OCCUPATIONAL EXPOSURES AMONG DENTAL ASSISTANTS IN LIMPOPO DENTAL CLINICS

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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 Dentistry in the branch of Community Dentistry

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DECLARATION

I, Mbulaheni Simon Nemutandani, hereby declare that this research report is my own work. It is being submitted for the degree of Master of Dentistry in the branch of Community Dentistry in the University of the Witwatersrand, Johannesburg. It has not been submitted or presented for any degree or examination at this or any other university.

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_____day of _____ 2007

The work presented in this report was undertaken in the Division of Public Oral Health, School of Public Health, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg.

DEDICATION

This thesis is dedicated to my wife Veronica, my two daughters Tenda-Mudzimu and Renda-Mudzimu, and my son Mashudu.

“Makwanda a mutuka a si vhu matshelo hawe. Pfunzo ndi ifa , line mutuka a kuna ngayo”

Lumpfumo lu gwelwaho nga tsilu, lufukulwa nga ndivho ya mutali

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ABSTRACT

The impact of AIDS and the dread of acquiring HIV infection from patients have led to the resurgence in infection-control practices among health care workers. Recent reports of blood-borne pathogen transmission in health care settings, including oral health, have caused considerable public health concern. Transmission has been reported from patient to patient, patient to health care workers, but rarely from health care worker to patient. The risks of dental clinicians acquiring serious infections have been well documented but the risk to dental assistants has received less attention, especially in South Africa.

Aim: To assess infection-control practices of dental assistants and their level of adherence to universal precautions in public health care facilities in Limpopo Province.

Objectives: To establish the prevalence and the type of occupational exposures among dental assistants working in public health care facilities in Limpopo Province.

Methods: A cross-sectional survey was conducted among dental assistants in Limpopo Province in 2005. The study population comprised all 73 employees who performed the functions of a dental assistant in public dental facilities. A self-administered questionnaire was used to collect information regarding work experiences and training, infection-control practice and knowledge, and the nature, incidences and reporting of any occupational exposures they had experienced. A follow-up telephone call was made to these dental assistants, after they had received the questionnaire, to re-iterate the importance of the survey and to request them to complete and return the questionnaire

in the prepaid envelope they had been given. The facilities were clustered according to the six districts in Limpopo Province. Ethical approval was given by the University of the Witwatersrand and the Department of Health and Welfare in Limpopo Province.

Results: Fifty-nine dental assistants returned the completed questionnaire, giving a response rate of 80.8%. Epi Info Version 3.3.2 programme was used to analyze the data. The majority of respondents were female (95%), with a mean age of 40.2 years (age range 23-54). More than 90% of the respondents had no formal training for their occupation, half (49.1%) did not have any health training, 22% were auxiliary nurses, 18.6% were "correspondence-trained" assistants who had been trained via distance learning and had no practical clinical training and only 10.2% of the respondents had received training at a technikon or university . The majority of the dental facilities (57.6%) had one dental assistant working alone, followed by those with two or three assistants (39.5%). The number of respondents assisting more than two oral clinicians in a day was 93.3%. The mean number of clinicians assisted per day was 3.8. The total numbers of dental assistants who experienced occupational exposures while working at the various dental clinics were 26 (44.1%), with 11.5% experiencing multiple injuries within the preceding six months. Auxiliary nurses and trained assistants were significantly more likely than untrained assistants to be aware of universal precautions, their protective effects, needle stick protocols, and of the need for personal protective equipments to be worn for all procedures ($p=0.001$).

Compliance with infection-control practices was low overall. More than two-thirds of the assistants routinely wore gloves during procedures. The lowest compliance reported was the use of protective eye shields, whilst more than 62.7% were not vaccinated against hepatitis B virus. More than two-thirds of the assistants were injured in the process of removing and or cleaning instruments; 65.3% of the injuries were direct punctures. Twenty-three percent did not report the injury. The risk of injury for the untrained assistants was 9.9 times higher than that for auxiliary nurses, p=0.008.

A small percentage (23.8%) of those with sharp injuries was placed on antiretroviral drugs. Surprisingly, a significant high percentage of respondents were given wound cleaning only as treatment of their occupational exposures (78.4%) and sharp injuries (83%).

Conclusion and recommendation

More than 90% of the respondents had no formal training for their occupation. Dental assistants were understaffed and had increased workload. The greatest incidence of injury was associated with the handling of sharp objects, and this included recapping used needles. Occupational exposures to infectious material were found to be relatively high whilst compliance to some basic infection-control guidelines was low among dental assistants. The training of dental assistants should be regulated. More suitably qualified dental assistants should be appointed and existing ones should be given in-service training on the importance of infection-control practices and compliance with universal precautions.

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AIDS	**Acquired immunodeficiency syndrome**
ARV	**Antiretroviral**
CDC	**Centers for Disease Control and Prevention**
DAs	**Dental Assistants**
HBV	**Hepatitis B Virus**
HCV	**Hepatitis C Virus**
HCWs	**Health Care Workers**
HIV	**Human Immunodeficiency Virus**
LP	**Limpopo Province**
OHCWs	**Oral Health Care Workers**
OHSA	**Occupational Health and Safety Act**
PPE	**Personal protective equipment**
SA	**South Africa**
UK	**United Kingdom**
UPs	**Universal Precautions**
USA	**United States of America**
WHO	**World Health Organisation**

CHAPTER ONE

INTRODUCTION

1.1. BACKGROUND INFORMATION

The prevention of occupational exposure and patient-acquired nosocomial infections has been the focus of infection control since the discovery of the mechanism of disease transmission by Lister and others in the 1800s (Greundemann and Fernsebner, 1995; Centers for Disease Control and Prevention (CDC), 1998a). In the modern era, health care workers have become increasingly aware of their risks of contracting diseases from patients, especially blood-borne infections such as Hepatitis B virus (HBV); human immunodeficiency virus (HIV); and, more recently, Hepatitis C virus (HCV).

More importantly, the impact of HIV and Acquired Immunodeficiency Syndrome (AIDS), and the dread of acquiring these infections from patients have led to a resurgence in the awareness of occupational risks for infections among health care workers (HCWs), in spite of the advent of antibiotics and vaccines (Webber, 2000). Recent reports of blood-borne pathogen transmission in health care settings including oral health settings have caused considerable public health concern. Transmission has been reported from patient to patient, patient to health care workers, and from health care worker to patient, albeit this last form of transmission has been reported quite rarely (Ramos-Gomez et al, 1997; McNamara & Bagramian, 1999; Stewardson et al, 2003, Dement et al, 2004).

Occupational exposure to blood can occur through a percutaneous injury (needlestick or other sharp injury a mucocutaneous incident (splash of blood or blood-containing fluids into the eyes, nose, or mouth) or blood contact with non-intact skin.

Global statistics on occupational exposures of health care workers to blood-borne pathogens are startling (Wong et al, 1991; Osborn et al, 1999). The World Health Organization (WHO) estimates that, among the 35 million health care workers worldwide, approximately 3 million experience percutaneous exposure to blood-borne viruses each year – 2 million HBV, 900 000 HCV, and 300 000 HIV (CDC, 1991). These injuries and incidents are estimated to result in 16 000 hepatitis C, 66 000 hepatitis B, and 200 to 5000 HIV infections.

More than 90% of these infections occur in low-income countries, and most are preventable (CDC, 1991). In 1987 the CDC proposed a new concept called "universal precautions." Universal precautions, as defined by CDC, are a set of precautions designed to prevent transmission of human immunodeficiency virus (HIV), Hepatitis B virus (HBV), and other blood-borne pathogens during the provision of first aid or health care. Under universal precautions, blood and certain body fluids of all patients are considered potentially infectious for HIV, HBV and other blood-borne pathogens. These precautions are based on the concept that all blood and body fluids that might be contaminated with blood should be treated as infectious because patients with blood-borne infections can be asymptomatic or unaware that they are infected (Jochimsen et al, 1999; Parkin et al, 2000).

In 1996, the CDC recommended that universal precautions be renamed 'standard precautions'. Standard precautions combine the major features of universal precautions and body substance isolation (designed to reduce the risk of transmission of pathogens from moist body substances).

Standard precautions apply to the following: 1) blood; 2) all body fluids, secretions, and excretions except sweat, regardless of whether or not they contain visible blood; 3) non-intact skin; 4) mucous membranes; 5) any unfixed tissue or organ (other than intact skin) from a human (living or dead); 6) HIV-containing cell or tissue cultures, organ cultures, or HIV- or HBV-containing culture medium or other solutions; and 7) blood, organs, or other tissues from experimental animals infected with HIV or HBV (CDC,1998b).

In 1996, the South African government legislated the Occupational Health and Safety Act (OHSA, 1996). The main objective of OHSA was to devise and implement policies and procedures that would protect both health care workers (including oral health care workers - OHCWs) and patients against occupational transmission of a variety of infectious diseases. Although the ultimate goal of such an Act is to create an environment of no risk, in reality, minimising the risk for infection remains the most practical goal.

In view of this legislation, most oral health services in South Africa adopted CDC recommendations regarding infection control to protect patients and health workers from occupational exposures within the dental setting.

This protocol focused primarily on the risk of transmission of blood-borne pathogens among health care workers (HCWs) and patients (CDC, 1998a and 2003; Wang et al, 2000).

Dental assistants (DAs) form an integral part of oral health service delivery in primary, secondary and tertiary oral health centres throughout South Africa.

The majority of the public facilities employ non-certificated dental assistants (Ayo-Yusuf, 2001; FOHL, 2005). In most centres, the job description of DAs is not clear and their duties vary from chair-side assisting and floor cleaning to reception duties. In addition to clinical assisting, dental assistants' tasks also include the handling and cleaning of sharp instruments contaminated with blood and saliva and the removal and safe disposal of anaesthetic needles and all contaminated wastes generated during routine dental treatment.

Chief dentists have reported that DAs in most of the clinics are overworked, short-staffed and incompetent (in terms of their training) to assist clinicians and to perform most tasks associated with dental profession. There is thus a serious concern that these DAs may be at an unacceptably higher risk for occupational injuries when compared to other categories of health care workers (FOHL, 2005). Of greater concern in Limpopo is the current practice of temporary assignment (three months duration) of auxiliary nurses to dental clinics to perform duties as dental assistants. These nurses have to be trained in their new roles as very few of them have had previous experiences in handling dental instruments or assisting in dental procedures.

After three months, new auxiliary nurses are then rotated through dental clinics and this process of job training and clinical assisting is repeated (FOHL, 2005). Additionally, in terms of risk for transmission, the conditions in which health services are delivered in South Africa, with no exception for oral health, are unique when compared to those of other developing countries in Africa, Europe and Latin America (Webber, 2000). The following points highlight some of the serious challenges:

- South Africa is reported to be among the countries with the fastest growing HIV and AIDS epidemic worldwide (Bateman, 2004; LGH Consortium, 2004; Walker, 2005);
- The prevalence of HBV within selected communities remains high; Mphahlele et al, (2006) predict that it will remain high for the next few years;
- Other pathogens, such as tuberculosis, are commonly diagnosed (Padayatchi et al, 2006);
- South Africa is a violent society and trauma is a regular presenting feature of many patients (Lalloo, 2005);
- Many factors, including poor working conditions, long working hours, poor environment, poor use of barrier protection and inadequate infection-control practices were reported to increase the risk of injury and infectious diseases in South Africa (Germishuys, 1979; de Selincourt, 1992; Yengopal et al, 2001; Duse et al, 2003; Nemutandani et al, 2006).

Anecdotal reports from Limpopo oral health facilities indicate that a significant number of dental assistants have been injured in the process of assisting clinicians, changing needles, and cleaning instruments (FOHL, 2005). Many have not reported the incidents out of fear, ignorance, and lack of information. Therefore, there is an urgent need to research this issue so that the problems related to dental assistants can be addressed on the basis of quantified evidence in the form of a scientific study.

NOTE: Although the term *standard precautions* has superseded the term *universal precautions* in much of the western world, *universal precautions* is preferred in this survey because it is the term most familiar to HCWs in low-income countries and is still being used by the World Health Organization and the International Council of Nurses (Kermode et al, 2005)**.**

CHAPTER TWO

LITERATURE REVIEW

2.1. INTRODUCTION

Several studies have documented an increased risk of exposures to and infection with pathogenic micro-organisms including the hepatitis B virus (HBV), the hepatitis C virus (HCV), the herpes simplex virus type 1 and 2, HIV, *Mycobacterium tuberculosis*, staphylococci, streptococci, and other viruses and bacteria that colonise or infect the oral cavity and respiratory tract among health care providers, including oral surgeons and dentists (Mosley et al, 1975; Pantelick et al, 1981; Webber, 2000; CDC, 2003; Dement et al, 2004).

These organisms can be transmitted in health care settings (Pearse, 1997) via:

- Direct contact with blood, oral fluids, or other patient materials;
- Indirect contact with contaminated objects (e.g., instruments, equipment, or environmental surfaces);
- Contact with conjunctival, nasal, or oral mucosa with droplets (e.g., splatter) containing micro-organisms generated from an infected person and propelled a short distance (e.g., by coughing, sneezing, or talking); and
- Inhalation of airborne micro-organisms that can remain suspended in the air for long periods (Pearse, 1997; CDC, 1998c; CDC, 2003).

Infection through any of these routes requires that all of the following conditions be present (Pearse, 1997; CDC, 2003):

- A pathogenic organism of sufficient virulence and in adequate numbers to cause disease;
- A reservoir or source that allows the pathogen to survive and multiply (e.g., blood);
- A mode of transmission from the source to the host;
- A portal of entry through which the pathogen can enter the host; and
- A susceptible host (i.e., one who is not immune).

The occurrence of these events provides the chain of infection (Pearse, 1997; Panlilio et al, 1999; Dement et al, 2004). Effective infection-control strategies prevent disease transmission by interrupting one or more links in the chain.

2.2. RISKS OF TRANSMISSION IN HEALTH SETTINGS

Awareness that HCWs are at risk of occupational infection with blood-borne pathogens grew during the 1970s when an increasing number of HCWs became infected with HBV, and was further heightened in the 1980s with the onset of the HIV epidemic. In response to these events, practice guidelines to enhance HCW safety by minimising the likelihood of exposure to blood, needles, and sharps were developed and implemented.

These initiatives emerged predominantly in the United States but were rapidly adopted and modified for use in other high-income countries. The content of the guidelines and the labelling of the guidelines have varied over time.

During the late 1980s and early 1990s the guidelines were known as *Universal Precautions* or *Body Substance Isolation*, but most recently they have been described as *Standard Precautions (*Garner, 1996*)*.

Although the results from studies evaluating the effectiveness of universal precautions (UPs) have been mixed, it is clear that UPs reduce the extent to which HCWs are exposed to the blood of others and, presumably, this in turn reduces their risk of occupational infection with blood-borne pathogens (Beekmann et al, 2005; Kermode et al, 2005).

The risk of transmission (**Table 1**) of blood-borne pathogens depends on a number of factors and appears to be greater for HBV than for HIV. The determinants of the risk of transmission of blood-borne pathogens include the type and frequency of blood contact, the prevalence of blood-borne pathogen infection among patients, and the risk of transmission after a single exposure to infected blood (Pantelick et al, 1981; CDC, 1998a; Webber, 2000; Dement et al, 2004).

TABLE 1: Risks of transmission of blood-borne pathogens following occupational exposure.

Virus	Risk
HIV	0.1-0.4%
Hepatitis B - eAg negative	2%
Hepatitis B - eAg positive	20-40%
Hepatitis C	1.2-10%
Ebola	High
Congo-Crimean hemorrhagic fever	Moderate to high

Source: AIDS SA, 1997

The risk of HIV seroconversion following an occupational blood exposure has been estimated to lie at 0.2 to 0.3 percent for parenteral exposures and at 0.1 percent or less for mucosal exposures (Henderson et al, 1990; Gruninger et al, 1992; Ippilito et al, 1993; Gerberding, 1995).

The risks associated with a percutaneous exposure to the hepatitis B virus (HBV) are estimated to lie at 2 percent for HBeAg negative and at about 30 percent for HBeAg positive blood (Alter et al, 1976; Gerberding, 1995).

Other studies have reported that the risk is as low as 1.8 percent for the hepatitis C virus (HCV) (Mitsui et al, 1992; Zuckerman et al, 1994; Lamphear et al, 1994 and Puro et al, 1995).

Studies of HIV seroprevalence rates among OHCWs have established that dental practice is associated with a relatively small risk of HIV transmission (0 to 0.08 percent), (Klein et al, 1988; Gruninger et al, 1992; CDC, 2003) and that, to date, no dental practitioner has been documented by the CDC to have acquired HIV through an occupational contact with the virus (CDC, 1998a).

Seroprevalence studies among dentists have resulted in higher rates for serologic markers of HBV infection (9 percent) and HCV (1.4 percent) when compared to HIV (Cleveland, 1996). In an annual health-screening programme of 1245 general dentists at the 1972 American Dental Association session, 0.9 percent tested positive for hepatitis B surface antigens, 12.7 per cent were antibody positive, and 43 per cent were seropositive with clinical hepatitis.

Another study by Reingold et al, (1988) which surveyed 434 dentists in California to examine risk factors for hepatitis B virus (HBV) infection, reported that seropositivity (12-26%) could be associated with age, work experience, number of years in practice, and training received. The strong correlation between years in practice and seropositivity was not affected by the reported use of gloves, face masks, or eye shields.

The use of gloves and other protective devices did not appear to offer substantial protection against HBV exposure in oral surgeons. They recommended that all health workers should receive HBV vaccinations.

Avoiding occupational blood exposures is the primary method used in preventing the transmission of the HBV, the HCV, and the HIV in the health-care setting (CDC, 1998b). However, hepatitis B immunisation and post-exposure management are integral components of a complete programme to prevent infection following the exposure to blood-borne pathogens and are an important element of workplace safety (OHSA, 1996; CDC, 1998c). Currently, there is no acceptable vaccine against HIV.

2.3. COMPLIANCE WITH UNIVERSAL PRECAUTIONS

2.3.1. Compliance among health care workers

Although UPs have been routinely practised in high-income countries such as Spain, reports from the USA and the United Kingdom (UK) (CDC, 2003) indicate that full compliance has been difficult to achieve. Non-compliance has been associated with a range of factors, which include a lack of knowledge (Henry et al, 1994; Gershon et al, 1995; Michalsen et al, 1997), an interference with work skills (Kelen et al, 1990; Henry et al, 1994), risk perception (Gershon et al, 1995), a conflict of interest (Gershon et al, 1995; Michalsen et al, 1997), not wanting to offend patients (Ramsey et al, 1996), a lack

of equipment (Henry et al, 1994; Nelsing et al, 1997) and time ((Kelen et al, 1990), uncomfortable personal protective equipment (PPE) (Kelen et al, 1990), inconvenience (Nelsing et al, 1997), work stress (Michalsen et al, 1997), and with a perceived climate of weak organisational commitment to safety (Gershon et al, 1995; Michalsen et al, 1997).

In contrast to the situation in high-income countries, the occupational safety of HCWs in low-income countries remains a neglected issue, even though OHCWs are probably at a greater risk of infection by blood-borne pathogens because of higher disease prevalence among the patient populations (Sagoe-Moses et al, 2001). In the health-care settings of low-income countries, UPs tend to be practised selectively (i.e., when a patient is known to be infected with a blood-borne pathogen) rather than universally (Kermode, 2005). An awareness of the risks associated with occupational exposures to blood is often lacking, supplies of personal protective equipment (PPE) are inadequate, and organisational support for safe practices is limited (Huskins et al, 1998; Sagoe-Moses et al, 2001).

Notwithstanding the above generalisation for high- and low-income countries, compliance to UPs remains a key problem. In an observational, multi-centre survey to investigate the degree of compliance with hand hygiene and use of gloves by Spain's hospital health workers in haemodialysis units, Arenas et al (2005) reported that gloves were actually used on 92.9% of occasions. Hands were washed only 35.6% of the time after patient contact and only 13.8% of the time before patient contact.

Poor adherence to hand washing among nurses was due to high number of patients treated by nurses. The personnel's knowledge of patients' infectious status did not modify their level of adherence to hand hygiene practices.

In a study conducted among 124 health care institutions in South-East France, Mallaret et al (2004) reported that 28.9% of the facilities lacked hand-washing water points, 32.2% had no sinks, and 48.5% had no local equipment maintenance. In USA, Doebbeling and others (2003) reported the mean rates of hand washing to be as low as 32% among medical doctors and nurses. These results highlight some of the problems encountered by high-income countries in applying UPs guidelines.

In a hand-decontamination practice survey (Jelly and Tjale, 2003) carried out among health professionals working in paediatric wards of Johannesburg Hospital, South Africa, compliance with standard hand-decontamination practices of the health professionals was found to be low (16.6% of the respondents failed to wash their hands at the start of work). Significantly, more health professionals washed their hands following contact with patients (63.6%) and following the removal of gloves (77.8%). More than half of the health professionals (51.5%) did not wash their hands after leaving the ward, whilst only 57.6% of the health professionals who decontaminated their hands used the correct hand washing technique.

2.3.2. Compliance among oral health care workers

In a further study, the cross-infection compliance of UK dental staff and students (Porter et al, 1995) working in a dental clinic was observed by a 'hidden' ceiling-mounted video camera. Procedures were recorded onto videotape, and the actions of the clinicians were observed. Porters and others, (1995) reported that the compliance with recommended guidelines for the control of cross-infection was poor.

It was further found that only 56% of the dental staff changed their gloves between patients. Facemasks and protective eyewear were only worn in 38% and 29% respectively. It was concluded that compliance with cross-infection-control measures was poor in dentistry even when clinicians were provided with appropriate facilities. In a study done by Scully and others (1992) in the UK, compliance with infection-control procedures in a dental hospital clinic was rated between low and high. Nearly all health care workers (96%) wore gloves to carry out dental treatments. In some cases gloves were neither changed nor hands washed between patients. Only one half of the dental assistants wore protective eyewear and about one third (38%) wore no masks. Some of the dental surgery assistants were seen wearing heavy-duty gloves (35%) whilst others observed were not complying with UPs. A small percentage of dental assistants (12%) were reported to have scrubbed soiled dental instruments without wearing any gloves.

In Sudan, Elkarim et al (2004) reported that 92% of dentists routinely wore gloves when treating patients, 50% wore face masks, 61% wore gowns, and 14.7% wore protective eye wear. Furthermore, 52% of the practitioners had been immunised against hepatitis B.

In a study conducted in Jordan among dentists, 81.8 % reported that they wore gloves during treatments and changed them between patients. However, a significantly smaller percentage (54.5%) reported wearing masks during treatments and changing them between patients (Al-Omari & Al-Dwairi, 2005). In a South African study among public service oral health workers, Rudolph and others (1998) reported that 50.0% of dentists did not discard gloves that were torn, cut, or punctured, whilst 12.1% did not change gloves for every patients treated.

Several studies done in Africa have reported that compliance rates with UPs among oral health care workers in oral health facilities (Naidoo, 1997; Akduman et al, 1998; Rudolph et al, 1998; Kopsala, 2000; Yengopal et al, 2001; Ogunbodede and Rudolph, 2002; Oosthuysen, 2002; Ogunbodede, 2004) ranged from 70 percent to 98 percent.

Barriers to compliance have been reported on extensively in literature. Some of these barriers include a lack of time (71% to 74%), the perceived "low risk" of patients (50% to 57%), the interference of personal protective equipment (PPE) with care (55%), and the unavailability of PPE (19.3-41%) (Nelsing et al, 1997; Grady et al, 1993). Other studies conducted in Denmark (Grady et al, 1993; Henry et al, 1994) have also concluded that a correlation exists between barriers and compliance.

The evidence from the literature suggests that poor compliance with UPs is the norm rather than the exception and occurs regardless of whether resources are available or not.

2.4. OCCUPATIONAL EXPOSURES IN DENTAL SETTINGS

Global statistics on occupational exposures to blood-borne pathogens among health care workers are a cause for concern (Wong et al, 1991; Osborn et al, 1999). In one study, an Australian hospital survey, Smith et al (2005) reported that the most commonly exposed staff members were the nurses(63.5%), followed by doctors (18.8%) and other staff (17.7%). The most common occupational exposures reported were needlestick injuries (38.9%), cutaneous exposures (32.7%), and other sharps-related injuries (28.4%).

There are several published reports of occupational blood exposures in dentistry (Porter et al, 1989; Siew et al, 1995; Ramos-Gomez et al, 1997; Kennedy and Hasler, 1999; Cleveland & Cardo, 2003). These studies vary significantly in their study designs and range from surveys of practising dentists/dental residents and dental schools to cross-sectional analyses of existing surveillance records and prospective studies of exposures. The analyses of data collected through these reports and future surveillance systems of dental occupational exposures are crucial to the development of safer dental products, practice modifications, and eventually for the creation of a standardised method of data collection.

The risk to dentists of acquiring a serious infection from their patients has been well recognised, and much has been published regarding the incidents of occupational exposures to blood and body fluids amongst dentists (Cleveland et al, 1995; McDonald et al, 1997; Webber, 2000; Younai et al, 2001). The incidents of exposures have been found by some researchers to be higher in dental assistants than in dentists.

Ramos-Gomez and others (1997) conducted a study at four dental teaching clinics in the USA, using a standard questionnaire to solicit and record data regarding accidental exposures to blood and body fluids. During a 63-month period, 428 parenteral exposures to blood or body fluids were documented. Dental students and dental assistants reported the highest rates of exposure. Syringe needle injuries were the most common type of exposure, while giving injections, cleaning instruments after procedures, and drilling were the activities most frequently associated with exposures.

McDonald et al (1997) analysed workplace injuries over a three-year period in an Australian dental school. Reports indicated that dental students experienced the highest number of injuries with a high risk of cross-infection, whilst dental assistants (35%) experienced the highest frequency of injuries per hours worked. In the same study, the most frequently reported causes of injuries to assistants were dental probes (27.8%), followed by burs (20.4%) and needle sticks during the disposal of local anaesthetic needles (18%).

Dental assistants working in specialised areas such as in orthodontic clinics, experienced different incidents of occupational exposure. In United States of America (USA), McNamara and Bagramian (1999) undertook a prospective survey amongst orthodontic assistants and reported that while orthodontic assistants have a slightly higher rate of injuries (33.1%) than orthodontists (32.9%), their annual rate of percutaneous injuries is less than half of that of dentists in general practice.
Experienced assistants were also shown to have a lower injury rate than those with less experience. Other studies carried out in the UK have demonstrated a higher risk of injury among unqualified assistants (Porter, 1989; Tokars et al, 1993).

In Africa, only one study on occupational exposures was found in the published literature (Medline search, 2006). The survey was carried out in Nigeria among dental assistants (Fasunloro and Owotade, 2004). Results from the study showed that oral health workers were exposed to occupational exposures, especially during invasive procedures and the disposal of local anaesthetic needles (32%). More than 37% of the respondents had experienced sharps injuries, including punctures, without reporting these (Fasunloro and Owotade, 2004).

There have been two African studies of needle stick injuries occurring in medical schools. Karstaedt and Pantanowitz (2001*)* carried out a study over two months in Johannesburg and Soweto, which involved 102 medical interns. They found that 83% of interns experienced at least one percutaneous injury, 43% being from an HIV-positive

source. Similarly, 54% recalled at least one mucocutaneous exposure, with 70% of these being from an HIV-positive source. Most (69%) of the percutaneous injuries were caused by a hollow needle.

Reasons for not reporting the exposures were predominantly stated as being: “no perceived health risk “ in respondents without HIV exposures and “insufficient time” in those with HIV exposures.

Newsom and Kiwanuka (2002*)* reported that needle stick injuries were common in a Ugandan medical school. Medical interns reported the injuries, followed by nurses and medical students. Most injuries occurred when patients moved during procedures or when they were re-sheathing needles. Most respondents (61%) took blood without wearing gloves. The risk from a single needle stick injury for HIV infection was about 0.08%, and for hepatitis B infection it was 0.135%.

There was only one published report on occupational exposures in South Africa (Webber, 2000). Although the study was done among OHCWs, dental assistants were not the main focus of the study. Blood-borne viruses, notably the HBV and HIV and occupational exposures were reported to pose a serious risk among oral health care workers in South Africa. It was recommended that OHCWs should adhere strictly to standard precautions and preventive strategies, should actively cultivate a safety-conscious attitude to their work, and should actively promote a culture of health and safety in their profession (Webber, 2000).

2.5. COMMON TYPES OF OCCUPATIONAL EXPOSURE

The type of occupational exposure most likely to transmit a blood-borne infection is a percutaneous injury (Cleveland & Cardo, 2003; Al-Sarheed, 2004). Percutaneous injuries are considered the most probable portal of entry for micro-organisms during accidental occupational exposures. This is documented by the surveillance data compiled by the CDC from 1981 to 2004.

During that twenty-three-year period there were a total of 56 documented cases of occupationally acquired HIV infections, which were reported in the USA. Forty-eight of these (86 %) were confirmed as being due to percutaneous exposures, while only five (9 percent) were confirmed to stem from mucous membrane contacts (CDC, 1998a).

In a longitudinal study on occupational exposures to blood in the dental teaching environment, the New York University College (Younai et al, 2001) reported that, out of 494 percutaneous exposures, almost 63 percent were related to instrument punctures or cuts and 38 percent to needle sticks. In a recently released study of 428 parenteral exposures to blood or other body fluids, conducted at four teaching clinics in San Francisco, 60 percent of injuries resulted from instrument punctures or cuts, and 36 percent were due to needle sticks (Ramos-Gomez et al, 1997).

In another study of eighty-one percutaneous exposures to blood and other potentially infectious materials at the dental training institutions in the USA, 69 percent of

exposures were puncture wounds or cuts from a variety of instruments (burs, explorers, scalers, laboratory knives, etc), and 31 percent were needle sticks.(Panagakos & Silverstein, 1997).

In terms of the severity of dental exposures, information on the depth of injury and presence or absence of visible blood on the instrument is not consistently available from the published reports. It appears that the majority of exposures in the dental environment are of a superficial nature (51.6 percent in the Younai et al (2001) study and 83 percent in the Ramos-Gomez et al (1997) study. It must be emphasised that collecting information on the details of exposures is crucial to the process of risk assessment. Epidemiologic and laboratory studies suggest that factors such as the depth of an injury or the volume of blood involved in an exposure affect the risk of HIV transmission after an occupational exposure (Mast et al, 1993; Cardo et al, 1997).

2.6. INSTRUMENTS LIKELY TO CAUSE OCCUPATIONAL EXPOSURES

McDonald et al (1997) reported that the most frequently reported causes of injuries to assistants were firstly dental probes and then burs and needle sticks, which injuries took place during the disposal of local anaesthetic needles. Dental assistants working in specialised areas such as in orthodontic clinics experienced percutaneous injuries caused by orthodontic wires and instruments (McNamara & Bagramian, 1999).

In the study by Karstaedt and Pantanowitz (2001), most of the percutaneous injuries occurred with a hollow needle (69%). Their results were consistent with those of a Ugandan study by Newsom and Kiwanuka (2002), which reported that 61% of percutaneous injuries occurred as result of needle sticks.

A review of the dental literature indicates that the rate of injuries from anaesthetic needles is high. It has been reported as being the cause in 36 percent (Gonzalez et al, 1997), 34 percent (Younai et al, 2001), 33 percent (Ramos-Gomez et al, 1997) and 31 percent (Panagakos and Silverstein, 1997) of studied cases respectively. Injuries caused by dental burs were also relatively high: 26 percent (Mitsui et al, 1992), 17 percent (Ramos-Gomez et al, 1997), 9 percent, and 8 percent (Gonzalez et al, 1997). Younai et al, 2001, reported scalers and curettes to be involved in 12 percent of occupational injuries (10 percent and 2 percent, respectively). In the study by Ramos-Gomez et al (1997) burs, scalers and curettes were categorised together as causing 8 percent of exposures (Ramos-Gomez et al, 1997). Although not commonly reported in dental studies, exposures related to the waxing instruments used during chair-side or laboratory prosthetic procedures were reported by 17.7 percent of surveyed workers (Younai et al, 2001).

2.7. RATES OF REPORTING OCCUPATIONAL EXPOSURES

The occupational exposure rates reported in the dental literature are expressed either in terms of the number of exposures per 10,000 patient visits, in terms of the number of exposures per 100 person-years (or variations of these) or in percentages.

Kennedy and Hasler (1999) attempted to establish a benchmark for the rate of occupational exposures within dental settings. In their report, in which twenty-eight of fifty-three U.S. dental schools responded to a mailed survey, the average exposure rate was reported as 4.0/10,000 patient visits for the third- and fourth-year dental students and 1.30/10,000 patient visits for the faculty in the faculty practice clinics.

Other rates described in the literature include 3.53/10,000 visits reported by Ramos-Gomez and colleagues (1997) (a prospective study of 428 documented exposures over a five-year period at four dental teaching clinics in San Francisco), and 12.5/10,000 patient visits reported by Cleveland et al (1995).

Both rates reported above were lower than the national average for dental schools in the United States as reported by Kennedy and Hasler (1999) (10.6 per 100 person-years for dental students) and those reported by Ramos-Gomez and colleagues in 1997 (8.4/100 person-years for dental students and 5.3/100 person-years for the residents).

These rates were significantly lower than the rates reported by Cleveland and colleagues, 1996, (396/100 person-years for the dental residents) and by Siew and

colleagues, 1995 (280/100 person-years for the practising dentists). The variations observed among these reports may be related to the differences in the methods of data collection.

The study reported on by Siew and colleagues consisted of self-reported exposures documented in a diary over a twenty-day period by participating dentists. The data reported by Cleveland et al (1996) was based on the actual observation of dental residents during the exposures. In both studies the rate of accurate reporting of exposures may have been higher than in some of the reports from dental school environments that relied on the exposed OHCW's compliance with complicated post-exposure management protocols.

Several studies have shown that health care workers, especially physicians in training, often do not report exposures because of a fear of losing insurance benefits or their employment, because of mistrust in the efficacy of prophylaxis, or because of a tendency to deny personal risk (Mangione et al, 1991; Stotka et al, 1991; Vergilio et al, 1993; Resnic and Noerdlinger, 1995; Koenig and Chu, 1995; Evans et al, 1996; Tereskerz et al, 1996).

The rate of reporting among OHCWs has been shown to lie between 15% and 35 % (Kotelchuck et al, 2004). In medical practice, reporting rates range from 30% to 40% (Koenig & Chu, 1995).

In a study carried out among employees in medical emergency departments in the USA the rate of reporting occupational injuries was higher than 66% (Jagger et al, 1994). In the study by Kotelchuck et al (2004) 34% of injuries were reported by the students in dental teaching, yet only 35% of needle stick injuries recalled by subjects were reported.

The risk for exposure to and infection by blood-borne pathogens among dental assistants in South Africa is not known, and anecdotal reports probably underestimate the actual risk because many exposures are not reported. Evidence suggests that dental assistants may be at an increased risk of exposure to blood-borne infections (Gonzalez et al, 1997; O'Neil et al, 1992; Koenig & Chu, 1995; Kennedy & Hasler, 1999; Osborn et al, 1999; Rosenthal et al, 1999). A close observation of dental assistants' infection-control practices and studies concerning the circumstances involved in their occupational blood/infectious body fluids exposures could lead to the introduction of safer devices and work practices that will offer dental assistants the best possible protection from infections.

The principal reasons suggested by various authors for not reporting occupational exposures among health workers, including oral health workers, were time constraints, the perceptions that percutaneous injuries did not represent a significant exposure, the perceptions that an injury or splash was minor, the perceptions that a patient was a low risk, that the instrument or device was clean, a lack of knowledge about the reporting mechanisms, and concerns about confidentiality and professional discrimination (Nelsing et al, 1993; Dement et al, 2004; Al-Sarheed, 2004).

The review of the literature has highlighted the importance of establishing the level of occupational exposure, the rate of reporting, the preventive and protective measures that are in place, and of determining the various factors that may contribute to exposures among dental assistants who are key members of the dental team.

2.8. RESEARCH QUESTION

What are the prevalence and the type of occupational exposures among dental assistants in Limpopo Province (LP), South Africa?

2.9. AIM OF THE STUDY

The aim of the study was to investigate the prevalence of occupational exposures among dental assistants in Limpopo Province and their level of adherence to universal precautions.

2.10. OBJECTIVES

The objectives of the study were:

1. To establish the prevalence and the types of occupational exposures among dental assistants;
2. To determine the adherence to universal precautions as recommended by CDC guidelines, 2003;
3. To identify the protective measures taken to prevent occupational exposures;
4. To assess the rate of reporting of and the management of occupational exposures; and
5. To determine the demographic profile of dental assistants in Limpopo Province.

CHAPTER THREE

MATERIALS AND METHODS

3.1. STUDY DESIGN

This was a cross-sectional analytical study.

3.2. STUDY POPULATION

A list of all public hospitals with dental facilities was obtained from the Department of Health and Social Development in Limpopo Province. There were 45 public hospitals in six districts of Limpopo Province at the time. Out of the 45 hospitals, 38 had dental facilities. The dental facilities were clustered according to the existing six districts in Limpopo Province: Bothlabelo (B), Capricon (C), Mopani (M), Waterberg (W), Sekhukhune (S) and Vhembe (V)**.** The study population comprised all employees in these public dental facilities who performed dental assisting work, both trained and untrained, and included auxiliary nurses.

3.3. SAMPLING

The sampling frame included all provincial oral health databases for dental assistants from 2005. It included auxiliary nurses, technikon-trained dental assistants, dental

assistants who had studied through distance-learning institutions, and untrained dental assistants.

The sample was limited to dental assistants who provided direct patient care. The selection was aimed at identifying those who were at risk to blood exposures. Those excluded were dental assistants whose primary activities were in administration or management. The final sample was 73 dental assistants out of 81(8 were working in administration offices).

3.4. DATA COLLECTION INSTRUMENT

The survey utilised a self-administered questionnaire. This instrument was selected because of the following advantages (Gershon et al, 1995; Kermode et al, 2005):

- Cost was relatively low;
- Freedom /anonymity of the respondent;
- The survey could be undertaken in a relatively short period of time;
- Geographic coverage, particularly in Limpopo Province, was more efficient.
- This method was deemed acceptable by the participants.

In terms of the second point above, the respondent could decide whether he/she wanted to complete the questionnaire and also when, where and how much time he/she wished to spend on it. This was particularly relevant for this investigation.

3.5. DEVELOPMENT OF THE QUESTIONNAIRE

The questionnaire was compiled and developed in consultation with supervisors and a statistician. Questionnaires from other similar surveys were studied and adapted accordingly (Gershon et al, 1995; Rudolph et al, 1998; Stewardson et al, 2003; Kermode et al, 2005). To maximise the responses, the questionnaire was limited to closed-ended questions. Categorical responses were predefined and neutral phrasing was used primarily. The questionnaire was divided into three areas of enquiry (**Appendix A)**:

A. Demographic information;
B. Knowledge, attitudes and practices of the principles of universal precautions;
C. And occupational exposure and management.

As a guide to the respondents on which occupational exposures should be included, the following definition was integrated:

An occupational exposure is defined as a percutaneous injury (e.g. a needlestick or a cut with a sharp object) or contact of a mucous membrane or non-intact skin (e.g. exposed skin that is chapped, abraded, or afflicted with dermatitis) with blood, tissue, or other body fluids that are potentially infectious (CDC, 1988 and 2003).

An occupational exposure occurs when:

1. Sharp injury - Your skin is punctured by a used needle or other sharp instrument.

*2. Mucocutaneous blood exposure - Blood or other potentially infectious material, such as saliva, comes into contact with broken skin or a mucous membrane (eye, mouth, nose), while carrying out your duties – chair-side assisting, cleaning and removing used instruments, handling soiled impressions, dentures and other similar appliances (*Stewardson et al, 2003).

The measured outcomes of interest were occupational sharps injuries and mucocutaneous blood exposures, proportions of injuries reported, and the adherence to UP guidelines. Respondents were asked to estimate the number of (1) exposures of skin, mouth, eyes, and/or nose to blood, (2) total sharps injuries, (3) rate of reporting and management of exposure injuries in the past 6 months. A six-month time period was used in order to minimise recall bias and to still obtain adequate precision of the estimates (Zwerling et al, 1995; CDC, 1998a). Compliance was rated as low (<50%), medium (50-80%), or high (>80%).

3.6. PILOT STUDY

The questionnaire was piloted among six dental assistants in Mpumalanga Province who were likely to be in contact with blood, needles, and sharps. The pilot study had the following objectives:

- To test the time needed for the completion of the questionnaire;
- To test the clarity of the questions; and

- To elicit any suggestions and comments that could improve the overall quality and or practical implementation of the questionnaire.

3.7. ETHICAL PROCEDURES

The protocol was approved by the Committee for Research on Human Subjects of the University of the Witwatersrand for ethical clearance, ***M 0 4 1 1 1 9*** (Appendix **E**), and the Postgraduate Committee in the School of Public Health, Faculty of Health Sciences (**Appendix F**).

The protocol was also submitted and presented to the Research Committee in the Department of Health and Welfare in Limpopo Province (**Appendix C**). Permission to conduct the study was granted (**Appendix D**). The same protocol was presented at the meeting of oral health workers in Limpopo Province for their assistance and support.

3.8. DISTRIBUTION OF THE QUESTIONNAIRES

A modified Dillman method was used together with various strategies to maximise response rates (Morris et al, 2001; Barclay et al, 2002; Calleja et al, 2005). The delivery of the questionnaires for this study took place between May and June 2005. At a meeting of oral health workers in Limpopo Province the researcher presented the protocol to the audience, informing them about the aim and objectives of the study and requesting support for the survey.

Subject information sheets, questionnaires and prepaid return envelopes were handed out to dental assistants with the assistance of chief dentists and the provincial oral health manager (**Appendix B**).

A week later, the researcher telephonically contacted all Dental Assistants in public hospitals in Limpopo Province to see if they had received the questionnaire and to re-iterate the importance of the survey and to request that they complete and return the questionnaires to the provincial oral health manager. These questionnaires were collected in person by the provincial oral health manager. Twenty respondents had not returned the questionnaires five weeks after the time of delivery. A further two weeks was given to these dental assistants to return the questionnaires. Those who did not wish to participate, despite the two-week extension, were encouraged to return the questionnaire unanswered. The researcher felt that the participants had been given more than enough time to return the questionnaires and that any further time extension would not yield a better response.

The questionnaires were delivered to 73 dental assistants, 65 were completed and returned (80.8%). Eight questionnaires were not returned (19.2%). Of the returned questionnaires 6 were excluded due to incomplete responses.

All the participants who met the inclusion criteria were included in the analysis. The survey was representative of all dental assistants working in public facilities in Limpopo Province, and the findings could be generalised to the wider population of dental assistants.

3.9. STATISTICAL ANALYSIS

Data from completed questionnaires was entered into a computer database and analysed using SPSS version 10.0 (Norusis, 1986). The descriptive statistics, variable scaling, and bivariate relationships were also assessed. The contingency table analyses of the possible associations between demographic and qualification variables and either percutaneous injury or mucocutaneous blood exposure was assessed with a χ^2 test. Where necessary, appropriate follow-up comparisons were made. Differences were considered significant at 0.05, with the confidence level set at 95%. A predictive analysis was used to estimate the odds of blood exposures and sharp-injuries. An odds ratio is a way of comparing whether the probability of a certain event is the same for two groups. An odds ratio greater than one implies that an event is more likely to occur and an odds ratio of less than one implies that the event is less likely to occur.

CHAPTER FOUR

RESULTS

4.1. RESPONSE RATE

At the time of the survey there were 45 public hospitals (including specialised hospitals) in Limpopo Province, of which seven had no oral health facilities. There were 73 employees working as dental assistants in 38 public hospitals of LP. Fifty-nine dental assistants returned the completed questionnaire, giving a response rate of 80.8%. Epi Info Version 3.3.2 programme was used to analyze the data.

4.2. DEMOGRAPHIC INFORMATION

A demographic profile of the participants in this survey has been summarised in **Table 4.1**. All the assistants who responded to the survey were black (100%) and were predominantly female (95%). The mean age of respondents was 40.2 years (range: 24-56 years; SD: 8.9). More than 60% of the dental assistants employed in the Capricorn, Mopani, Vhembe and Waterberg districts had worked in their positions for more than 12 months, whilst 67% of dental assistants in the Sekhukhune district had less than three months' working experience.

Table 4.1 Number and percentage of dental assistants from Limpopo Province by specific characteristics

								Number (n)	**%**
Gender	Male							3	**5.1**
	Female							56	**94.9**
Age in years Mean age(sd) **40.2 (8.9)**	<30							11	18.6
	31-40							29	**49.2**
	41-50							14	**23.7**
	>50							5	8.5
Health districts: Bothlabelo(B), Capricon (C), Mopani (M), Waterberg(W), Sekhukhune(S) and Vhembe(V)		**B (n)**	**C (n)**	**M (n)**	**S (n)**	**V (n)**	**W (n)**	**No**	**%**
No of months working at a dental clinic as Dental Assistant (**Mean :1.2 years, Range:0.1-12 years; SD, 9.5**)	<12	3	2	3	3	7	2	20	**34**
	>12	5	9	6	3	8	8	39	**66.1**
Training experiences	Distance learning							11	**18.6**
	Auxiliary nurses							13	**22.1**
	Untrained assistants							29	**49.1**
	Technikon or university trained							6	**10.2**

In terms of previous training experience, almost half of the respondents (49.1%) were untrained assistants, 22% were auxiliary nurses, 18.6% were “correspondence-trained” assistants who had been trained via distance learning and had no practical clinical training and only 10.2% of the respondents had received training at a technikon or university.

Note: The HPCSA recognises only DAs that have been trained at an accredited technikon or university.

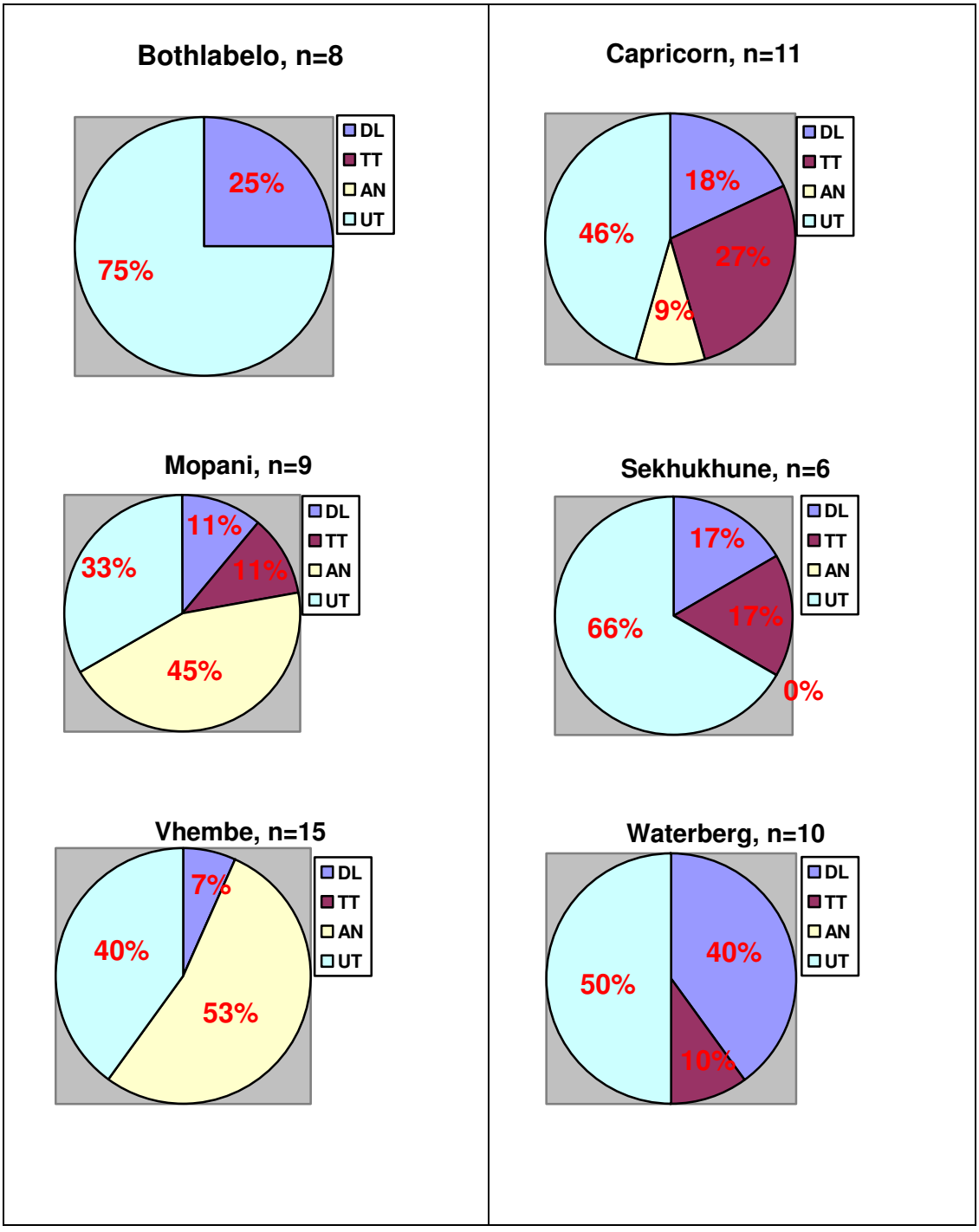


Figure 4.1 Distribution of dental assistants per district. Distance-trained assistants **(DL),** n=11 (18.6%); technicon-trained **(TT**), n=6 (10.2%); auxiliary nurses **(AN),** n=13 **(22%)**; and *untrained assistants **(UT**), n=29 (49.1%).*

The distribution of dental assistants **(Figure 4.1**) indicates that Vhembe district has the most dental assistants (n=15). It is clear that most dental assistants employed in LP have had no proper training to effectively carry out their duties. The majority were auxiliary nurses (n=8), followed by untrained assistants (n=6). Two of the districts, Bothlabelo and Vhembe, had no properly trained assistants at all.

4.3. WORK LOAD OF THE DENTAL ASSISTANTS

Table 4.2 Number and percentage of dental assistants by work load

		N=59	%
No of dental assistants working at facility	One	34	**57.6**
	Two	18	30.5
	Three	5	8.5
	Four or more	2	3.4
Number of clinicians assisted at facility	One	11	18.6
	Two	12	20.3
	Three or more	**36**	**61.1**
Number of patients treated per day	Fewer than 15	5	8.5
	Between 15-25	12	20.3
	Between 26-40	**27**	**45.7**
	More than 40	**15**	**25.4**

Men	*sd*	*Min*	*25%*	*Med*	*75%*	*Max*	*Mode*
3.8	*1.9*	*1*	*3*	*4*	*4*	*7*	*4*

Table 4.2 provides the information on the workload of DAs in LP. The majority of the dental facilities (57.6%) had only one dental assistant. Less than 4% of the facilities had more than four assistants at any point in time. Sixty-one percent of the assistants were employed in the clinics in which they were required to assist more than three clinicians at any given time. More than 71% (42) of dental assistants worked in dental clinics that treated more than 26 patients per day. The mean number of clinicians assisted by each respondent was 3.8 (SD+/- 1.9). The highest number of clinicians assisted by a single assistant within the previous six months was seven. This study showed that the shortage of dental assistants resulted in other nursing assistants (22%) being "permanently" placed at dental clinics **(Figure 4.1**).

4.4. KNOWLEDGE AND UNDERSTANDING OF UNIVERSAL PRECAUTIONS (UPs)

The knowledge and understanding of UPs that the respondents showed is summarised in **Figure 4.2.**

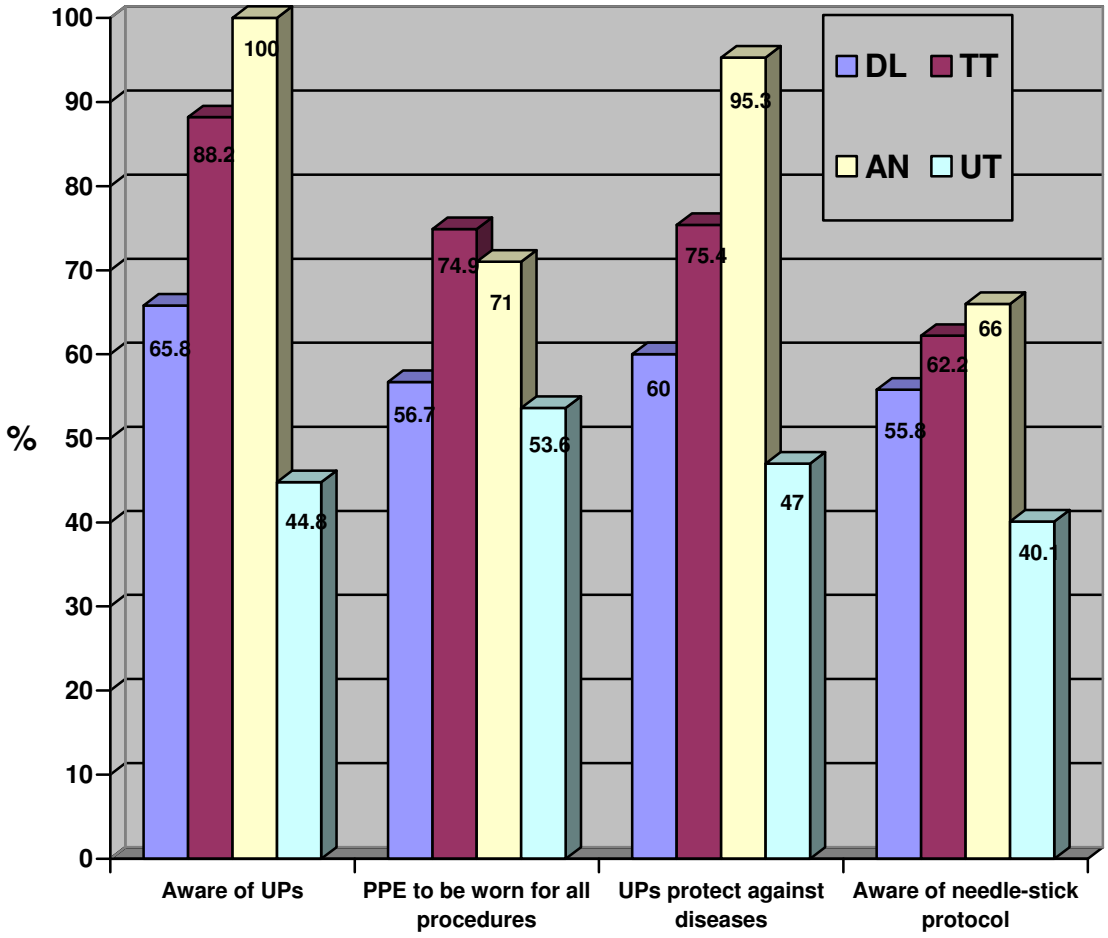


Figure 4.2 Knowledge and understanding of Universal Precaution and infection transmission among dental assistants by type of training. DL= distance-trained assistants; TT=technikon-trained; AN=auxiliary nurses; and UT=untrained assistants *(UT)*.

Knowledge of UPs varied among the respondents (see Fig 4. 2). The least informed were the untrained assistants, nearly half (44.8%) being unfamiliar with the term “UPs”. In contrast, 100% of the nurses were aware of UPs, followed by technikon-trained assistants (88.2%) and distance-trained assistants (65.8%).

The awareness level of needle stick protocol was lower than that of UPs across assistants with all types of training.

Auxiliary nurses and trained assistants were significantly more likely than untrained assistants to be aware of universal precautions, their protective effects, needle stick protocols, and of the need for PPE to be worn for all procedures ($p=0.001$). There was no significant differences between UT and DL dental assistants regarding their knowledge of PPE ($p=0.07$), nor between AN and TT dental assistants regarding awareness of needle-stick protocol ($p=0.09$).

4.5. OVERALL COMPLIANCE WITH UNIVERSAL PRECAUTIONS

Table 4.3 provides information on compliance with UPs**.** Self-reported compliance with some practices, such as wearing gloves during procedures, the changing of gloves, making sure that instruments are autoclaved, and wearing gloves during waste disposal was high (>80%), but compliance with several other practices such as the use of eye protection and the washing of hands before gloving was low (<50%). Twenty-eight percent of the assistants acknowledged that some of the reusable instruments, such as the hand pieces and their attachments, were reused without being sterilised. Thirty two percent of them did not disinfect the working surfaces and light handles after procedures. All respondents reported using their hands to recap used needles.

Table 4.3 Number and percentage of subjects by reported compliance with Universal Precaution

Items	COMPLIANCE WITH UNIVERSAL PRECAUTION					
	YES		NO		TOTAL	
	No.	%	No.	%	No.	%
I wear gloves during procedure	54	**91.5**	5	8.5	59	100.0
I wash hands before putting on gloves	32	54.2	27	45.8	59	100.0
I wear a mask during procedures	30	50.8	29	49.2	59	100.0
I change gloves for each patient	48	**81.3**	11	19.7	59	100.0
I wash hands before removing gloves	45	76.3	14	23.7	59	100.0
I always wear protective garments during	38	64.4	21	35.6	59	100.0
I make sure that hand instruments are autoclaved/chemoclaved before use	50	84.7	9	15.3	59	100.0
I disinfect working surface and light handles after each patient	40	67.8	19	32.2	59	100.0
I usually recap used needles	49	**83.0**	10	17.0	59	100.0
I use my hands to recap used needles	59	**100**	0	0	59	100.0
I immediately dispose used needles	54	91.5	5	8.5	59	100.0
I wear eye protection while assisting	19	28.2	40	**67.8**	**59**	100.0
I received all three HBV vaccinations	37	62.7	22	**37.3**	**59**	100.0

Almost half of the respondents (49.2%) indicated that they did not wear facemasks. Nearly two thirds of the respondents (40 out of 59 respondents) did not wear eye protection against potentially infectious agents and flying debris during procedures. Thirty-seven percent (22) of the respondents were not vaccinated against HBV.

4.6 COMPLIANCE BY TYPES OF TRAINING

Figure 4.3 illustrates the use of barrier techniques classified according to the types of training among dental assistants. Auxiliary nurses reported the highest compliance with the wearing of gloves (98%), the changing of gloves between patients (88%), the recapping of used needles (77%) and the washing of hands between patients (52%) when compared to others assistants. The second highest compliance rate was reported by technikon-trained assistants, followed by distance-trained assistants. Untrained assistants reported the lowest compliance rate.

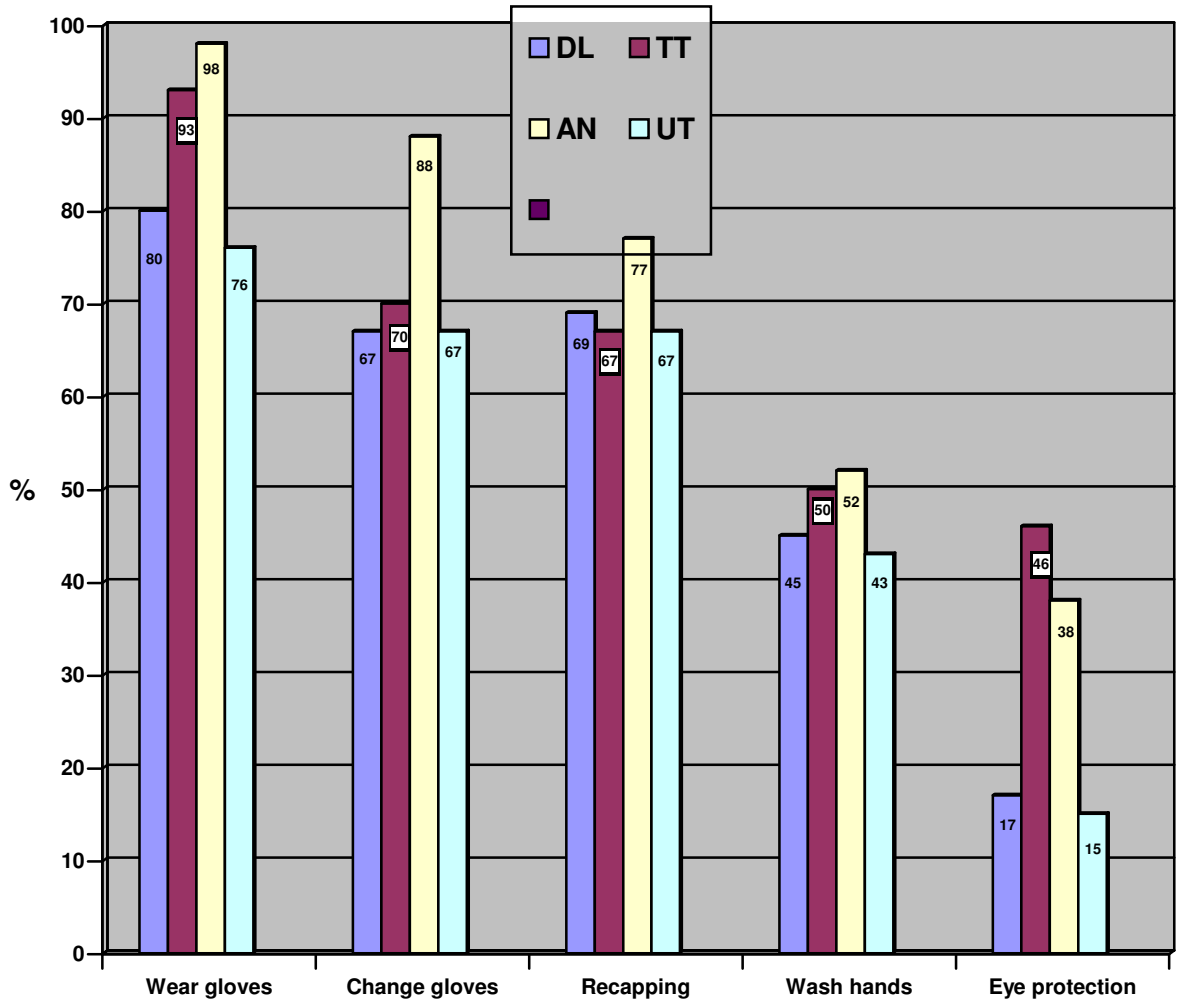


Figure 4.3 Use of Universal Precautions among dental assistants by type of training. DL= distance-trained assistants, TT=technicon-trained assistants; AN=auxiliary nurses; and UT=untrained assistants

Auxiliary nurses (AN) were significantly more likely than untrained assistants (UT) to "always wear gloves" ,"always change gloves", "always wash hands before gloving and after removing gloves" and "always wear eye protection while assisting" (p=0.002).

There was no significant difference between untrained and distance-trained assistants regarding the wearing of eye protection or face shields (p=0.08)

4.7 BARRIERS TO SAFE PRACTICE OF INFECTION CONTROL

Respondents were asked to express their experiences with regard to the environment that enables them to comply with UPs, including the support received from line function supervisors. The responses of respondents in terms of barriers to the safe practice of infection control ranged from blaming a lack of materials to blaming a lack of information on protection measures against infectious diseases (**Table 4.4**).

Table 4.4 Number and percentage of the respondents related to barriers to safe practice

Items * UPs= universal precautions ; PPE= personal protective equipments	Agree		Disagree			
	Yes	%	Yes	%	No	%
Gloves are not available	3	5.1	56	84.9	59	100
Gloves are not sufficient for changing	13	22.0	46	88.0	59	100
Water is not always available	7	11.9	52	88.1	59	100
Face masks are not readily available	16	27.1	43	62.9	59	100
No autoclave machine (not working)	10	16.9	49	83.1	59	100
Disinfectant usually not available or in short supply	15	25.4	44	74.6	59	100
Protective garments are often not available	**45**	**76.3**	**14**	**23.7**	59	100
Special waste disposal system is not available	**53**	**89.8**	**6**	**10.2**	59	100
No eye protection glasses/shields available	**34**	**57.6**	**25**	**42.4**	59	100
I know how to protect myself from blood-borne eases	**57**	**97.4**	**2**	**2.6**	59	100
I am too busy to follow the recommended UPs*	25	43.8	34	56.2	59	100
I don't use UPs because my workmates don't use it	**38**	**65.6**	**21**	**34.4**	59	100
If I use UPs it may offend the patients	**33**	**55.8**	**26**	**44.2**	59	100
In emergency situations, use of UPs is not necessary	15	25.0	44	75.0	59	100
Patients here don't have diseases such as HIV/AIDS	**44**	**74.3**	**15**	**25.7**	59	100
I 'm trained in the correct use of protective equipment	44	74.3	15	25.7	59	100
Protective equipment makes me feel uncomfortable	31	53.9	28	46.1	59	100
Wearing PPE makes it difficult to do the job properly	35	59.2	24	40.8	59	100

Although the majority (94.9%) of the respondents agreed that gloves were available, 22% reported that there was an insufficient stock of gloves to change gloves between each patient. The majority of the respondents reported work environments that did not support the taking of precautions, as indicated by shortages of protective garments (76.3%) and disposal containers for used needles and other sharp objects (89.8%).

Despite the high number of respondents (97.4%) who knew how to protect themselves from infectious blood-borne diseases, 43.8% acknowledged that they were too busy to follow the recommended precaution measures, 55.8% felt that compliance with recommended precautions would offend patients, and 74% stated that patients did not display visible symptoms of blood-borne viruses such as HIV.

4.8. OCCUPATIONAL BLOOD EXPOSURES (OBEs*)*

Table 4.5 Number and percentage of the reported blood exposures by type of training

TRAINING, n (%)					
Frequency of Exposures during the last 6 months	Auxiliary Nurses 13	Distance-trained 11	Technicon-trained 6	Untrained 29	TOTAL 59
No exposure reported	10(76.9)	6 (54.5)	4 (66.7)	10 (34.5)	30(50.8)
One exposure reported	2 (15.4)	3 (27.3)	2 (33.3)	8 (27.6)	15(25.4)
Two or more exposures reported	1(7.7)	2 (18.2)	0 (0.0)	11 (**37.9)**	14(23.8)

The number and percentage of assistants who had experienced blood exposures and sharps injuries in the previous six months is shown in Table 5 and 6. Almost half of the respondents (49.2%) indicated that they had experienced one or more occupational blood exposures in the previous six months. Auxiliary nurses had the lowest percentage of exposures of respondents (22.1%; 3 out of 13), whilst untrained assistants reported the highest percentage (65.5%; 19 out of 29) of occupational blood exposures. Eleven of the untrained assistants (37.9%) who experienced blood exposures had experienced two or more exposures.

About 45% (5 out of 11) of the distance-trained assistants reported experiencing one or more occupational blood exposures in the previous 6 months, while 9% experienced 5 or more exposures. Almost two-thirds (65%) of untrained assistants reported one or more occupational blood exposure in the previous 6 months. Less than a quarter (23%) of auxiliary nurses and one-third (33%) of technikon-trained assistants had experienced one or more occupational blood exposures in the same period.

Auxiliary nurses reported the lowest percentage of occupational blood exposures within the preceding six months (23.1%), followed by technikon-trained (33.3%) and distance-trained (45.5%) assistants. Untrained assistants reported the highest percentage of occupational blood exposures (65.5%). The difference between untrained and trained assistants was significant ($p=0.001$).

4.9. SHARPS INJURIES

Table 4.6 Number and percentage of sharps injuries among dental assistants in past 6 months by type of training

TRAINING, n (%)					
Frequency of Exposures during the last 6 months	Auxiliary Nurses 13	Distance-trained 11	Technicon-trained 6	Untrained 29	TOTAL 59
No exposure reported	11(84.6)	7 (63.6)	5 (83.3)	10 (34.5)	33(55.9)
One exposure reported	2 (15.4)	2 (18.2)	1(16.7)	5 (14.3)	10(16.9)
Two or more exposures reported	0(0)	**2 (18.2)**	0 (0.0)	14 **(50.0)**	16(27.2)

The frequency of the sharps injuries experienced by respondents in the past six months was analysed according to the type of training **(Table 4.6)** they had had. More than half (55.9%) of respondents had not experienced a percutaneous injury during the past six months. This figure is higher than that reported for occupational blood exposures in Table 5 above. Auxiliary nurses had the lowest percentage of exposures out of all respondents (15.4%; 2 out of 13) who had experienced injuries in the previous six months, followed by technikon-trained assistants (16.7; 1 out of 6). Within that period, untrained assistants reported the highest percentage (64.3%) of injuries.

Untrained assistants reported the highest percentage (65%) of sharps injuries (either one or more than one injury reported), followed by distance-trained assistants (36%) and technikon-trained assistants (17%). Auxiliary nurses were the least injured (16%). In terms of the frequency of injuries, untrained assistants continued to experience the most number of injuries within the previous 6 months. Untrained assistants were significantly more likely to experience injuries than trained assistants and auxiliary nurses ($p=0.001$).

4.10. EXPOSURE UNDER- REPORTING

Table 4.7 Under-reporting of sharps injuries and mucocutaneous blood exposures by type of training in the past 6 months.

Respondent group	Number of sharp injuries	Number of incidents unreported (%)
Distance-trained	4	**3 (75)**
Technikon-trained	2	1 (50)
Auxiliary nurses	1	0 (0)
Untrained assistants	19	**16 (84)**
Total	26	20 (79)
	Number of blood exposures	Number of incidents unreported (%)
Distance-trained	5	**4 (80)**
Technikon-trained	2	1 (50)
Auxiliary nurses	3	2 (66)
Untrained assistants	19	**18 (95**)
Total	29	25 (86)

The number of incidents (occupational blood exposures and sharps injuries) that were not reported varied according to types of training. Overall, two-thirds of the percutaneous injuries were not reported or were not formally documented (**Table 4.7**). Most of the untrained assistants (16 of 19, i.e. 84%) and distance-trained assistants (3 out of 4 i.e. 75%), who had experienced a sharps injury in the previous 6 months, had not reported it. In contrast, all sharps injuries experienced by auxiliary nurses and half of those experienced by technikon-trained assistants in the same period were reported (p=0,001). Relatively few mucocutaneous blood exposures were reported (14% of respondents overall) when compared to sharps injuries (21%).

4.11. RISK OF BLOOD EXPOSURES AND SHARPS INJURY

Table 4.8 Odds Ratio of blood exposures and sharp injuries by type of training

Blood exposures	**Odds Ratio**	**95% C.I.**		**P-Value**
Training (DT/AN)	2.7778	0.4812	16.0337	0.2534
Training (TT/AN)	1.6667	0.1977	14.0538	0.6386
Training (UT/AN)	6.3333	1.4127	28.3931	0.0159
Sharps injuries	**Odds Ratio**	**95% C.I.**		**P-Value**
Training (DT/AN)	3.1429	0.4498	21.9578	0.2483
Training (TT/AN)	1.1000	0.0798	15.1535	0.9432
Training (UT/AN)	9.9000	1.8206	53.8341	0.0080

The odds ratio for blood exposures and sharps injuries among distance-trained assistants was 2.7 (95% CI, 0.6-16) and 3.1 (95% CI, 0.4-21.9) respectively when compared to that of auxiliary nurses. This means that the risk of occupational blood exposures and sharps injuries among distance-trained assistant was 2, 7 and 3.1 as high as that of auxiliary nurses. For untrained assistants, the risk of experiencing blood

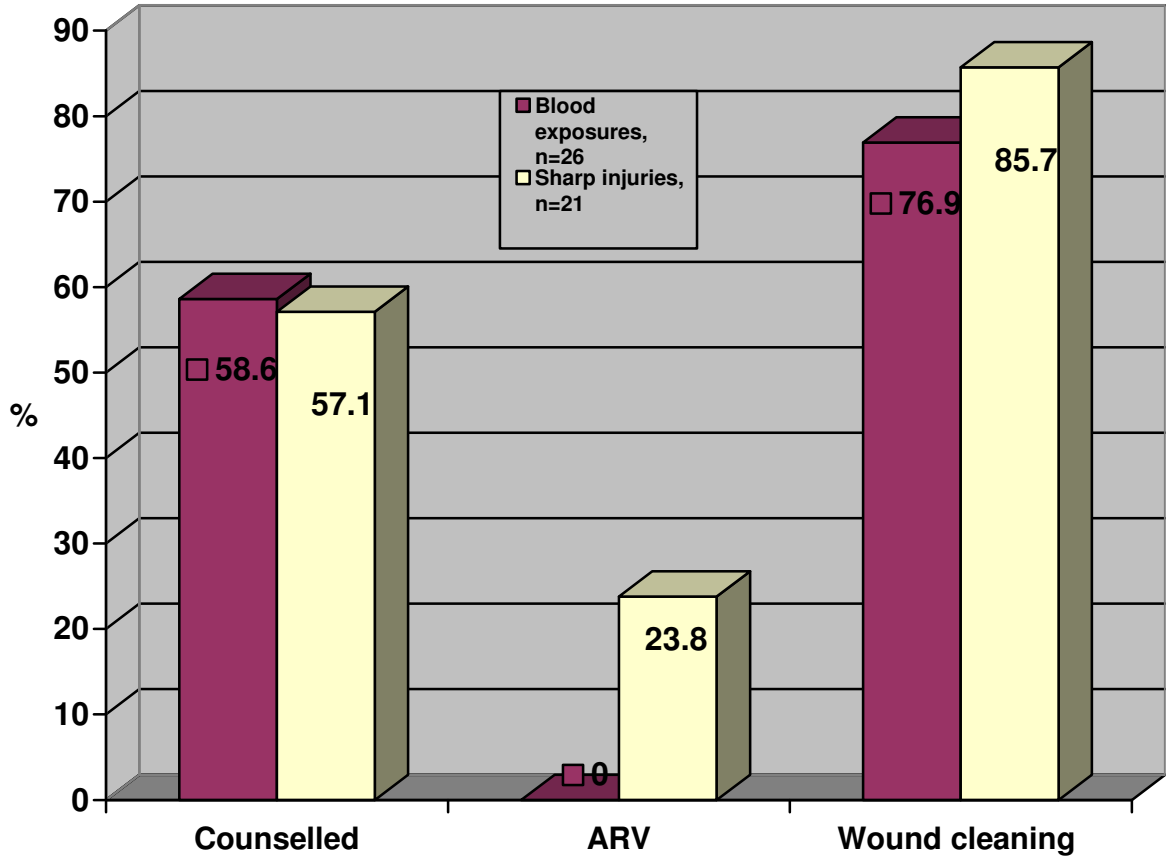
exposures was 6.3 times as high as that for auxiliary nurses (95% CI, 1.4- 28.3, standard error of 0.76 (p= 0.01). The difference between untrained assistants and auxiliary nurses was statistically significant (p=0.01). The confidence intervals are wide because of the small sample size used in this survey.

The same group (untrained assistants) had a much higher chance of experiencing sharps injuries (9.9 times) in the same time period, when compared to auxiliary nurses (95% CI, 1.8-53.8) (a standard error of 0.86). The overall margin of error was wide, ranging from 0.76 to 1.08 S.E. Since the p value is small (0.008), this trend is statistically significant.

The probability of observing such a large difference between distance-trained assistants /auxiliary nurses (p= 0.253) and technikon-trained assistants / auxiliary nurses (p=0.63) for blood exposures and distance-trained assistants / auxiliary nurses (p= 0.248) and technikon-trained assistants / auxiliary nurses (p=0.943) for sharps injuries was probably due to chance. The difference between distance-trained assistants and auxiliary nurses was not significant (p=0.94).

4.12. MANAGEMENT OF REPORTED OCCUPATIONAL EXPOSURES

Figure 4.4 Types and percentage of treatment received by dental assistants in public health care facilities in Limpopo Province



Management of occupational exposures occurring among dental assistants who reported their experiences ranged from: (i) wound cleaning, (ii) and wound cleaning with a referral to a counselling clinic, to (iii) the prescription of antiretroviral drugs (ARV) after counselling.

In terms of counselling services, 58.6% (15 out of 26) of those exposed to blood and 57.1% (12 out of 21) of those exposed to sharps injuries were counselled. Regarding ARV treatments, none of the respondents who had experienced blood exposures were placed on ARVs, whilst a very small number, 5 (23.8%) of those who reported sharps injuries, were placed on ARVs. Surprisingly, a high percentage of respondents were only given wound cleaning as a treatment for their blood exposures (20 out of 26; 76.9%) and sharps injuries (18 out of 21; 85.7%). There was no significant difference between blood-splashed and sharps-injured assistants regarding the wound cleaning and counselling services provided to them ($p=0.067$).

CHAPTER FIVE

DISCUSSION

5.1 TRAINING EXPERIENCE AND WORKLOAD OF DENTAL ASSISTANTS

Since the inception of the Oral Health Forum in 1994, oral health workers in Limpopo Province have constantly raised the issues of the poor levels of oral health services and the shortages of skilled oral health personnel. In some dental clinics, oral clinicians reported that they were working without assistants. Reports indicate that the delivery of dental services, especially in the remote rural communities, was often suspended for years, as a result of staff shortages (Ayo-Yusuf, 2001; FOHL, 2005).

A number of findings from this current survey appear interesting in light of the heightened concern raised by the Oral Health Forum in Limpopo Province: the use of unskilled dental assistants, staff shortages, assistants' lack of knowledge and understanding of various dental instruments, low adherence to safe infection-control practices in dental clinics, and shortages of dental instruments and consumables (FOHL, 2005).

The results of this study indicate that more than 90% of the dental assistants currently employed in public hospitals of Limpopo Province had no formal training in their occupation. Eighteen percent of the respondents reported having received distance

training in dental assisting, without having had any exposure to clinical training in a dental setting. The need for and value of this type of course needs to be questioned, as the trainees do not get exposure to the dental setting. This implies that more than 90% of Das would not meet the current's Health Professions Council of South Africa guidelines for registration of qualified DAs.

The majority of respondents (66.1%) reported that they had worked at dental clinics for more than a year. In the long term, the knowledge and skills of infection control of these DAs can be improved by in-house training. However, this does not appear to be a useful means, as it takes time to train them. Some of the assistants cannot read or write (Ayo-Yusuf, 2001; FOHL, 2005). All qualified nurses (100%) had worked in the dental setting for less than six months. It is a normal practice to rotate auxiliary nurses, who are students in training, through different departments, including the dental department in a hospital. The average period spent at one department was three months (Ayo-Yusuf, 2001). This rotation is possible since all dental clinics in LP are located within hospital premises. The main objective of the rotation is to expose nurses to oral health and conditions associated with it. Later in their training in community nursing, they would be knowledgeable and would be able to refer patients with oral conditions to dental clinics. The shortages of dental assistants and, in some cases, the insistence by dental supervisors that nurses remain longer than 3 months at dental clinic resulted in some of them being placed permanently at clinics.

This permanent placement is not a solution to address staff shortages as auxiliary nurses are not fully trained to perform all the functions of DAs. Before 2002, there were no dental assistant posts in the staffing establishment of the Department of Health and Social Development in Limpopo Province. It is thus not surprising that the majority of DAs (90%) were recruited with no experience and training. The implication for Limpopo Province is significant- a solution will have to be found to provide a suitable training (meeting HPCSA) so that they can be registered as DAs.

The World Health Organization (WHO) recommends a ratio of between (1.5-2:1) one-and-a-half and two dental assistants for every one oral health clinician (Zillén & Mindak, 2000). The results of this study indicated that dental assistants were overworked. More than half of the respondents (57.6%) reported working alone in their clinics and assisting more than two clinicians at their clinics (94.2%). The mean number of clinicians assisted by each respondent was 3.8 (SD+/- 1.9). These shortages of qualified dental assistants and an increasing workload have resulted in auxiliary nurses being 'permanently' placed at dental clinics. Although their level of infection control was good, probably due to their training in nursing, retention of nurses at dental clinic is not sustainable in the long term as they are trained in another field. The career path and salary scale of the auxiliary nurses is much better than that of the dental assistants. Furthermore, dental settings require specialised training to sterilise and handle dental instruments; operate high-tech equipment and provide chairside assistance to clinicians. The HPCSA requires DAs to complete an accredited training course that is specific for the job of dental assisting.

In 1990, Zillén & