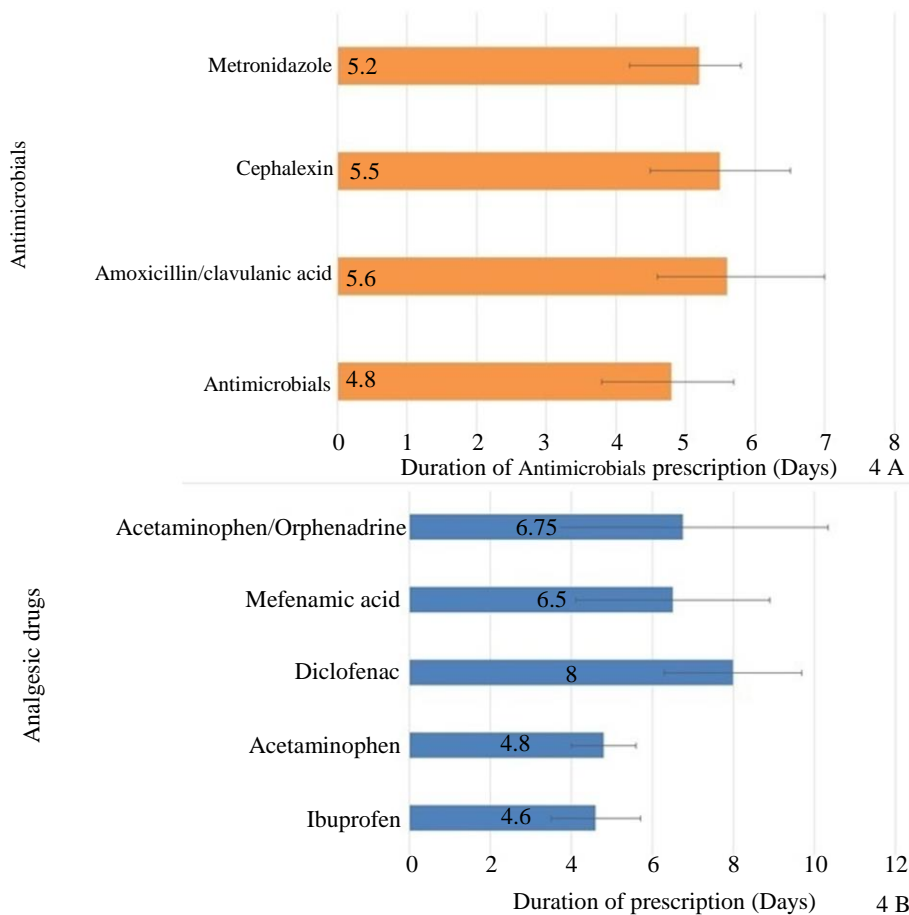
Amongst the three analgesic drugs, acetaminophen and ibuprofen are listed in both WHO Model list and BNF (WHO, 2019a; 2019b; BDF, 2015). Similarly, metronidazole and cefuroxime axetil are not listed in both the Compendia of essential medicine. On the other hand, mefenamic acid, chlorhexidine (0.2%), 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.



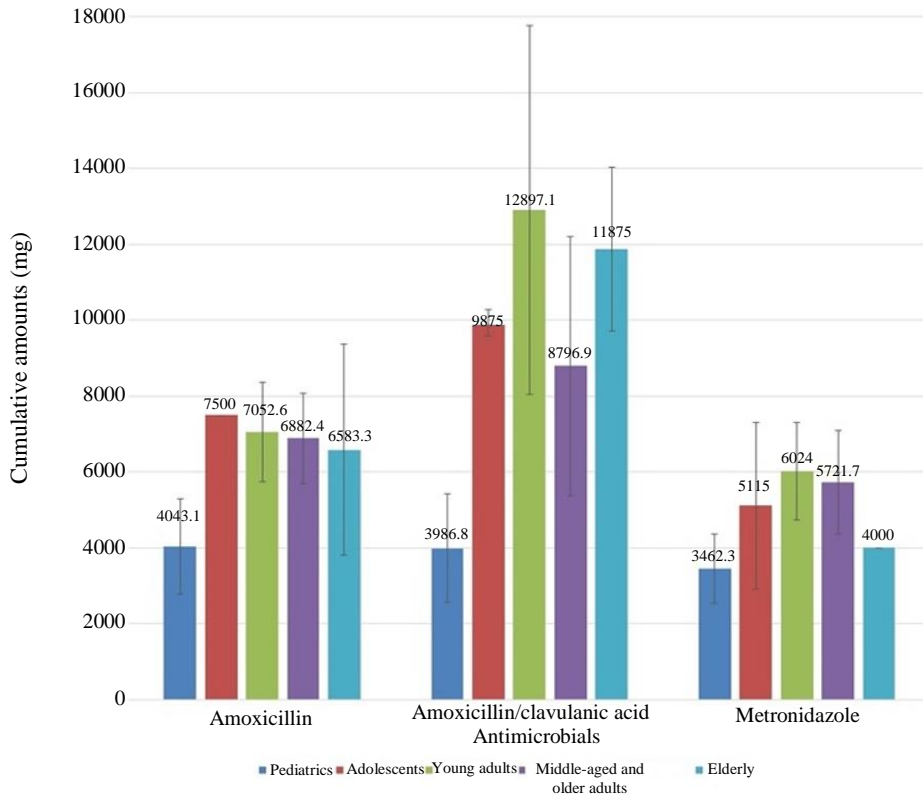
**Fig. 2:** Diagnoses, Dental intervention and prescription \*other diagnoses-dentin hypersensitivity, retained root, tooth wear, aphthous ulcers, oral mucositis, dry socket, temporo-mandibular disorders, discolored teeth, malocclusion and traumatic ulcers due to prosthesis



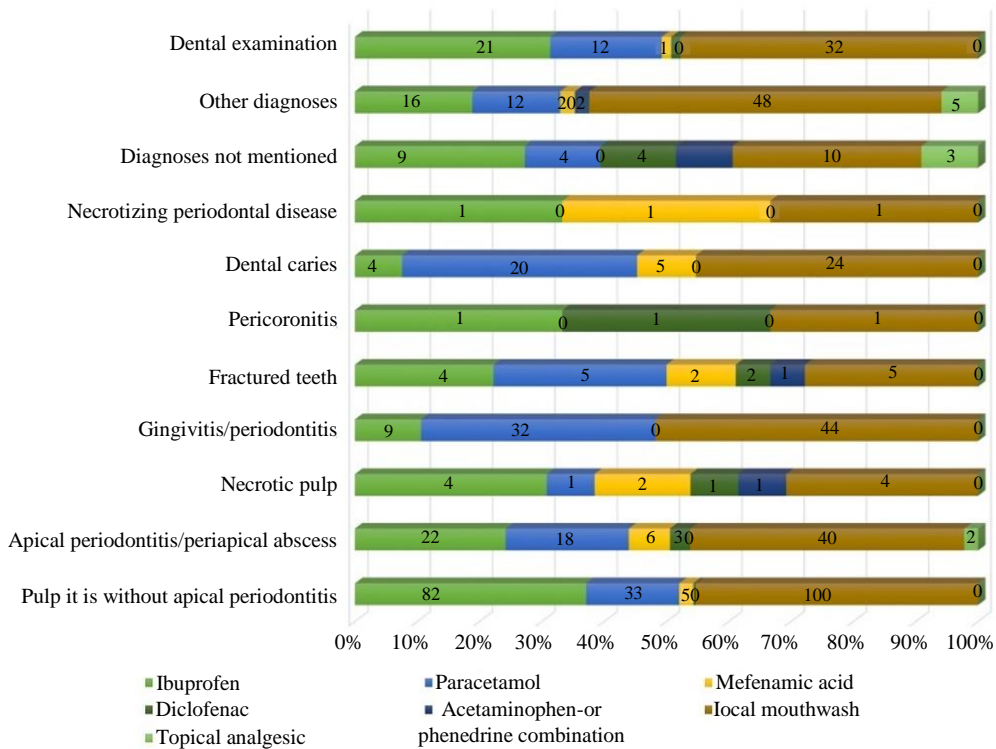
**Fig. 3:** Diagnoses and antimicrobials prescribed



**Fig. 4:** Duration of antimicrobials and analgesics prescribed Simple bar chart showing comparison of duration of antimicrobial drugs (top) and analgesics (bottom). The error bars represent 2 SD from the mean duration

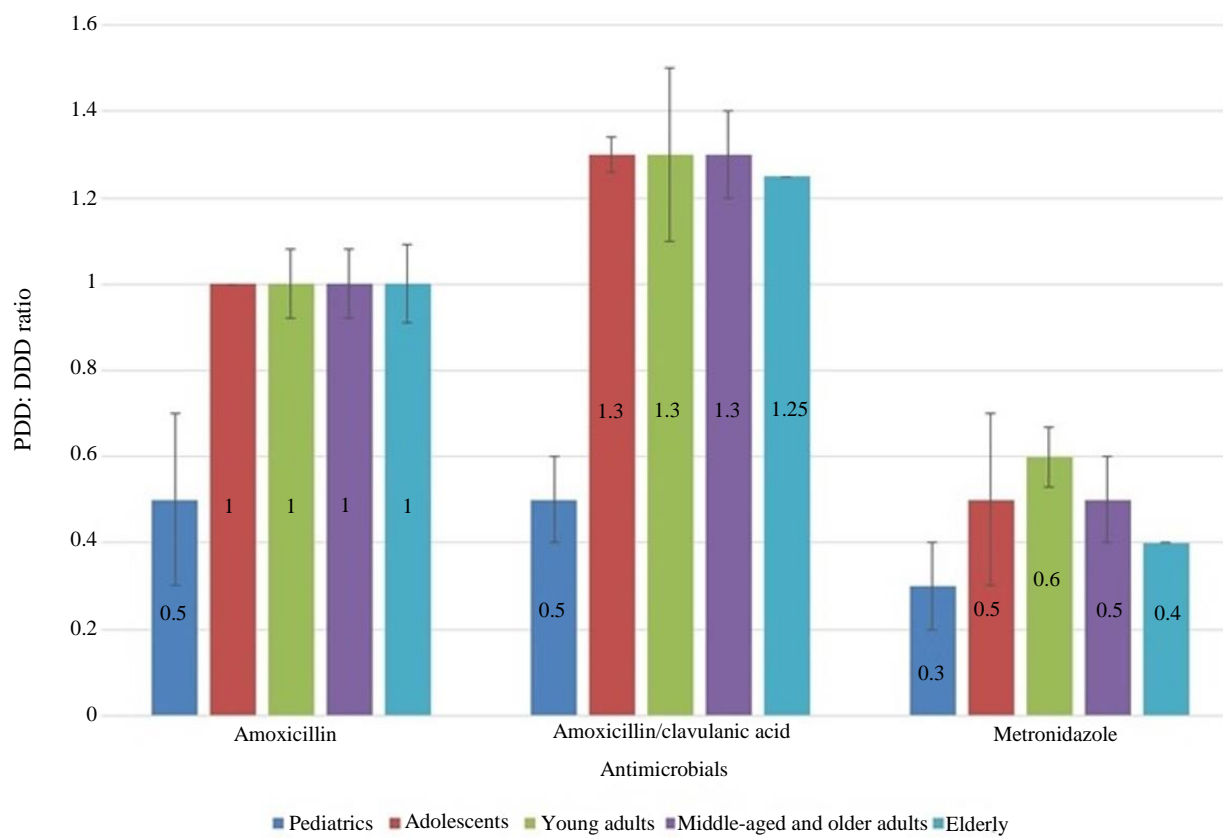


**Fig. 5:** Cumulative amounts of antimicrobial drugs in various age groups Simple bar chart showing cumulative amounts of antimicrobial drugs in various age groups. The error bars represent 2 SD from the mean amount

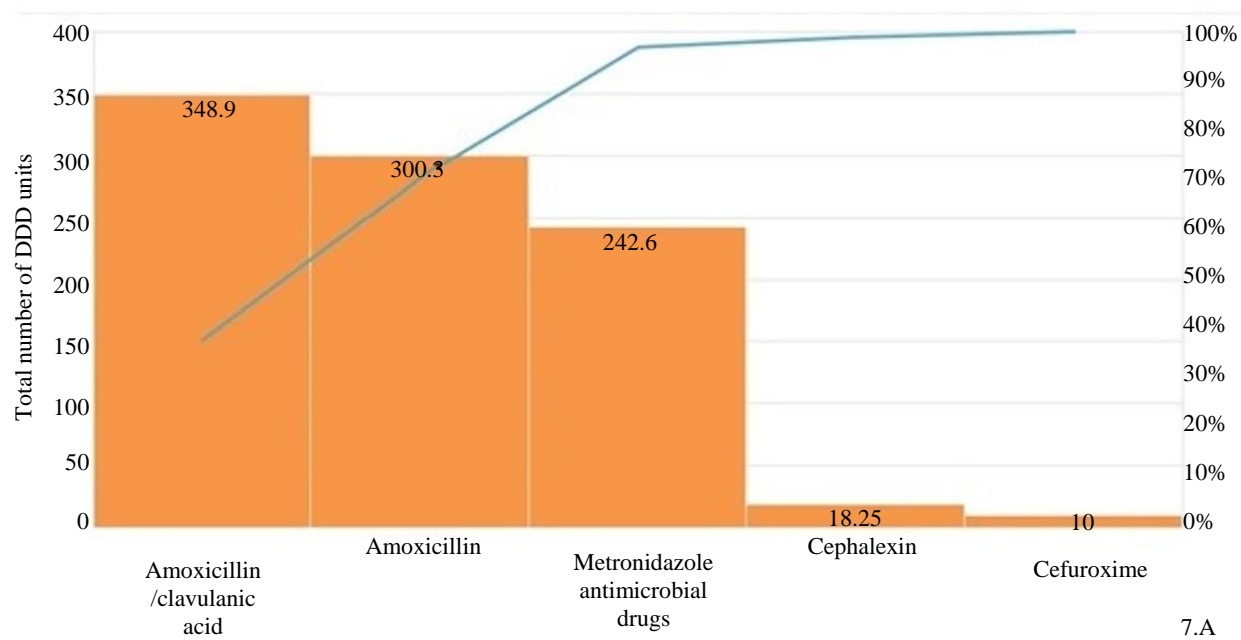


**Fig. 6:** Diagnoses and analgesics prescribed

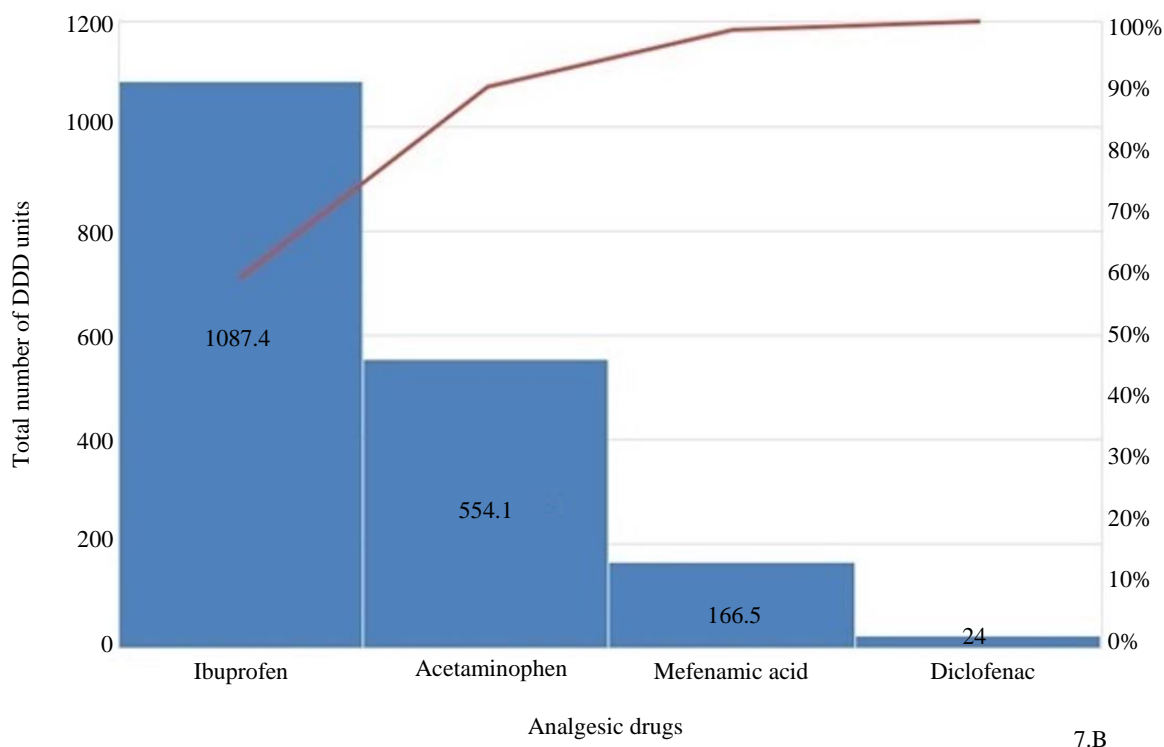




**Fig. 7:** Comparison of PDD: DDD ratios of antimicrobial drugs in various age groups Simple bar chart depicting the mean PDD: DDD ratios of antimicrobial drugs in various age groups. The error bars represent 2 SD from the mean ratio



7.A



**Fig. 8:** DU 90% of antimicrobials and analgesics amongst the study participants 8A depicts the utilization of each of the antimicrobial drugs and 8 B depicts the same for analgesic drugs

### Drug Utilization 90% (DU 90%)

Amoxicillin and amoxicillin/clavulanic acid accounted for 90% of the total antimicrobial drugs used (Fig. 8A). Similarly, ibuprofen and acetaminophen accounted for 90% of the analgesics prescribed to the patients (Fig. 8B).

### Discussion

We carried out the present study on prescription and drug utilization by the Ministry of Health, primary care dentists in 395 patients that were prescribed various medications. 35.1% of patients were only prescribed medications without any specific dental intervention. Approximately 13% of the records showed inappropriate diagnosis and their rationale for prescription could not be determined. Medications were prescribed for pulpal, periapical, periodontal conditions which is irrational based on any Antibiotic prescription guidelines that are currently being recommended. (SDCEP 2016) 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

(SPS, 2012; Abushaheen *et al.*, 2020). However, dentists have been attributed to the misuse of this discovery and contributed immensely to the rising calamity of antibiotic resistance (Abushaheen *et al.*, 2020; Oberoi *et al.*, 2015). The development of antibiotic resistant strains leads to increased healthcare cost, increased mortality rates and unpredictable treatment outcomes (Abushaheen *et al.*, 2020).

According to recent American Heart Association (AHA) guidelines, prophylactic antibiotics, are only indicated in certain patients with increased risk of Infective endocarditis and an invasive dental procedure is being planned. [19] There are detailed and updated guidelines on the prophylactic and treatment use of antibiotics published by the SDCEP (Beacher *et al.*, 2015), Faculty of General Dental Practice (FGDP) (AAE, 2017), The National Institute for Health and Care Excellence (NICE) (APAIE, 2018). However dentists across the world, often, presented with very poor knowledge regarding the existing guidelines (AP, 2020; NICE, 2020; Adeyemo *et al.*, 2011). 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 Wong *et al.* (2016)



In the present study, the unindicated medication use can be attributed to the suspension of all invasive and aerosol generating procedures in the dental clinic due to COVID-19, in addition to other factors, already identified from previous studies (Marra *et al.*, 2016; Segura-Egea *et al.*, 2017; Zahabiyoun *et al.*, 2015; Jayadev *et al.*, 2014; Nabavizadeh *et al.*, 2011; Gowri *et al.*, 2015). Although this is not the only factor, this could be an additional factor that can contribute to antibiotic misuse. The aim of the paper is not to identify all the factors that lead to over-prescription. However, the paper emphasizes that access to procedural factors also needs to be considered. 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 rather than complete suspension of procedures. We propose the use of pre-treatment triage, 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 (Nagraj *et al.*, 2020; Mason *et al.*, 2018; Zahabiyoun *et al.*, 2015; Pan *et al.*, 2020). These measures will help prevent dentists using medications to manage their out-patients. While antibiotic stewardship programs across the World are aiming to address other factors contributing to antimicrobial resistance such as slow adoption of recent recommendations and guidelines, substituting the necessary surgical intervention with antibiotics due to lack of skills etc., this is an additional factor which stewardship programs will have to consider in the future.

In conclusion, within the limitations of the study, suspension of certain dental procedures may contribute to overuse of medications in primary care dental practices and this factor needs to be considered in antibiotic stewardship programs related to dentists.

### Author's Contributions

**Gowri Sivaramakrishnan:** Contributed to conception, design, data acquisition and interpretation, drafted and critically revised the manuscript

**Fatema Al Sulaiti:** Contributed to conception, design, data acquisition and interpretation, performed all statistical analyses, drafted and critically revised the manuscript

**Muneera Alsobaiei and Kannan Sridharan:** Contributed to conception, design, and critically revised the manuscript

All authors gave their final approval and agree to be accountable for all aspects of the work.

### Ethics:

The study protocol was approved by the Ethics Committee at the Ministry of Health, Bahrain.

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