

Antibiotic prophylaxis for dental procedures: current practise amongst South African dentists.

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A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Science in Dentistry

DECLARATION

I, Wei-Hsuan Huang, declare that this research report is my own work. It is being submitted for the degree of Master of Science in Dentistry in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any other degree or examination at this or any other University.

A handwritten signature in black ink, appearing to read 'Wei-Hsuan Huang', is written over a horizontal dotted line. The signature is stylized and cursive.

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22nd day of February 2012

Abstract

Purpose

Guidelines regarding the prevention of infective endocarditis have been published by the American Heart Association (AHA) in 2007 and the National Institute for Health and Clinical Excellence, UK, (NICE) in 2008. These are contradictory, even though both are from developed countries. It is not known whether they are suitable for developing countries such as South Africa, nor is it known whether they are followed by general dental practitioners. The aim of the study was therefore to conduct a survey amongst dental practitioners in South Africa to determine knowledge of the guidelines and practises followed in antibiotic prophylaxis.

Method

Emails were sent to dentists registered with South African Dental Association requesting their participation in an internet-based survey. The survey was to record some demographic features of the respondents; their awareness/knowledge of the AHA and NICE guidelines; their prescribing practises for antibiotic prophylaxis; and their opinions on which conditions required coverage, which dental procedures were considered invasive, and how they would wish to receive updated information.

Results

The limited response rate necessitated the pooling of the data, but it was felt that the data would be valuable if some trends emerged and if they highlighted the need for conformity to guidelines or indeed if guidelines were even necessary. One hundred and four respondents completed the survey. It was encouraging that most (88%) were aware of the AHA guidelines, but only 55% knew of the NICE guidelines. However, few actually followed the recommendations for antibiotic prophylaxis, and few correctly prescribed for patients allergic to penicillin. The large number of cases of rheumatic fever in this country implies that the risk of contracting infective endocarditis may be greater than in developed countries and that the NICE guidelines, which advocate no antibiotic prophylaxis except for a few specified conditions, may not be appropriate.

Conclusion

Despite the low sample size, the trends shown are of real concern. There is clearly a need for local guidelines, and once these are established, there is an urgent need to inform all dental practitioners of the appropriate prescription of prophylaxis for patients.

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ANTIBIOTIC PROPHYLAXIS FOR DENTAL PROCEDURES: CURRENT PRACTISE AMONGST SOUTH AFRICAN DENTISTS.

CHAPTER 1. INTRODUCTION

There are several conditions for which antibiotic prophylaxis has been advocated prior to invasive dental procedures. For example, infective endocarditis can occur when bacteria (*Streptococci*, *Staphylococcus aureus* and *Enterococci* are important causative organisms) enter the bloodstream during an interventional procedure and mix with matrix molecules and platelets at the sites of endocardial cell damage, causing an inflammation of the heart valves as well as of the endocardium (Wilson, Taubert and Gewitz et al 2007, NICE 2008).

In industrialised countries, valvular disease is often degenerative in origin but in developing Africa, it is most commonly the result of infectious disease – directly as infective endocarditis or indirectly as acute rheumatic fever (Essop and Nkomo 2005). Recommendations for the prevention of infective endocarditis have been issued for the last 50 years by the American Heart Association (Wilson et al 2008). Infective endocarditis is a life threatening and uncommon infection that has an annual incidence of fewer than 10 per 100,000 cases in the populations of industrialised countries where such studies have been done. Despite the advances in modern medicine, a high morbidity and mortality still surrounds this condition (NICE 2008). In a study in the Western Cape, South Africa, there was a 6 month mortality rate of 35.6% of patients who were referred to hospitals with definite infective endocarditis (Koegelenberg et al 2003).

1.1 Infective Endocarditis

Infective endocarditis (IE) is reported as a degenerative disease of the elderly. In developed countries before the era of antibiotics it was mainly a disease of young adults with rheumatic heart disease (RHD) as the major cause. Mitral valve prolapse, intravenous drug use, preceding valve replacement and vascular instrumentation have now become the main factors leading to infective heart disease as reported by developed countries. This shift in the face of IE has mainly been attributed to the decrease of RHD with the use of antibiotics; an increase in the numbers of prostheses placed intravascularly; medical advancements leading to improved diagnostic abilities; and increased survival of patients with degenerative and congenital heart disease (Koegelenberg et al 2003).

The pathophysiological process of IE is a sequence of events whereby bacteria enter the circulation during invasive procedures (such as dental extraction), causing a transient bacteraemia. Bacteria circulating in the body adhere to damaged cardiac endothelium. The damaged endothelium incites a platelet plug formation as part of the coagulation process to which further bacteria attach. This nidus of bacteria, damaged endothelium and coagulum is called the “vegetation” and it can dislodge and flow to any part of the body to cause an embolism in any organ in the body. The vegetation can also cause a local abscess on the cardiac tissues, causing extensive damage.

The definitive diagnosis of IE is made by positive blood cultures and the application of diagnostic criteria. Patients who present with cardiac murmurs and high fever are suspected of IE. The previous diagnostic criteria were the Reyn criteria; the currently accepted clinical guideline is now the Modified Duke criteria: the original Duke criteria were improved by Lamas and Eykyn in 1997 (Prendergast 2006). Echocardiographs are an important diagnostic tool in the Modified Duke criteria to test for endocardial involvement. Blood cultures are also used to identify the specific causative organism in order to treat the infection swiftly and accurately without increasing

resistance from inadequate antibiotic therapy. There are 3 sets of diagnostic criteria and 4 alternatives:

1. Pathological criteria –microorganisms and active endocarditis can be seen on histological cultures
2. Major criteria – includes blood cultures and evidence of endocardial involvement
3. Minor criteria – includes a susceptible history which predisposes to IE.

For a definitive diagnosis, one of the 4 listed alternatives has to be positive:

- Pathological criteria positive
- 2 major criteria positive
- 1 major and 2 minor criteria positive
- 5 minor criteria positive

If there is no histological evidence and the infection resolves with antibiotic therapy in less than four days, IE is not suspected (Prendergast 2006).

Between 1997 and 2000, Koegelenberg et al reported that at Tygerberg Academic Hospital, South Africa, the mean age of patients with IE was 37.7 years with a predominance of males. The mean age of these patients was not only significantly younger than the developed world but also had a higher mortality rate. More than 72% of patients with definitive IE were tested positive for RHD, by far the highest predisposing factor in these patients. This is in stark contrast to developed countries where RHD is now not even a common risk factor. The authors also credit the pattern of IE to low socioeconomics and poor oral care (Keogelenberg et al 2003). In developing countries, there has been little change compared with developed countries.

1.2 Rheumatic Heart Disease

Acute rheumatic fever (RF) is caused by certain strains of group A β -haemolytic streptococci. The antigen of the streptococci has a destructive reaction with human tissue, most notably the cardiac tissue – causing severe refractory heart failure known as rheumatic heart disease (RHD). Patients with a previous history of streptococcal infection have a higher risk of developing rheumatic fever, which is diagnosed using the modified Jones criteria during the first attack (Cilliers 2006) (Table 1).

Table 1. Modified Jones criteria for diagnosis of acute rheumatic fever, updated 1992 (after Cilliers 2006)

Major criteria
Carditis, polyarthritis, subcutaneous nodules, erythema marginatum, chorea
Minor criteria
Prolonged PR interval on electrocardiogram, arthralgia, fever, acute phase reactants (raised erythrocyte sedimentation rate or raised C reactive protein levels)
Plus supporting evidence of a preceding streptococcal infection for both major and minor criteria

A prompt diagnosis with adequate treatment of group A β -haemolytic streptococcal tonsillopharyngitis is essential as a sore throat could be followed by acute rheumatic fever, a sequence that is commonly ignored. The secondary prevention of rheumatic fever is continuous antimicrobial prophylaxis along with treatment of the streptococcal pharyngitis. The secondary prevention is the key to prevent recurrent episodes of RF (Gerber et al 2009). With such stringent regimens of antibiotic cover, antibiotic resistance can easily occur, especially in areas with poor medical care.

With only 10% of the world's population, Africa is home to half of the world's children suffering from RHD (Sani, Karaye and Borodo, 2007). Sub-Saharan school children have a 5.7 per 1,000 prevalence of RHD, the highest in the world, followed by indigenous people from Australia and New Zealand and south central Asia (Cilliers 2006). This shows that RHD is not only a disease of developing countries but also of disadvantaged communities in industrialised countries.

In a study conducted in Addis Ababa, Ethiopia (Oli and Asmera 2004), of the 457 cardiovascular deaths (which also included cerebrovascular accidents), 26.5% of the mortality rate was attributed to RHD. Congestive heart failure caused up to 70% of deaths of these. These figures are startling as the mean age was younger and the prevalence of RHD higher than that of industrialised countries presently. Interestingly, the figures are similar to the era predating the use of antibiotic prophylaxis.

