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# Antibiotic utilization in a dental teaching hospital in Yogyakarta, Indonesia

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**Abstract:** *Background:* Various antibiotics are prescribed by dental practitioners to treat odontogenic infections. However, there has been no comprehensive study of antibiotics use in a dental teaching hospital in a developing country using World Health Organization (WHO) dose measurement units. *Objective:* This study was designed to evaluate the use of antibiotics among dental outpatients at a dental teaching hospital in Yogyakarta, Indonesia. *Methods:* A cross-sectional study of outpatients' medical records was carried out in order to identify oral antibiotics administered during January-December 2011. Prescriptions that included antibiotics (N=2024) were separated from total prescriptions collected from medical records. The source and type of antibiotics prescribed and the diagnoses were recorded. Anatomical Therapeutic Chemical classification and Defined Daily Dosage (DDD) measurement units were assigned, and the information was compiled, coded, analyzed in accordance with WHO guidelines. *Results:* Thirteen different antibiotics were prescribed and all were administered to patients. Antibiotics were frequently prescribed contrary to generally accepted criteria and there was wide variation in prescribing. The most commonly prescribed antibiotic was amoxicillin (78.8%), followed by clindamycin (9.0%) and metronidazole (5.0%). The dental diagnosis most frequently reported was pulp gangrene (26.7%), followed by pulp necrosis (8.8%) and impaction-related problems (6.4%). There was a marked increase in total antibiotics use expressed in defined daily dose (DDD) per 1000 patient visit per month during September to November, which might have been associated with seasonal change or availability of student health insurance at the start of the academic year. *Conclusion:* Our findings show a high level of inappropriate antibiotics usage at a dental teaching hospital in Indonesia, and indicate that there is a need for educational initiatives and guidelines to promote best practice and appropriate use of antibiotics in this hospital.

**Keywords:** Antibiotics Utilization, Dental Teaching Hospital, Yogyakarta, Indonesia

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## 1. Introduction

Drug utilization research has been defined by World Health Organization (WHO) as the marketing, distribution, prescription, and use of drugs in a society, with special emphasis on the resulting medical, social, and economic consequences (NNN, 1997), and one of its aims is to assess whether drug therapies are appropriate or not. This concept also covers dental practitioners, who often prescribe antibiotics for the management of odontogenic infections (Dar-Odeh et al., 2008). Indeed, antibiotics account for the vast majority of medicines prescribed by dental practitioners (Lewis, 2008). So far, however, there have been few studies of antibiotics prescribing by dental practitioners in developing countries (WHO, 2006).

Drug utilization studies are important to enable objective evaluation and analysis of health professionals' work and to

provide feedback and ways to improve their performance. In this context, such studies should represent a method of increasing job satisfaction and a means of education for health professionals, rather than being perceived as a threat or bureaucratic burden (Nandimath and Ahuja, 2012). The development of drug utilization research has made it possible to study drug prescribing and drug usage in a scientific and formal manner (Truter, 2008). This in turn should lead to a reduction of unnecessary prescribing, thereby reducing the burden on patients, the incidence of adverse reactions, and the likelihood of drug resistance. Thus, drug utilization studies are useful not only in the evaluation of health systems in general, but also in improving patient outcomes.

Antibiotics prescribing in particular may not necessarily be based on patient need, and not all patients' needs are necessarily met by drug therapy (Naik et al., 2013).

Antibiotic therapy is required in dental clinical conditions where oral infection is associated with raised body temperature and signs of systemic spread of infections (Swift and Gulden, 2002), but antibiotics are also prescribed for various indications for which their use is inappropriate or not warranted. We were particularly interested in antibiotics prescribing by dental practitioners, as there have been few studies in this area, and these have shown wide variation in prescription practice (Thomas, 1996). Therefore, the aim of the present research was to evaluate antibiotics prescribing by dental practitioners in a dental teaching hospital in Yogyakarta, Indonesia, utilizing standard methodology based on defined daily doses (DDD) of the drugs.

## 2. Methods

A cross-sectional study was performed using data in the medical records of registered outpatients at the Prof Soedomo Dental Teaching Hospital, Universitas Gadjah Mada, during January to December 2011. A trained data collector (a dentist) collected antibiotics usage data by scrutinizing the medical records, and prescriptions that included antibiotics (N=2024) were separated from the total medical records. This information was compiled, coded, and analyzed. All data were fully anonymized to protect the privacy of patients. This study was approved by the Ethical Committees of Kanazawa University and the Medical Faculty of Universitas Gadjah Mada.

The WHO recommends use of the ATC/DDD index (2013), which was created in collaboration with the Centre for Drug Statistics Methodology, for evaluation of the intensity of antibiotics use in hospitals. The ATC/DDD index provides ATC codes and DDD values for each agent. In our study, the DDDs of administered antibiotic agents were listed according to the ATC/DDD Index 2013 group J01 (antibiotics for systemic use) suggested by the WHO (2013). To calculate the total DDD for each antibiotic, the strength of the dosage form was multiplied by the total units of each antibiotic received, and then the resulting figure was divided by the DDD of that antibiotic to give the total number of DDDs that outpatients received. The denominator for exit data was the number of patients attending in each month. Data in grams were converted into DDD per day.

All data were coded, entered into a Microsoft Excel® spreadsheet and analyzed using the SPSS 15.0 software package. Note that all percentages are given to one decimal place, so totals may not add up to 100%.

## 3. Results

Analysis of the total number of 14,784 outpatients registered yielded 1625 outpatients who were prescribed an antibiotic. In total, 2024 prescriptions for antibiotics were issued during 2011. During the study period, the mean ages of male and female patients were  $30.7 \pm 13.7$  and  $32.0 \pm 14.1$  years, respectively. More males (55.7%) than females (43.8%) received antibiotics.

During the study period, 13 different antibiotics were prescribed. Table 1 shows that amoxicillin (J01CA04) was most frequently prescribed (78.8%), followed by clindamycin (J01FF01) and metronidazole (J01XD01), which accounted for 9.9% and 5.0%, respectively.

Overall, 122 diagnoses were recorded for which antibiotics had been prescribed (Table 2). Pulp gangrene (26.7%) was the most frequent diagnosis, followed by pulp necrosis and impaction-related problems, which accounted for 8.8% and 6.4%, respectively.

**Table 1.** Distribution of antibiotics prescriptions in 2011

Antibiotics	ATC code	Frequency of prescription	Percentage (%)
Amoxicillin	J01CA04	1596	78.8
Clindamycin	J01FF01	201	9.9
Metronidazole	J01XD01	102	5.0
Lincomycin	J01FF02	42	2.1
Ciprofloxacin	S02AA15	30	1.5
Spiramycin	J01MA02	25	1.2
Erythromycin	J01FA01	18	0.9
Cefadroxil	J01DB05	2	0.1
Cephalosporin	J001DC	2	0.1
Doxycycline	J01AA02	2	0.1
Tetracycline	J01AA07	2	0.1
Ampicillin	J01CA01	1	0.1
Chloramphenicol	J01BA01	1	0.1
<b>Total</b>		<b>2024</b>	<b>*</b>

\*Percentages are given to one decimal place, so the total is not 100%

**Table 2.** Diagnoses for which antibiotics were prescribed in 2011

Diagnosis	Frequency	Percentage
Pulp gangrene	540	26.7
Pulp necrosis	178	8.8
Impacted	130	6.4
Radices	123	6.1
Periodontitis	117	5.8
Pulpitis	43	2.1
Pericoronitis	31	1.5
Vital tooth-orthodontic treatment	28	1.4
Irreversible pulpitis	24	1.2
Abscess	22	1.1
Diagnosis not mentioned	411	20.3
Others	176	8.7
<b>Total</b>	<b>2024</b>	<b>100</b>

Figure 1 summarizes the numbers of outpatient visits and antibiotics prescriptions in each month during 2011, showing a marked increase during September through November. Figure 2 shows the distribution of antibiotics prescriptions according to diagnostic category. There was a

marked increase in “diagnosis not mentioned” during September through November. Figure 3 shows the monthly utilization of various antibiotics measured as DDD/1000 patients. The results are similar to those obtained for percentages of patients receiving an antibiotic. Amoxicillin was consistently the most commonly prescribed antibiotic

throughout the year. Interestingly, we observed a marked increase of antibiotics use in September through November, followed by a marked decline in December. Figure 4 shows the numbers of patients according to age group. The increase of antibiotics use during September through November was mainly due to patients in the age range of 18-28.

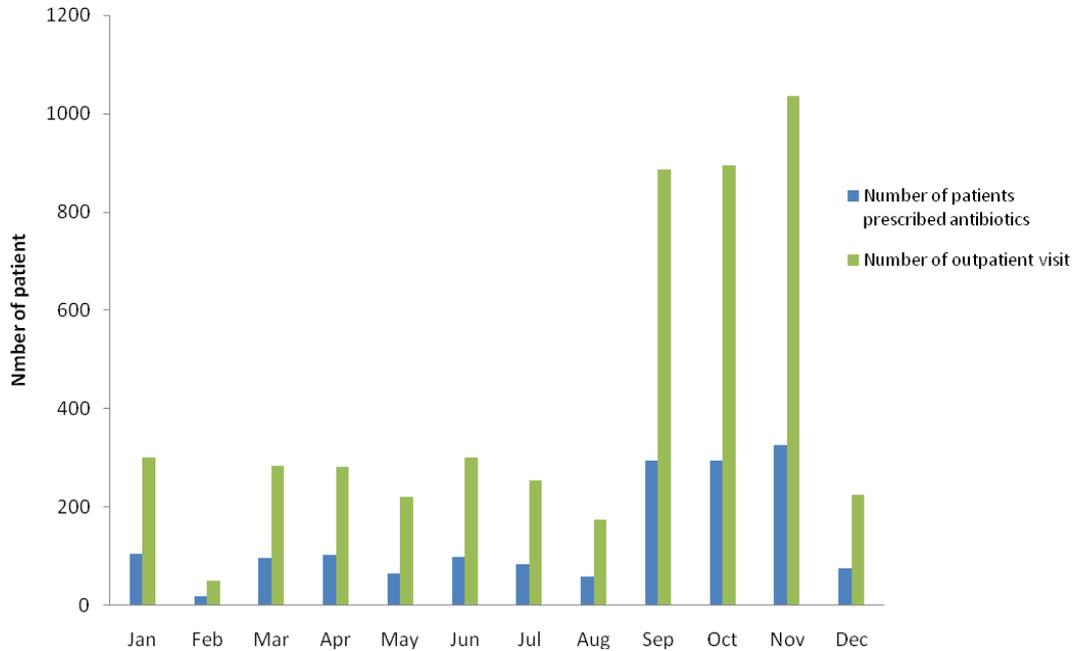


Fig. 1. Numbers of outpatient visits and antibiotics prescriptions in each month during 2011

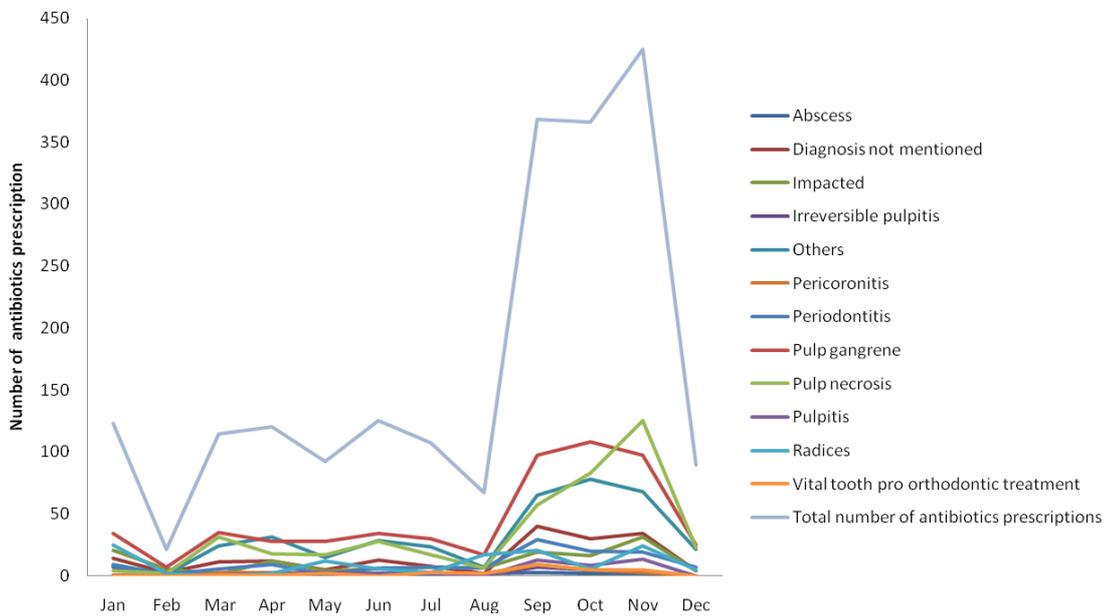


Fig. 2. Distribution of antibiotics prescription in each month according to diagnosis during 2011

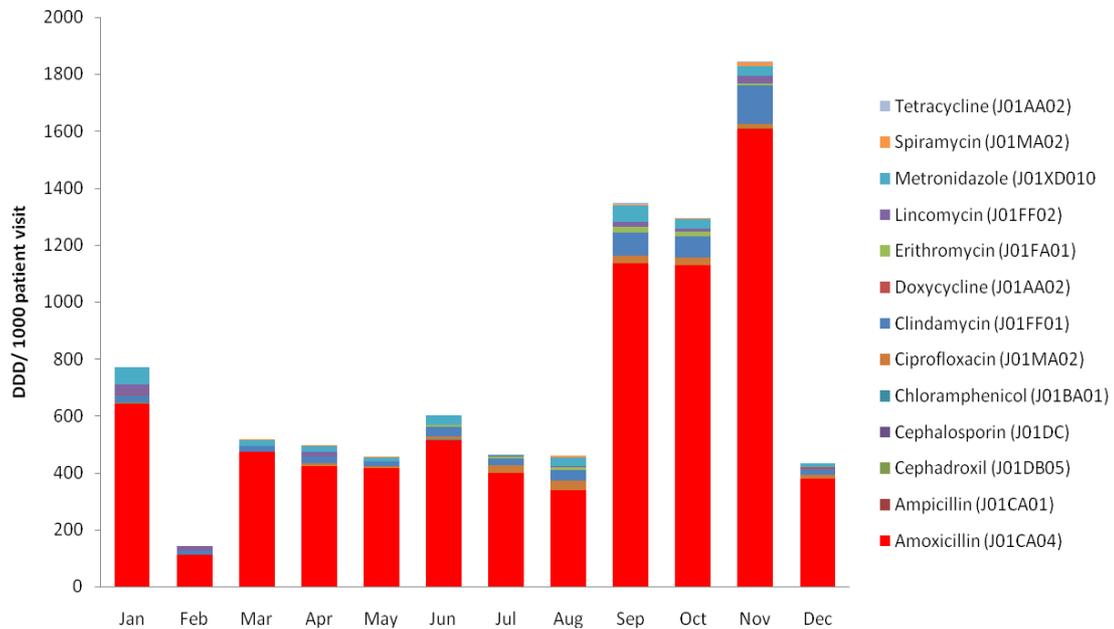


Fig. 3. Utilization of each antibiotic in each month in 2011 (DDD/1000 patient visits)

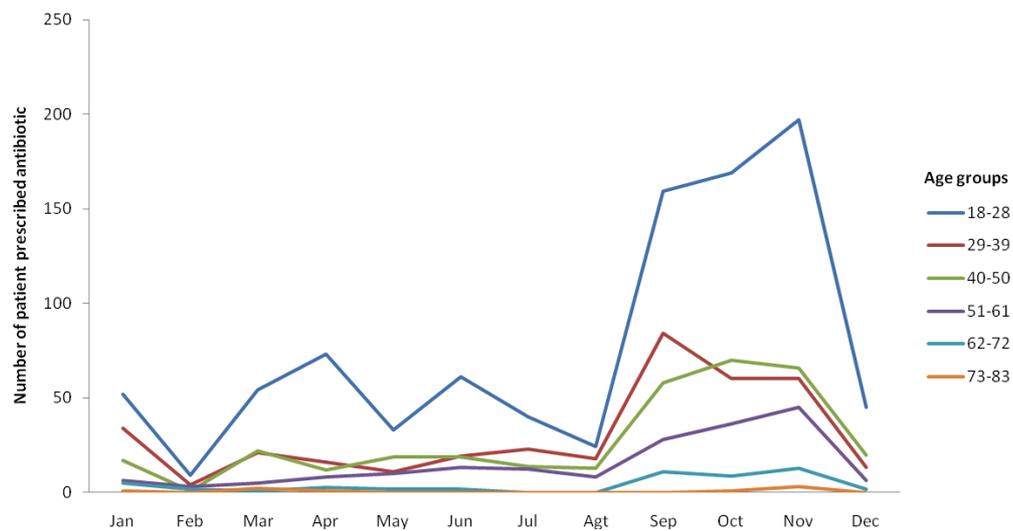


Fig. 4. Numbers of patients prescribed antibiotics in each month of 2011 according to age group

## 4. Discussion

To our knowledge, this is the first comprehensive study of antibiotics use by dental practitioners at a dental teaching hospital in a developing country using the WHO-defined drug-measuring unit DDD (WHO, 2000). Surveillance of antibiotic use at hospitals in developing countries is often difficult because comprehensive databases may not be available and antibiotics prescriptions may not be well documented in medical records.

Antibiotic selection in developing countries is likely to be done on an empirical basis, because facilities for culture and sensitivity testing may not be available. Since the main isolates from dental infections are often complex mixtures of facultative and anaerobic bacteria (Lewis, 1990 and Lewis, 1995), choice of a wide-spectrum antibiotic may be rational.

Indeed, we found that amoxicillin was the most commonly prescribed antibiotic (78.8%), and it appeared to be considered as the drug of choice. Amoxicillin is also the preferred antibiotic by dental practitioners in England and Australia (Palmer, 2000; Jaunay, 2000). It is an effective broad-spectrum agent with low allergenicity, and oral administration affords an effective concentration in gingival cervical fluid (Tenenbaum, 1997).

Clindamycin, which came into dental practice in the 1990s (Bilij, 1994) was the second most prescribed antibiotic (9.9%). For a long time it was used in the prophylaxis of infectious endocarditis (IE), mainly in patients with verified penicillin allergy (Pipalova et al., 2014), and there is considerable clinical evidence of its efficacy and safety in the management of dental infections (Brook, 2005). However, The Dental Practitioners'

Formulary (DPF) recommends that clindamycin should not be used routinely for the treatment of dental infections (DPF, 2002). Nevertheless, our survey shows that clindamycin was frequently prescribed in this dental hospital for the management of dentoalveolar infections.

Metronidazole (ATC code J01XD01) was the third most commonly prescribed antibiotic in the present study (5.0%) and has been reported as the second most commonly prescribed agent by dentists elsewhere (Palmer, 2000 and Roy, 2000). It is considered the first choice treatment for anaerobic infections, as frequently encountered in perioronitis and gingivitis.

For outpatients with penicillin-derivative allergies, erythromycin (0.9%) was the commonest alternative, followed by cephalosporin (0.1%). Some mild dental infections can be effectively managed with erythromycin (Palmer, 2000).

In our survey, we identified 122 diagnoses for which antibiotics were prescribed, of which the most common was pulp gangrene (26.7%). However, there is a lack of evidence for the efficacy of antibiotic treatment of pulp gangrene, as well as other conditions such as irreversible pulpitis (1.2%). Systemic antibiotics should only be used in acute cases where drainage and or debridement intervention is impossible, and where local spread of infection has occurred (Addy and Martin, 2003).

Although pulp gangrene, pulp necrosis, and impaction-related problems can usually be managed by surgical intervention, such as dental extraction or odontectomy, and systemic antibiotics have no significant additional benefit (Dar-Odeh et al., 2010), we found many cases of antibiotics prescribing for pulp gangrene (26.7% of total prescriptions), pulp necrosis (8.8%), and impaction-related conditions (6.4%). Such inappropriate use of antibiotics may be justified on a "just-in-case" basis to prevent postoperative infection due to poor aseptic clinical technique or improperly sterilized equipment following surgical dental management (Salako et al., 2004; Al-Haroni and Skaug, 2006). On the other hand, pericoronitis (1.5% of total prescriptions) may involve heavily infected pericoronal pouches (Reebye et al., 2002) that require local intervention and systemic antibiotic treatment.

Interestingly, we found a large increase in antibiotics prescribing during September to November in this dental hospital (figure 1). This period corresponds to the rainy season. However, as shown in figure 4, the increase was largely accounted for by patients in the age range of 18-28, and may reflect the influx of new university students with university-issued insurance for the new semester. As shown in figure 2, the most common diagnosis during this period was pulp gangrene, followed by pulp necrosis. These diagnoses generally require only operative measures such as restoration, root canal treatment, or extraction (Dar-Odeh, 2010). Since the vast majority of dental infections are bacterial and self-limiting, it seems likely that dental practitioners were inappropriately prescribing antibiotics for these conditions. The subsequent decline in antibiotics prescribing during

December, concomitantly with the declining number of outpatients, coincides with the examination period at this university hospital, where many patients are university students (informal conversation, 2013).

This is the first antibiotic utilization study in dental teaching hospital in Indonesia. The results of this study are broadly consistent with the limited data available from other developing countries, and suggest common issues such as inadequate access to information on current best practice and a need for further training among dental practitioners (Al-Mubarak et al., 2004; Dar-Odeh et al., 2008; Farzeen, 2011). Medical history record-taking has also been mentioned as problematic (Murti and Morse, 2007). This was also the case in our survey, as attested by the high percentage of examples in the 'not mentioned' information category.

Overall, our results suggest a need for systematic continuing education for dental practitioners and improved access to current information concerning international best practice. In addition, it would be desirable to develop local guidelines for rational use of antibiotics, both to reduce the burden on patients and to limit the development of bacterial resistance. Improvements in the collection, management, and maintenance of data would also be helpful for monitoring changes in trends of antibiotics prescribing.

## 5. Conclusion

Our study showed is the first to evaluate the prescribing pattern and usage of antibiotics in an Indonesian dental teaching hospital. Our results indicate a high level of inappropriate prescribing, probably due in part to poor availability of culture and testing facilities to identify common pathogens and evaluate their sensitivity to antibacterial agents. There is a clear perceived need for educational initiatives to promote best practice and appropriate use of antibiotics, as well as for the development of proper prescribing guidelines for antibiotics in relation to dental diagnosis. Improved data collection and management would also be helpful for monitoring changes in trends of antibiotics prescribing.

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