In Nigeria, another study used echocardiography in the detection of RHD amongst locals and reported 9.8% of patients had RHD (Sani et al 2007). Patients with RHD showed common complications of pulmonary hypertension, valvular cardiomyopathy and functional tricuspid regurgitation. Essien et al (2008) also examined patients with RHD in Nigeria and determined that RHD was still primarily a disease of the mitral valve.

A study of rheumatic valvulopathies in Shishong Hosiptal, Cameroon, showed that of the abnormal echocardiograph readings studied, 64.5% showed a diagnosis of RHD. Complications of RHD in Cameroon included pulmonary hypertension, valvular cardiomyopathy and functional tricuspid regurgitation, similar to that of RHD complications in Nigeria. The researchers concluded that children who present with pre-cordial murmurs should alert practitioners to possible RHD in rural Cameroon (Tantchou Tchoumi and Butera 2009).

In South African, only two studies have been published regarding the prevalence of RHD. The first study was conducted in Soweto in 1972 and reported an RHD prevalence rate of 7.1 per 1,000 schoolchildren. The second was in Inanda (Durban) in 1984 which reported a prevalence rate of 1.0 per 1,000 schoolchildren (Robertson, Volmink and Mayosi 2006). In 1973, the top 10 causes of mortality in young adults (age 15-24 years) included RF and RHD.

Clur (2006) published a study carried out in 1995 documenting the frequency of RF/RHD in patients from different provinces in South Africa who presented at three of the teaching hospitals of the University of the Witwatersrand. At the time of the study in 1995, poverty was rife amongst the rural populations. The provinces with the highest reported frequency of RF/RHD were KwaZulu-Natal, Mpumalanga and the Northern Cape. These provinces had the highest concentration of rural population of the patients presenting at the hospitals. Gauteng province had a lower than expected frequency and severity of RF/RHD. This may be due to the improved standard of care and accessibility of medical facilities as Gauteng is the economical hub of the country. These figures may no longer be valid as South Africa has gone through significant political and economic changes since then and for some, the standard of living has relatively increased with better medical care for the general population.

With such high figures of RHD reported in developing countries, some researchers believe that a primary prophylaxis implemented to prevent rheumatic fever and rheumatic heart disease would be a feasible option (Karthikeyan and Mayosi 2009). This suggestion is strengthened by the Cuban experience in which between 1986 and 1996, Cuban health officials conducted several campaigns to combat and prevent RHD. The results of these campaigns were analysed and showed a significant reduction of RHD from 2.27 per 1,000 children in 1986 to 0.24 per 1,000 in 1996. More impressive was the decline of recurrent attacks of rheumatic figure, measuring 0.4 patients per 100,000 compared with 6.4 patients per 100,000 before the programme was implemented. The researchers claimed that the campaigning was still within acceptable cost to health care funding (Nordet et al 2008).

Rheumatic heart disease was previously the most common underlying condition predisposing to infective endocarditis. In developed countries, RHD afflicts the older population but the incidence has decreased significantly. In developing countries, the incidence is still very high and affects the younger population, especially schoolchildren (Wilson et al 2008). The annual incidence of rheumatic heart disease in developed countries is 1 to 2 per 100,000 whereas in developing countries, the figure is as high as 100 per 100,000 (Nkgudi et al 2005). In contrast to developing countries, the incidence of RHD in developed countries has declined to an insignificant amount, and mitral valve prolapse is now the most common predisposing factor (Wilson et al 2008). Consequently, in developed countries, rheumatic heart disease does not appear on the AHA guideline as a cardiac condition warranting antibiotic coverage. In Africa, RF still has a high incidence amongst the general population (Essop and Nkomo 2005) and so such guidelines may be inappropriate.

However in developing countries including South Africa, where the prevalence of rheumatic heart disease remains high, no local guidelines exist. The World Health Organization (WHO) in 2001 estimated from surveys of school-going children that the prevalence of chronic rheumatic heart disease varied from 2.7 per 1,000 in Nairobi to 14.3 per 1,000 in Kinshasa (Essop and Nkomo 2005). Koegelenberg et al (2003) in their 3 year prospective study on infective endocarditis in the Western Cape, reported that of the definite endocarditis cases, rheumatic heart disease was the leading predisposing factor and was present in 72% of those patients. In light of this evidence from the African continent, the guidelines published by the AHA and NICE may not be applicable.

In 2004, the World Health Organization (WHO) published a guideline on the prevention of RF and RHD. In response to this publication, leading African medical experts gathered at the first All Africa Workshop on Rheumatic Fever and Rheumatic Heart Disease in South Africa in 2005. The results of this gathering produced the Drakensberg Declaration on the Control of Rheumatic Fever

and Rheumatic Heart Disease in Africa which proposed the ‘ASAP Programme’ , the name of which is derived from its aims to “*increase Awareness of RF/RHD among the general public and practitoners , the establishment of Surveillance programmes to measure of the burden of disease in the population; Advocacy to increase allocation of resources for the treatment of affected children and young adults; and the implementation of primary and secondary Prevention schemes in all countries of Africa*” (Mayosi 2006).

1.3 New Guidelines for antibiotic prophylaxis

Recent literature has reported a change in the standard of care regarding antibiotic prophylaxis as a result of data and research published by developed nations. New guidelines for the antibiotic prophylaxis of bacterial endocarditis were published by both the American Heart Association (AHA) and the United Kingdom’s National Institute for Health and Clinical Excellence (NICE) in 2007 and 2008 respectively. The Journal of the American Dental Association has re-published these with reference to dentistry (Wilson et al 2008). Many papers have since been published regarding these guidelines and their implementation, as they appear to be contradictory (Wray et al 2008; Daly et al 2008; Kim and Keys 2008; Oliver et al 2008; Shovlin, Bamford and Wray 2008; van der Bijl 2008; Lockhart et al 2007). Health practitioners should be made aware of these controversies so they can make informed decisions, especially if there are local conditions which may influence the choice of guidelines.

1.3.1 The AHA guidelines

The previous AHA guidelines categorised the risk of infective endocarditis in the presence of underlying cardiac conditions. These conditions were placed under three categories: high risk, moderate risk and negligible risk. Antibiotic prophylaxis was recommended for high and moderate risk categories. In 2007, increasing evidence prompted a revised edition of infective endocarditis prophylaxis guidelines which was published in ‘Circulation’, the Journal of the AHA. The principal reasons stated for the revised guidelines were:

- Infective endocarditis is much more likely to result from frequent exposure to random bacteraemias associated with daily activities than from bacteraemia caused by a dental, gastrointestinal (GI) tract or genitourinary (GU) tract procedure
- Prophylaxis may prevent only an exceedingly small number of cases of infective endocarditis, if any, in people who undergo a dental, GI tract or GU tract procedure
- The risk of antibiotic-associated adverse events exceeds the benefit, if any, from prophylactic antibiotic therapy
- Maintenance of optimal oral health and hygiene may reduce the incidence of bacteraemia from daily activities and is more important than prophylactic antibiotics for a dental procedure to reduce the risk of infective endocarditis

The 2007 AHA guidelines recommended that patients with the following cardiac conditions should be covered with antibiotic prophylaxis prior to invasive dental surgery:

- Prosthetic cardiac valve or prosthetic material used for cardiac valve repair;
- Previous infective endocarditis;
- Congenital heart disease including
 - Unrepaired cyanotic congenital heart disease
 - Palliative shunts and conduits
 - Completely repaired congenital heart defect with prosthetic material or device, whether placed by surgery or by catheter intervention during the first six months after the procedure
 - Repaired congenital heart disease with residual defects at the site or adjacent to the site of a prosthetic patch or prosthetic device
- Cardiac transplantation recipients who develop cardiac valvulopathy
- The abovementioned conditions with a previous episode of infective endocarditis

An increased lifetime risk of acquiring infective endocarditis was the sole basis on which the previous AHA guidelines recommended prophylaxis. The new guidelines made a departure from

this belief. Although antibiotic prophylaxis is recommended, the AHA admits there is still inconclusive evidence as to its efficacy prior to invasive surgery in the prevention of infective endocarditis associated with bacteraemia. The AHA recognises that although a small number of cases could be prevented by prophylaxis, only patients categorised in the highest risk category should receive antibiotic coverage for invasive surgery. Certain dental treatments are considered to be invasive surgery by the AHA, but the AHA acknowledges that the direct effect of antibiotic prophylaxis on the reduction of the incidence of infective endocarditis is still unknown (Wilson et al 2008).

The recommended dosage of antibiotic cover has remained unchanged since 1997 at 2g amoxicillin one hour before elective invasive surgery or 600 mg Clindamycin if the patient has penicillin hypersensitivity (Wilson et al 2008). Invasive procedures were defined as all dental procedures that would cause an influx of oral bacteria into the bloodstream via the manipulation of gingival tissue or the periapical region of teeth or perforation of the oral mucosa (Wilson et al 2008).

1.3.2 The NICE guidelines

The NICE guidelines now recommend that antibiotic prophylaxis coverage against infective endocarditis is not required for any patients undergoing dental procedures although it still recognises groups of patients at risk. NICE recommends the following cardiac conditions as being at risk of developing infective endocarditis (NICE 2008):

- Acquired valvular heart disease with stenosis or regurgitation
- Valve replacement
- Structural congenital heart disease, including surgically corrected or palliated structural conditions, but excluding isolated atrial septal defect, fully repaired ventricular septal defect or fully repaired patent ductus arteriosus, and closure devices that are judged to be endothelialised

- Previous infective endocarditis
- Hypertrophic cardiomyopathy

The traditional method was to prescribe antibiotic prophylaxis to patients prior to invasive surgery because the resulting bacteraemia causing organisms were assumed to be sensitive to antibiotics and therefore antibiotic coverage would prevent infective endocarditis (Durack 1995). The objectives in order for a prophylaxis to be effective include: identification of patients at risk, identification of the procedures that are liable to provoke bacteraemia, and choice of a suitable regimen. There should also be “a favourable balance between the risk of side-effects from prophylaxis and development of the disease” (Moreillon and Que, 2004). NICE states that many researchers consider this assumption not to be proven (Prendergast 2006, NICE 2008). Fatal anaphylaxis caused by an adverse reaction to antibiotics may be more detrimental than a strategy of no antibiotic prophylaxis, which is also more cost effective. Furthermore, there appears to be a lack of consistent association between invasive surgery, dental or non-dental, and the development of infective endocarditis. In a hygiene-compromised mouth, regular tooth brushing may cause a greater and more frequent bacteraemia than from a single invasive dental procedure. NICE also recommends that chlorhexidine mouth wash should not be given to patients as a prophylaxis against infective endocarditis prior to dental surgery as there was no evidence to determine whether or not chlorhexidine mouthwash reduced the risk (NICE 2008).

Both AHA and NICE have admitted that there is no concrete evidence that antibiotic cover is directly linked to the prevention of infective endocarditis although the AHA believes that prevention, although slight, may still save lives. However, antibiotic adverse effects may outweigh the potential inconclusive benefits (NICE 2008). Some adverse effects include emerging antibiotic resistance and hypersensitivity. The unnecessary costs incurred by prescribing unnecessary antibiotics can also be eliminated (Oliver et al 2008).

1.4 The Efficacy of Antibiotics

The prevalence of rheumatic heart disease in developed countries has decreased drastically since the antibiotic era (Koegelenberg et al 2003). Conversely, since the first clinical suggestion of the use of antibiotics prior to dental procedures during the 1950s by the American Heart Association, the figures for IE have not significantly changed.

Hypersensitivity is the main adverse effect of penicillin, not always in the form of an anaphylactic reaction: skin irritations are also a mild form with as many as 1 in 5 people suffering from these reactions. Antibiotic prophylaxis makes up a small portion of deaths caused by fatal anaphylactic reaction. The number of deaths caused by antibiotic prophylaxis reaction is 5 times higher than that caused by infective endocarditis from invasive dentistry (Seymore et al 2000). Due to the callous prescription of antibiotics by medical and dental personnel, common antibiotics are now often too weak for virulent strains of bacteria, and this is a problem in all populations, regardless of the socioeconomic situation in developed countries (Seymore et al 2000). Dentists are also often unsure of which cardiac conditions would warrant antibiotic prophylaxis due to previous ambiguous publications of IE prevention guidelines, in which conditions were categorised in accordance with risk level, also leading to over-prescription of prophylaxis.

1.5 Prophylactic antibiotics and conditions other than IE

There are other conditions for which antibiotic prophylaxis has been advocated in the literature, those that are not covered by the NICE or AHA guidelines, which focus only on infective endocarditis. Such conditions include:-

- Pulmonary arteriovenous malformations
- Hereditary haemorrhagic telangiectasia (HHT)
- Rheumatoid arthritis (RA)
- Systemic lupus erythematosus (SLE)
- Patients with coronary artery stents
- Diabetes mellitus (DM)
- End-stage renal disease
- Patients with total joint replacements
- Immuno-compromised patients

1.5.1 Hereditary arteriovenous malformations and pulmonary arteriovenous malformations

Hereditary haemorrhagic telangiectasia (HHT) is a disorder of the fibrovascular tissue. It is a condition that manifests with nose bleeds, gastro-intestinal bleeds, mucocutaneous telangiectasia and arteriovenous malformations (AVM) of the lungs, brain, skin, liver and gastrointestinal tract. HHT is an insufficiently publicised condition. It is an autosomal dominant trait and is inherited. The signs and symptoms develop gradually as a person ages: nose bleeds are usually the first symptoms to appear, and 71% of affected individuals show signs by the age of 16. As the age range moves up, by the age of 40, 90% show signs and symptoms.

When HHT was first documented in the 19th century, the condition consisted of nose bleeds, gastro-intestinal bleeding and atypical vascular structures. In the 1940s these vascular malformations included pulmonary, hepatic and cerebral circulations and was brought to attention

by Osler, Weber and Rendu, and thus is commonly referred to as Osler-Weber-Rendu syndrome (Shovlin et al 2008).

A definite diagnosis of HHT would include three of the four criteria (Shovlin et al 2008):

1. Spontaneous, recurrent nose bleeds
2. Mucocutaneous telangiectasia
3. Visceral involvement
4. Affected primary relative

The most significant clinical feature to the dental profession is AVMs of the lungs. In cases of pulmonary AVMs, there is an abnormal right-to-left shunt and normal vessels in the lungs are replaced by thin-walled vessels. Blood is unable to receive adequate oxygen and is also not able to filter sufficiently which is likely to prolong the length of bacteraemia in patients suffering with pulmonary AVMs. Due to the nature of these thin-walled vessels, haemorrhages may also occur. Antibiotic prophylaxis before dental and surgical procedures is advised as some clinically silent pulmonary AVMs commonly cause neurological sequelae and increase the risk of brain abscesses. Unlike many conditions which have no specific identifiable source of infection, the organisms found in brain abscess aspirates are strongly linked to those of the oral flora, specifically bacteria found in patients with periodontal disease. Involvement of the lungs and brain is a leading cause of death in young patients from these brain abscesses and strokes. When the ADA and NICE published guidelines for the prevention of IE, HHT was not considered as patients suffer from risk of brain abscess formation rather than IE. The antibiotic prophylaxis recommended for adult patients with HHT as suggested by the UK National Health Service (NHS) is a single dose of amoxicillin 3g by mouth 1 hour before the procedure. Children under 5 years take a quarter of the adult dose and children from 5-10 years require half the adult dose (Shovlin et al 2008). Shovlin et al (2008) have suggested the use of co-amoxycylav to include gram negative and anaerobic bacteria, as amoxycillin has a higher rate of resistance with a less broad spectrum coverage.

1.5.2 Rheumatoid arthritis

Rheumatoid arthritis (RA) is a 'chronic multisystem disease of presumed autoimmune aetiology'. The aetiology is presumed to be multifactorial with genetic, endocrine, infectious and immune participation. The distinctive features of RA are bilateral and symmetric chronic inflammation of the synovium (Treister and Glick 1999).

When a patient suffers from RA, T-cells infiltrate the synovial membrane of the joint. An immune response is provoked by the T-cells in the joint space which eventually causes inflammation, tissue damage and bone resorption. Malaise, fever, anaemia and elevated serum acute phase reactants are also signs that manifest in patients suffering with RA (Dinarello 1988).

Eighty percent of patients first develop signs of RA from 35 to 50 years of age. Within the first two years of the disease, radiographic signs of damage to the joint are evident in more the half the patients. This number increases to 70% of patients within three years (Fuchs et al 1989; Van der Heijde et al 1995). Women are more frequently affected and diagnosed with RA than men and within 10 years, more than half the patients are unable to sustain a job due to the debilitation of function from the disease (Yelin, Henke and Epstein 1987).

Oral manifestations of patients suffering with RA include stomatitis and gingival hyperplasia (as side effects of medicaments); temporomandibular joint dysfunction (caused by the disease itself); secondary Sjögren's syndrome; and periodontal involvement. Dentists treating such patients should shorten the appointment time as well as optimise the patient's comfort level with joint support whilst in the chair (Treister and Glick 1999).

In 1997, the American Dental Association and the American Orthopaedic Surgeons published guidelines which recommended that antibiotic prophylaxis should be prescribed to patients who

have had total joint replacements and suffer from severe RA. The regimen that was recommended was that of the recommended dosage by the AHA as prophylaxis against infective endocarditis (American Dental Association, American Academy of Orthopedic Surgeons 1997). The new guidelines published by the ADA, however, have since excluded these patients.

1.5.3 Systemic lupus erythematosus

Systemic lupus erythematosus (SLE) is a multisystem disease of unknown aetiology which has both skin and oral manifestations. Although the precise aetiology is unknown, environmental and genetic factors play an important role (Neville et al 2002). There have been several studies published, indicating that patients with SLE have a higher occurrence of cardiovascular abnormalities. The most commonly associated endocardial lesion is Libman-Sacks endocarditis, also known as verrucous endocarditis (Roldan, Shively and Crawford 1996). Other conditions include endocarditis, myocarditis, pericarditis and coronary artery disease secondary to atherosclerosis or arteritis (Lehman et al 1983; Nihoyannopoulos et al 1990; Metz et al 1994).

Libman-Sacks endocarditis impairs heart valves. These heart valves are prone to haemodynamic changes which, combined with reticuloendothelial system and complement pathway abnormalities, render the patient at risk of developing infective endocarditis (Miller et al 1999). Despite this connection, the link between infective endocarditis and patients with SLE is infrequent. Miller et al (1999) suggested that it was 'unclear whether valvulopathy commonly associated with SLE constitutes a significant risk factor for the development of IE'. Figures from other studies regarding the prevalence of IE in patients with SLE range from 1-4% (Lehman et al 1983; Zysset et al 1987; De Rossi and Glick 1998). Miller et al (1999) reported a 0% prevalence of IE in SLE patients in 1999. The primary concern for patients with SLE is that 50% of patients have some form of cardiac involvement.

In 1997, the American Heart Association still advocated that patients with SLE and known valvular abnormalities be classified under high- or moderate-risk categories and patients should thus receive antibiotic prophylaxis prior to invasive dental treatment (Dajani et al 1997). The aim of antibiotic prophylaxis for patients with SLE is therefore the prevention of IE. Although the AHA and Lupus Foundation of America recommended antibiotic prophylaxis the ADA found little evidence to support both this (Lockhart et al 2007). Consequently, the new guidelines published by the ADA now do not include patients who suffer from SLE.

1.5.4 Patients with Coronary Stents

Roberts and Redding (2000) suggested that dentists should consult with a patient's physician and or cardiologist during the first 30 days after placement of a coronary stent although there is little evidence to support the need for antibiotic prophylaxis cover. The AHA also does not recommend the use of antibiotic coverage for these patients.

1.5.5 Diabetes Mellitus

Some experts and articles advocate the use of antibiotic prophylaxis as diabetics are predisposed to endocarditis during infections. However, the ADA has found low scientific evidence to support this (Lockhart et al 2007).

1.5.6 End Stage Renal Disease

Tubular and interstitial nephropathies, chronic glomerulonephropathies, nephroangiosclerosis, polycystosis and diabetic nephropathy are all common causes of renal failure which lead to end-stage renal disease. Haemodialysis is the treatment for patients with end-stage renal disease (ESRD). Nosocomial organisms are constantly being introduced into the bloodstream during dialysis. Due to the constant exposure to these organisms, there is a higher incidence of infective endocarditis in the patients. The most common organism that causes IE in patients who are on dialysis is *Staphylococcus aureus* which is also one of the most common causative organisms in IE

not related to ESRD. Dialysis patients with IE also have a higher morbidity and mortality rate due to the associated co-morbidities and the fragile state of their immune response. The *Staphylococcus* species that infect dialysis equipment are also more resistant and virulent to conventional *Staphylococcus* treatment and thus also increase the mortality rate.

Patients who are on haemodialysis are 50 times more likely to be infected with IE than the general population as reported for industrialised countries, the incidence of IE in patients who are on haemodialysis is as high as 308 per 100,000 as reported by Abbott and Agodoa (2002). In 2009, Rekik et al published a study that was the largest in Africa albeit with a small sample size regarding IE in ESRD patients. From this study, of the 182 patients admitted for IE at Hedi Chaker University Hospital of Sfax, Tunisia, 8.8% were on haemodialysis treatment. The causative organism for 68.7% of the IE cases was *Staphylococcus aureus*.

There was no consensus in the literature regarding patients with peritoneal dialysis catheters and haemodialysis shunts. The literature that has been published encouraging antibiotic prophylaxis has mainly been based on textbooks and professional opinions (Lockhart et al 2007). Both the AHA and NICE do not indicate patients with ESRD should require antibiotic prophylaxis treatment prior to invasive procedures.

1.5.7 Patients with Joint Replacements

Post-operative infections associated with prosthetic surgery were classified as ‘late’ and ‘early’ infections in the late 1950s and early 1960s. During that period, the prevalence of infections associated with prosthetic joint surgery was 15-25% post-operatively. Wound infection was thought to be the cause of early infection within the first 2 months post-surgery. Late infections, appearing later than 2months, were thought to be caused by haematogenous spread. Post-operative infections were reduced to about 1% after the habitual prescription of antibiotic prophylaxis to patients before joint replacement surgery (Suzarman and Young 1989). From this finding, wound

contamination is thought to be the main cause of late wound infection rather than haematogenous spread.

Oral causes of hip and joint infections have consistently been found to have a minimal relationship (Thyne and Ferguson 1991; Ainscow and Denham 1984; Ching et al 1989; Jacobson et al 1986). Those which do have dental causes showed a recent history of dental infections. It can thus be concluded that optimal oral health is recommended prior to joint replacement surgery. In a study of 180 late joint infections, antibiotic prophylaxis prior to invasive dental procedures failed to prevent joint infections (Maderazo, Judson and Pasternek 1988). Insignificant isolation of dental related organisms from infected joints have been reported in episodes of late joint infections (Ainscow and Denham 1984; Ching et al 1989; Maderazo et al 1988). It can thus be suggested that the efficacy of antibiotic prophylaxis prior to dental treatment in a joint replacement cannot guarantee protection.

Seymour et al (2000) has calculated the cost analysis of prescribing two types of antibiotic prophylaxis (amoxicillin and cephalexin) prior to dental treatment along with no prophylaxis for all patients with prosthetic joints. Prophylaxis of amoxicillin to dental patients with joint prostheses would be almost three times more costly and cephalexin would be almost six times more expensive than not prescribing antibiotic prophylaxis (Seymour et al 2000). The cost difference is attributed to the prevalence of anaphylactic reactions to antibiotics amongst patients. The risk of a reaction to antibiotics was considered far greater than that of joint infections from invasive dental treatment (Jacobson, Schweitzer and Kowalski 1991).

The British Society for Antimicrobial Chemotherapy (BSAC) has recommended that patients who are immuno-suppressed are not as susceptible to bacteraemia from invasive dental procedures as previously believed (BSAC Working Party Report, 1993). Evidence from literature reviews has also established that haematogenous infections are usually the main source of late infections in

patients with joint replacements due to rheumatoid arthritis (Maderazo et al 1988; Poss et al 1984). Seymour et al (2000) have concluded that the case for antibiotic prophylaxis for patients who have had joint replacement therapy is weak and unsubstantiated. There is no evidence from randomised, placebo-controlled studies that have shown its efficacy and it would be more costly to treat patients for adverse reactions to antibiotics. Despite these findings, Rompen et al (2008) still suggested that antibiotic prophylaxis coverage was recommended for the immune-compromised patient with a systemic condition (including those receiving immunosuppressive therapy), for example diabetes patients suffering with dermatological infections as well as ones with immediate and untreated focal infections.

In spite of the lack of evidence regarding antibiotic prophylaxis for patients with prosthetic joints, a large number of orthopaedic surgeons still believe that antibiotic coverage is necessary for these patients. A survey conducted in 2008 in New Zealand revealed that 94% of respondents (specialist orthopaedic surgeons) would prescribe antibiotic prophylaxis for patients with prosthetic joints prior to invasive dental procedures and 90% thought that it was necessary to cover the patient with prophylaxis as long as there was a prosthetic joint present (Tong and Theis 2008).

There is clearly controversy and uncertainty surrounding patients with joint prostheses who require invasive dental therapy and a systematic review should be conducted quite urgently.

1.5.8 Immunocompromised patients

Since the advent of anti-retroviral therapy (ART) or highly active antiretroviral therapy (HAART), the morbidity and mortality of patients suffering with human immunodeficiency virus (HIV) have been on the decrease (Shirlaw et al 2002).

HIV infections do not contribute to an increased risk of infective endocarditis (Ntsekhe and Hakim 2005). Koegenlenberg et al (2003) reported that only 1 out of 92 patients with infective endocarditis was seropositive in their report that examined risk factors for infective endocarditis in the Western Cape.

However, Shirlaw et al in 2002 suggested that 'antibiotic cover prior to oral surgery or periodontal treatment is recommended for patients whose polymorph (PMNL) count drops below $500\mu\text{l}^{-1}$ '. This is also suggested by the guidelines published by the AHA. Shirlaw explained this decision by stating that a drop in neutrophils weakens the defence mechanisms against microbial organisms which would in turn increase bacterial invaders causing an unwanted infection. The authors also admit that there has been no evidence published regarding the link between dental procedures causing bacteraemia and septicaemia amongst patients with HIV.

Immunosuppression secondary to cancer and chemotherapy is also a concern. As with HIV/AIDS, neutropenia is also the main concern in these patients. There is no strong evidence for or against the practice of antibiotic prophylaxis coverage for these patients although it is recommended by the American National Cancer Website (Lockhart et al 2007).

1.5.9 Summary

Table 2. Conditions other than IE for which antibiotic prophylaxis has previously been suggested:

Condition	Need for antibiotic prophylaxis?
Pulmonary arteriovenous malformations	Yes
HHT	Yes
Rheumatoid arthritis	No
Systemic lupus erythematosus	No
Coronary stents	No
Diabetes mellitus	No
End stage renal disease	No *
Patients with joint replacements	No **
Immunocompromised patients	No ***

**There is no consensus in the literature, encouragement of antibiotic prophylaxis use is mainly opinion based. Excluded by AHA and NICE.*

***Lack of evidence but still a practice by certain orthopaedic surgeons. Excluded by AHA and NICE.*

****Antibiotics only recommended for patients whose PMNL count drops below $500\mu\text{l}^{-1}$. Included by AHA.*

CHAPTER 2. AIMS AND OBJECTIVES

AIM

The aim of this research was to investigate the prescribing patterns of a sample of South African dentists when prescribing antibiotics as prophylaxis for dental procedures, as well as their knowledge of any guidelines.

OBJECTIVES

- To carry out a survey of a sample of South African dentists to assess their prescribing practises for antibiotic prophylaxis, as well as their knowledge of such guidelines.
- To ascertain from the respondents their preferred method of receiving such any guidelines and information
- To determine if the published guidelines are relevant to developing countries in general and SA in particular
- To make recommendations to the health authorities on suitable mechanisms for determining and disseminating guidelines created for South African conditions

CHAPTER 3. METHODS

3.1 Questionnaire (see Appendix 1)

Permission for this research was granted by the Human Ethics Committee of Wits University (Human Ethics Committee clearance certificate M090829). A directory of dentists practising in South Africa was obtained from the South African Dental Association (SADA). As the postal system was considered unreliable, the study was conducted by means of an online survey. All dentists residing in South Africa and with an e-mail address were included and sent an initial email inviting them to participate. Final year students, dentists on community service, and specialists were also included in the survey. The email included information on informed consent and gave assurances of anonymity. If they responded and agreed to participate, they were then sent a link to the online questionnaire, and informed that their clicking on that link and taking the survey constituted their agreement to the consent forms and acknowledgement that anonymity would be kept. The survey was open to respondents for a period of two months.

There were some time constraints for this study and so it was decided not pursue dentists further than that initial approach. This is a limitation of this study, and required the pooling of data.

The survey comprised six major topics:

1. Demographics of the respondents: age, years since graduation and current place of practice.
2. Knowledge of the current guidelines recently published and which guidelines, if any, the respondents followed.
3. Current antibiotic prophylaxis coverage prescribed by the respondents to adult and child patients. Participants were also asked to indicate where they would source the information if they were unsure of the prophylaxis dosage.
4. Knowledge of conditions which would require antibiotic prophylaxis coverage.
5. Opinions on dental procedures that were considered invasive

6. Opinions on the need for guidelines specific to South Africa. Participants were given an opportunity to suggest who they thought should disseminate such information and by what means they would like to receive the information.

The questions were derived after the review of the literature revealed the variety of not only guidelines but of advice regarding antibiotic prophylaxis and dental procedures.

The results were analysed and compared for conformity with the newly published AHA and NICE guidelines. The survey also served as a means to understand any prescription trends of the respondents. The list of medical conditions and dental procedures were examples that appeared in previous guidelines (Wilson et al 2008).

In addition, lists of the most popular methods to research information regarding prophylaxis, the conditions for which prophylaxis was required and conditions which were considered invasive, were produced using the answers with the highest frequency. The need for local guidelines and which authorities should be responsible to publish said guidelines were also analysed by the answers with the highest frequency.

3.2 Data Analysis

Data was coded and stored in a Windows Office 2007 Excel[®] spreadsheet and analysed for summary statistics and frequency of responses using Statistica Version 9, Statsoft[®].

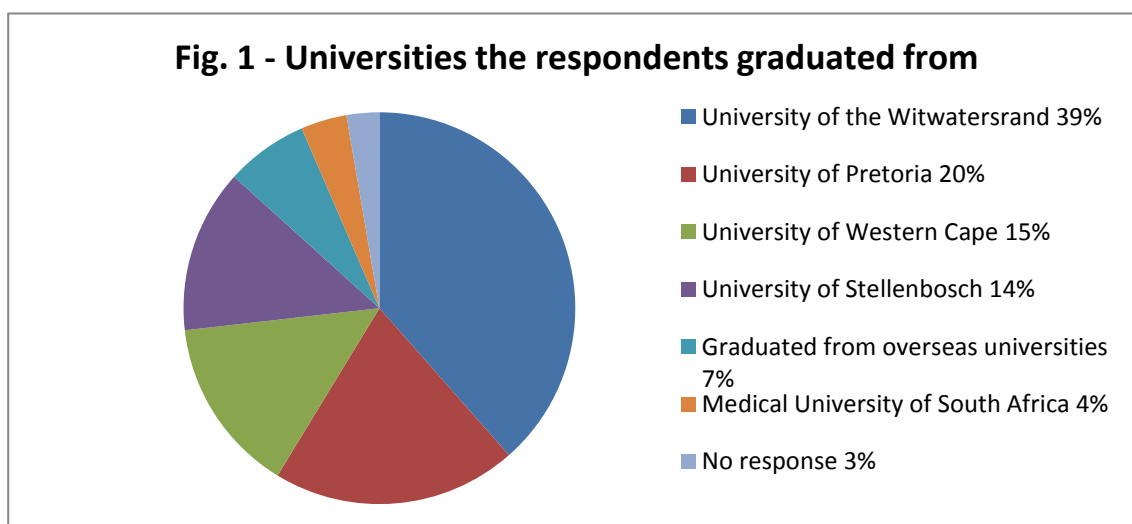
CHAPTER 4. RESULTS

The survey was sent to 2,425 email addresses as provided by SADA which included general dentists, final year students, dentists on community service and specialists.

4.1 Demographics

Of the 2, 425 email addresses, 320 (13%) were found to be incorrect, or needed to be updated, and so it can be assumed that 2,105 emails were successfully sent. Of these, 17 (0.7%) of the recipients declined to participate for reasons such as retirement, currently not being situated in South Africa or currently in full-time orthodontics practice where antibiotics are not prescribed. Of the remaining emails sent, 105 respondents responded (5%). Although the response was small, it was felt that 105 respondents were sufficient to provide useful information.

The majority of the respondents (40 graduates, 39%) graduated from the University of the Witwatersrand. The University of Pretoria had the second most respondents at 21 graduates (20%) followed by the University of Western Cape with 15 graduates (15%) and the University of Stellenbosch with 14 graduates (14%). Graduates who did not qualify in South Africa made up 7% (7 graduates) of the total. Disappointingly, only 4 (4%) graduates from the Medical University of South Africa responded to the survey (Figure 1).



The largest number of respondents (35 respondents: 34%) who answered the survey graduated from university within the last 5 years. As the years since graduation increase, the number of respondents who replied grew less. This may be attributed to an interest in computer technology by the younger graduates as well as an increased exposure to computers during the years of training.

4.2 Antibiotic prescription

In total, 97 respondents (93%) prescribed antibiotic prophylaxis to adult patients, and 75 respondents (72%) prescribed antibiotic prophylaxis to child patients. There was no statistically significant difference between the choice to prescribe antibiotic prophylaxis to adult and child patients using the chi square test ($p>0.05$).

Most respondents (92, 88%) were aware of the newly published AHA guidelines for antibiotic prophylaxis but only around half (57, 55%) knew of the NICE guidelines. The AHA guideline was the most widely followed, by almost two thirds (65%) of the respondents whereas only 12 respondents followed guidelines by the NICE. The rest of the respondents either did not know the guidelines or did not follow either guidelines when treating patients.

The respondents who reported that they do prescribe antibiotics had a poor conformity to the AHA recommended antibiotics for adult and child patients. (Table 3). The number of correct responses for children who are unable to take oral medication was very low (12 and 13%).

Table 3. Conformity to AHA recommended antibiotics by respondents

	NUMBER OF RESPONDENTS CONFORMING TO AHA RECOMMENDED ANTIBIOTICS			
	For patients who can take oral medication		For patients who cannot take oral medication	
	Not allergic to penicillin	Allergic to penicillin	Not allergic to penicillin	Allergic to penicillin
Adult Patients	41 (39%)	45 (43%)	20 (19%)	27 (26%)
Child Patients	29 (28%)	25 (24%)	12 (12%)	13 (13%)

The actual antibiotics and their dosages prescribed by the respondents are shown in Tables 4 and 5, which also show the AHA recommended antibiotics and dosages.

The most commonly prescribed antibiotic was the same for adults and children. Amoxicillin (2g for adults, 50mg/kg for children) was selected as the antibiotic to prescribe to patients who are not allergic to penicillin and are able to take oral medication. Clindamycin (600mg for adults, 20mg/kg for children) was the most commonly prescribed by respondents for patients who are allergic to penicillin and are able to take oral medication. For patients who are unable to take oral medication, ampicillin (2g IM/IV for adults, 50mg/kg IM/IV for children) was the most common choice for these patients who are not allergic to penicillin. Clindamycin (600mg IM/IV for adults, 20mg/kg IM/IV for children) was most commonly recommended for these patients with penicillin allergies. Erythromycin was the second most common antibiotic recommended by respondents for those who are allergic to penicillin, and augmentin for non-penicillin allergic patients.

The numbers prescribing the AHA recommended antibiotic for both adult and child patients were low: no more than 45% of correct prescriptions were provided for each category and as few as 13 % for child patients unable to take oral medication. The average of correct answers for all categories of adult patients for whom antibiotic prophylaxis was prescribed was 33% and 19% for child patients.

Table 4. Antibiotics and their dosages recommended by the AHA, and those prescribed by the respondents for adult patients; items in red conform to the guidelines

ANTIBIOTICS PRESCRIBED BY RESPONDENTS FOR ADULTS							
For patients who can take oral medication				For patients who cannot take oral medication			
Not allergic to penicillin		Allergic to penicillin		Not allergic to penicillin		Allergic to penicillin	
AHA recommendation: Amoxicillin 2g		AHA recommendation: Cephalexin 2g Clindamycin 600mg Azithromycin or Clarithromycin 500mg		AHA recommendation: Ampicillin 2g IM or IV Cefazolin or Ceftriaxone 1g IM or IV		AHA recommendation: Cefazolin or ceftriaxone 1g IM/IV Clindamycin 600mg IM/IV	
Antibiotics prescribed	Number of respondents prescribing this	Antibiotics prescribed	Number of respondents prescribing this	Antibiotics prescribed	Number of respondents prescribing this	Antibiotics prescribed	Number of respondents prescribing this
Amoxicillin 2g	41 (39%)	Clindamycin 600mg	47 (45%)	Ampicillin 2g IM/IV	20 (19%)	Clindamycin 600mg IM/IV	28 (27%)
Augmentin 1-3g	8 (8%)	Erythromycin 1-3g	18 (17%)	Amoxicillin 500mg-3g IM /IV	10 (10%)	Cefuroxime 1,5g IM/IV	1 (1%)
Amoxicillin 3g	2 (2%)	Clindamycin 900mg-1g	2 (2%)	Augmentin 1,2g IM /IV	2 (2%)	Erythromycin 1g IM/IV	1 (1%)
Penicillin 1-3g	3 (3%)			Penicillin 1g IM or IV	2 (2%)	Cefazolin 1g IM/IV	1 (1%)
Erythromycin 2g	1 (1%)			Lincomycin 1g	1 (1%)	Ciproflaxacin 200-400mg q12h for 2 days	1 (1%)
Clinda hexal 600mg	1 (1%)						
Metronidazole 200mg	1 (1%)						

Table 5. Antibiotics and their dosages recommended by the AHA, and those prescribed by the respondents for child patients; items in red conform to the guidelines

ANTIBIOTICS PRESCRIBED BY RESPONDENTS FOR CHILDREN							
For patients who can take oral medication				For patients who cannot take oral medication			
Not allergic to penicillin		Allergic to penicillin		Not allergic to penicillin		Allergic to penicillin	
AHA recommendation: Amoxicillin 50mg/kg		AHA recommendation: Cephalexin 50mg/kg Clindamycin 20mg/kg Azithromycin or Clarithromycin 15mg/kg		AHA recommendation: Ampicillin 50mg/kg IM or IV Cefazolin or Ceftriaxone 50mg/kg IM or IV		AHA recommendation: Cefazolin or ceftriaxone 50mg.kg IM or IV Clindamycin 20mg/kg IM or IV	
Antibiotics prescribed	Number of respondents prescribing this	Antibiotics prescribed	Number of respondents prescribing this	Antibiotics prescribed	Number of respondents prescribing this	Antibiotics prescribed	Number of respondents prescribing this
Amoxicillin 50mg/kg	28 (27%)	Clindamycin 20mg/kg	23 (22%)	Ampicillin 50mg/kg IM or IV	13 (13%)	Clindamycin 20mg/kg IM or IV	14 (13%)
Augmentin 10-50mg/kg	2 (2%)	Erythromycin 20-50mg/kg	2 (2%)	Amoxicillin 50mg/kg IM or IV	3 (3%)	Erythromycin of unspecified dosage	3 (3%)
Augmentin 600mg- 3g	2 (2%)	Erythromycin 125mg-3g	2 (2%)	Augmentin 600mg IV	1 (1%)	Lincomycin 50 mg	1 (1%)
Amoxicillin 500mg	2 (2%)	Erythromycin 60ml	1 (1%)	Penicillin 500mg IM	1 (1%)		
Clindamycin 20mg/kg IM or IV	1 (1%)	Erythromycin of unspecified dosage	2 (2%)	Amoxicillin of unspecified dosage	4 (4%)		
Amoxicillin 500mg	1 (1%)			Penicillin of unspecified dosage	3 (3%)		
				Erythromycin of unspecified dosage	1 (1%)		

4.3 Sources of information used and Procedures for which antibiotics were prescribed

The most popular means of researching information when respondents were unsure of the dosage of antibiotic prophylaxis to give to patients was via the Monthly Index of Medical Specialties (MIMS) published by Magazine Publishers Association of South Africa, a collection of drugs and interactions commonly used by medical professionals. This was used by 27% of the respondents. Respondents also favoured consulting with the patient's general practitioner or physician. Only 12% chose to consult the AHA guidelines although 18% would search for information on the internet. The method respondents used to search for antibiotic prophylaxis for both adults and children were similar (Table 6).

Table 6. The most popular methods of seeking information on antibiotics and dosages

SOURCE OF INFORMATION	FOR ADULTS (%)	FOR CHILDREN (%)
MIMS	27	24
Internet	18	12
Consulting with general practitioners or physicians	16	17
AHA	12	10
South African Medical Formulary	9	7
Other means	22	16

The most common conditions for which respondents would prescribe antibiotic prophylaxis is shown in Table 7.

Table 7. Conditions for which antibiotic prophylaxis cover was recommended

CONDITION	PERCENTAGE OF RESPONDENTS PRESCRIBING COVER
Prosthetic cardiac valve or prosthetic material used for cardiac valve repair	15
Previous infective endocarditis	15
Cardiac transplantation recipients who develop cardiac valvulopathy	14
History of rheumatic fever	14
Hip replacement therapy (within last 6 months)	13
Congenital heart disease	11

4.4 Conditions considered invasive by respondents

The conditions which respondents considered to be invasive (and therefore requiring antibiotic cover if this is considered necessary), are shown in Table 8. Conditions such as wiring of a fractured mandible, intraligamentary injections of local anaesthetic, subgingival fillings, placement of a matrix band, pregnancy, drainage of abscesses were placed under 'Other conditions' as these figures were too low to be considered significant.

Table 8. Conditions considered invasive by respondents

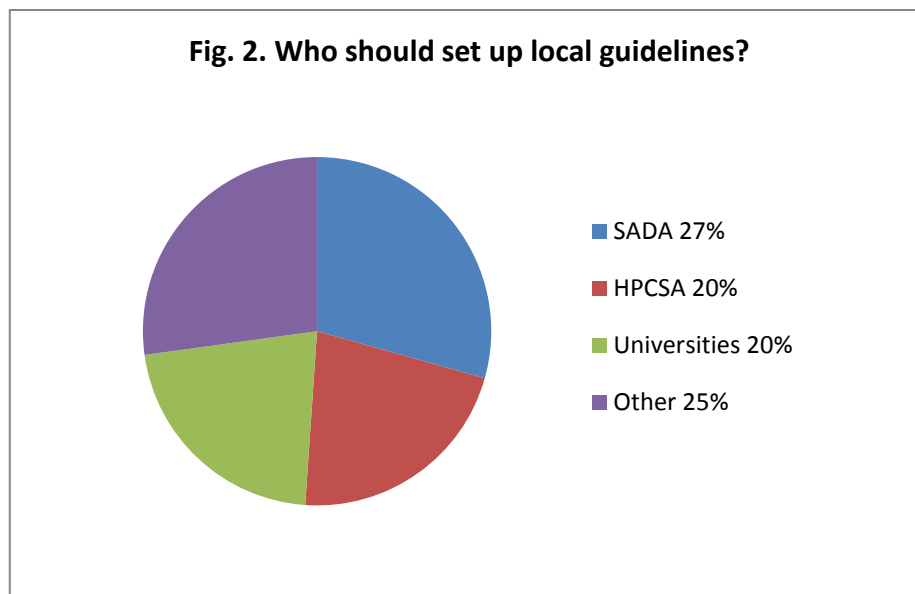
CONDITION	PERCENTAGE OF RESPONDENTS WHO FELT THIS TO BE AN INVASIVE PROCEDURE
Surgical extraction of teeth	17
Root planing	16
Non-surgical extraction of teeth	15
Endodontic treatment	12
Implant placement	12
Scaling and polishing	11
Placement of gingival retraction cord	9
Other conditions	18

The above table (Table 8) indicates the top seven procedures that respondents felt to be invasive surgery. Surgical extraction of teeth, root planning and non-surgical extraction of teeth were considered to be invasive by most respondents. Placement of gingival retraction cords and scaling and polishing was considered invasive by the least number of respondents but was still in consideration by some. Other conditions reported by respondents were subgingival fillings, administration of local anaesthetic, general fillings, crown preparation and matrix band placement.

4.5 The need for local guidelines

The majority of respondents (80 respondents -77%) agreed that there should be local guidelines set for practitioners in South Africa. Respondents also agreed that the South African Dental Association (SADA), the Health Professions Council of South African (HPCSA) as well as

academic institutions should be responsible for setting up these local guidelines. Twenty five percent (26 respondents) suggested the guidelines be set up via ‘other’ means such as the Department of Health, orthopaedic, cardiothoracic, maxillofacial and oral surgery societies and the Medical Association of South Africa (Figure 4).



The respondents had equal feelings as to which health authorities should publish the guidelines for South Africa. Twenty seven percent (28 respondents) thought SADA should take the lead in the dissemination of the new guidelines, 20% (21 respondents) chose the HPCSA and 20% (21 respondents) felt the leading academic institutions should be the authority. Twenty five percent (26 respondents) thought that various other medical bodies should set the guidelines. Eight respondents (8%) did not offer a suggestion.

Respondents were given the opportunity to specify how they would prefer the dissemination of a local guideline. The preference was via notification from SADA, (37 respondents); 31 felt that information should be disseminated via publication in journals; and 26% replied that information should be sent through e-mails.

CHAPTER 5. DISCUSSION

The results of this study need to be interpreted with care, because of the limited response rate, and the necessity to pool the data as a result. Nevertheless it was felt that the data would be valuable if some trends emerged and if they highlighted the need for conformity to guidelines or indeed if guidelines were even necessary. Previous surveys in other countries regarding the practice of antibiotic prophylaxis have all been sent via post and this was the first of its kind to be completed on the internet. This may have been the reason for the poor response, but the SA postal system was considered too unreliable, and so it was felt that an internet-based survey would be ideal. Clearly though, this was not the case. It is possible that a latent mistrust of electronic communication may exist, especially with respect to promises of anonymity which may be cynically received.

But within the limitations of a low response rate, it seems that the outcomes of this survey are not dissimilar to previous studies evaluating the knowledge of dental practitioners.

It was encouraging that most respondents (88%) were aware of the newly published AHA guidelines for antibiotic prophylaxis, but interestingly, only 55% knew of the NICE guidelines. However, it is of concern that few actually followed the recommended guidelines (Table 3). It may be inferred that those who do not prescribe are in fact following the NICE guidelines but it was not possible to verify this from the data. Only two respondents who knew of the NICE guidelines do not prescribe prophylaxis for adult patients and 11 respondents who knew of the NICE guidelines did not prescribe prophylaxis for children.

Respondents were able to identify which antibiotics to use for different instances but many failed to give the correct dose and duration for which the medication should be taken, according to the AHA guidelines.

Since the inception of the need to prevent IE in patients in 1955, the AHA had previously recommended penicillin as prophylaxis up to 1990 (Wilson et al 2008) and since then, amoxicillin. Since 1990, amoxicillin became the antibiotic of choice as recommended by the AHA in its last three guidelines published. However, augmentin was the second highest first line drug of choice amongst all respondents, despite the fact that augmentin has never been included in any of the previous guidelines published by the AHA.

Respondents were more knowledgeable about the recommendations for adult prophylaxis although recommendations for children have been included in the guidelines since 1960 (Wilson et al 1990). Half the respondents were able to identify which antibiotic and dosage should be prescribed to adult patients who are allergic to penicillin but only 23% could correctly identify the antibiotic and dosage for a child with the same allergy. Very few (13%) knew the dosage and duration for children unable to take oral medication.

Erythromycin was a common choice of the respondents for patients who are allergic to penicillin or ampicillin. Erythromycin is listed in the Monthly Index of Medical Specialties (MIMS 2010) with an indication as prophylaxis against bacterial endocarditis, but the AHA recommends cephalexin (a cephalosporin), clindamycin, or a choice of two macrolides: azithromycin or clarithromycin. Erythromycin is an older generation of macrolide with lower levels of tolerability and the spectrum it covers is not as broad as the newer macrolides recommended by the AHA. Erythromycin as an alternative for patients who are allergic to penicillins and ampicillins was not documented in either the 1997 or 2008 AHA guidelines. Both recommend the newer macrolides.

When considering other conditions for antibiotic prophylaxis not in the guidelines, the most frequently mentioned (by 13% of the respondents) was patients with a history of hip replacement in the previous 6 months (Table 7). Hip replacement therapy is not considered by the AHA or NICE to be a condition that needs antibiotic coverage as there is no substantial evidence in the literature to support the practice.

The respondents favoured MIMS as a source of information regarding the prescription of antibiotic prophylaxis. There also appears to be a consensus that SADA, HPCSA and academic institutions should set local guidelines as these are the bodies that local dental professionals look to, to receive guidance from. Respondents also felt that SADA should be responsible for disseminating the latest published guidelines as well as published journals. The third highest choice for receiving new information, was via e-mails. This is not surprising for this group of respondents, but may not be useful for the majority of dentists who did not respond to the emails requesting their participation in this survey.

Similar surveys have been undertaken to assess the knowledge of dentists regarding the published infective endocarditis guidelines as well as their implementation. Studies of this nature have been published in the United States (Nelson and Van Blaricum 2002), Canada (Epstein, Chong and Le 2000, Lauber et al 2007), the United Kingdom (Palmer et al 2000, Boyle, Gallagher and Sleeman 2006, Thompson et al 2007) and Israel (Zadik et al 2008). In the majority of these studies, there seems to have been a general misconception by dentists as to which conditions needed antibiotic coverage and which dental procedures were considered invasive. As both the AHA and NICE guidelines are fairly new, it is of continuing importance to assess the knowledge of practising dentists. No studies have been undertaken to assess this in South Africa. There also appear to be no mechanisms in place for the health authorities to either make local recommendations or to disseminate such information to clinicians.

In addition, there appears to have been no mechanism by which a national consensus could be reached on the need for antibiotic prophylaxis in the first place. Both the AHA and NICE guidelines have been published for developed countries, and contradict each other when considering prophylaxis for the prevention of infective endocarditis. There is also no clear consensus on just which dental procedures are sufficiently invasive to require prophylaxis, nor on which medical conditions require antibiotic coverage.

CHAPTER 6. CONCLUSION AND RECOMMENDATIONS

1. Within the limitations of this study, it is possible that very few dentists know or follow the NICE guidelines, and although the AHA guidelines may be more widely known, it is unlikely that they will be followed precisely.

Erythromycin is still commonly perceived as the drug of choice for patients who are allergic to penicillins and ampicillin, yet has not been recommended for many years. The publishers of MIMS should be alerted to this.

The respondents to this survey were more aware of the dosage and duration of antibiotic prophylaxis for adult patients than for child patients.
2. If the trends observed in this sample are in any way representative, then it is of grave concern that there are no guidelines disseminated to dental practitioners in this country.

SADA, SAMA, the HPCSA, local journals and publications like MIMS should be the media by which these new guidelines should be disseminated.
3. Local antibiotic prophylaxis guidelines are therefore needed and the medical and dental professions, perhaps through their representative organisations (SADA and SAMA), together with the health authorities, should address this issue as a matter of urgency.
4. Developing countries in general, but South Africa in particular may need a separate set of guidelines other than those published by the AHA and NICE in light of the different prevalence of conditions such as rheumatic fever.

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Appendix 1: Questionnaire

1. Demographics

Please place an X in the appropriate box:

1.1 Age:

20-29 ☐

30-39 ☐

40-49 ☐

50-59 ☐

60+ ☐

1.2 Gender

F

☐

M

☐

1.3 Years since graduation:

☐

1.4 Currently you are a

Student in year of study:

☐

Dental practitioner

☐

Registered specialist in Community dentistry

☐

Registered specialist in Maxillofacial and Oral Surgery

☐

Registered specialist in Oral Pathology

☐

Registered specialist in Orthodontics

☐

Registered specialist in Periodontics and Oral Medicine

☐

Registered specialist in Prosthodontics

☐

1.5 Type of practice: Place an X in each box that applies. For example, if you are in full-time private practice but do sessions at an academic hospital or local public sector clinic, place an X in the 1st and last boxes; if you are in full-time public sector but do RWOPS, check the 2nd and 3rd.

Full-time private practice

☐

Full-time public service

☐

Part-time private practice

☐

Part-time public service

☐

2. Antibiotic prophylaxis for infective endocarditis

2.1 Are you aware of the guidelines for antibiotic prophylaxis to prevent infective endocarditis published by:

The American Heart Association (AHA)

Yes

☐

No

☐

The (UK NHS) National Institute for Health and Clinical Excellence (NICE)

Yes

☐

No

☐

2.2 Which guidelines do you follow?

AHA

☐

None

☐

NICE

☐

Don't know

☐

2.3 What do you prescribe when you want to put your ADULT patients on antibiotic prophylaxis cover for the following situations?

None: I do not prescribe antibiotics for the prevention of infective endocarditis

☐

2.3.1 *Able to take oral medication:*

Name of antibiotic:

Dosage and duration:

2.3.2 Unable to take oral medication

Name of antibiotic:

Dosage and duration:

2.3.3 Allergic to penicillins or Ampicillin orally:

Name of antibiotic:

Dosage and duration:

2.3.4 Allergic to penicillins or ampicillin and unable to take oral medication

Name of antibiotic:

Dosage and duration:

2.3.5 If you are unsure of the dosage and means of administration, where would you go to find that information?

2.4 What do you prescribe when you want to put your CHILD patients on antibiotic prophylaxis cover for the following situations?

None: I do not prescribe antibiotics for the prevention of infective endocarditis

☐

2.4.1 Able to take oral medication:

Name of antibiotic:

Dosage and duration:

2.4.2 Unable to take oral medication

Name of antibiotic:

Dosage and duration:

2.4.3 Allergic to penicillins or Ampicillin orally:

Name of antibiotic:

Dosage and duration:

2.4.4 Allergic to penicillins or ampicillin and unable to take oral medication

Name of antibiotic:

Dosage and duration:

2.4.5 If you are unsure of the dosage and means of administration, where would you go to find that information?

2.5

2.6 Other conditions which may need antibiotic cover

Acknowledging there are few guidelines available to guide the practitioner, nevertheless you may feel that antibiotic prophylaxis should be prescribed prior to invasive dental procedures for certain conditions. Which of the following conditions, if any, would you prescribe antibiotic prophylaxis for? (place an X in only those boxes which you feel apply)

2.5.1 History of rheumatic fever

☐

2.5.2 Hereditary haemorrhagic telangiectasia

☐

2.5.3 Diabetes mellitus

☐

2.5.4 Hip replacement therapy (within last 6 months)

☐

2.5.5 HIV positive with no anti-retrovirals

☐

2.5.6 HIV positive and on anti-retrovirals

☐

2.5.7 Rheumatoid arthritis

☐

2.5.8 Systemic lupus erythematosus

☐

2.5.9 AIDS

☐

2.5.10 Prosthetic cardiac valve or prosthetic material used for cardiac valve repair

☐

2.5.11 Previous infective endocarditis

☐

2.5.12 Congenital heart disease

☐

2.5.13 Cardiac transplantation recipients who develop cardiac valvulopathy

☐

2.5.14 Are there any other conditions which you would prescribe prophylactic antibiotics for?

Yes

☐

No

☐

If Yes, please state:

3. Which of the following dental procedures do you consider invasive and therefore may require antibiotic cover?

4.1 Routine anaesthetic injection through non-infected tissue

☐

4.2 Taking dental radiographs

☐

4.3 Placement of orthodontic or prosthodontic appliances

☐

4.4 Adjustment of orthodontic appliances

☐

4.5 Shedding of primary teeth

☐

4.6 Bleeding from trauma to the lips or oral mucosa

☐

4.7 Placement of gingival retraction cord

☐

4.8 Tooth preparation for a crown

☐

4.9 Non-surgical extraction of teeth

☐

4.10 Surgical extraction of teeth

☐

4.11 Endodontic treatment

☐

4.12 Scaling and polishing

☐

4.13 Root planing

☐

4.14 Other:

4. The need for local guidelines

5.1 Do you believe that South African conditions are such that local guidelines should be drawn up?

Yes ☐ No ☐

5.2 If Yes, who should do this:

5.3 How should they be disseminated (i.e. how would you like to be kept up to date and aware of any local guidelines)?

Thank you for completing this questionnaire, it is much appreciated!

If you would like to make any other comments, please feel free to do so (the box will expand as you type):

Patient Information Leaflet and Informed Consent

STUDY TITLE: **Antibiotic prophylaxis for dental procedures: current practise amongst South African dentists.**

INVESTIGATOR: Dr W Huang

INSTITUTION: School of Oral Health Science at Wits Dental Hospital

DAYTIME AND AFTER HOURS TELEPHONE NUMBER(S): 082 451 2599

To the Participant: *This consent form describes the study, and requests you to participate by answering questionnaires. If you have any queries, please contact the Investigator.*

Introduction

As a student studying towards a master's degree (MScDent) and part-time clinical supervisor at the Wits Dental Hospital, I would like to invite you to consider participating in a research study. Your participation in this study is entirely voluntary and refusal to participate will involve no penalty or loss of benefits to which you may otherwise be entitled.

This information leaflet is to help you to decide if you would like to participate. You should fully understand what is involved before you agree to take part in this study. If you have any questions, please do not hesitate to ask me. You should not agree to take part unless you are satisfied about all the procedures involved. If you decide to take part in this study, completion of the questionnaire will be confirmation that you understand and agree to the study.

Purpose of the study

Some guidelines have been published over the years in the USA and UK (but not South Africa) concerning antibiotic prophylaxis for dental procedures. In order to ascertain the need for local guidelines, it is necessary to first ascertain the current practises of South African dentists as well as their knowledge and awareness of antibiotic prophylaxis. Ultimately the aim of the study is to make recommendations to the health authorities on suitable mechanisms for determining and disseminating guidelines created for South Africa.

Length of the study and number of participants

Your participation would require that you complete a questionnaire either via email or online on a website to answer questions on your current knowledge regarding antibiotic prophylaxis, your current practise in this regard, and your opinion on the need for local guidelines, who should produce them, and how they should be disseminated so that you can be kept up to date.

Your rights as a participant in this study

Your participation in this study is entirely voluntary and you can decline to participate, without stating any reason.

Financial arrangements

There are no financial implications for you, other than your time taken to read about the study and complete the questionnaire.

Ethical approval

This study protocol has been submitted to the University of the Witwatersrand, Human Research Ethics Committee (HREC) and written approval has been granted by that committee. The study has been structured in accordance with the Declaration of Helsinki, which deals with the recommendations guiding doctors in biomedical research involving human participants. A copy may be obtained from me should you wish to review it.

Confidentiality

All information obtained during the course of this study, including personal data and research data will be kept strictly confidential. All your responses to the questionnaires will remain anonymous and only the Investigator will know you only as a respondent. Data that may be reported in scientific journals will not include any information that identifies any of the participants in this study.

Informed Consent

By completing the questionnaire and/or by signing and returning this document if I so wish,

- I hereby confirm that I have been informed about the nature, conduct, benefits and risks of this study
- I have received, read and understood the above written information (Participant Information Leaflet) regarding this study
- I am aware that the results of the study, including any personal details will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by Dr Huang.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study when I complete the questionnaire.

Participant

Printed Name: Signature

Date and time.....

Study Doctor

I, Dr Wei-Hsuan Huang, herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

Signature Date and time
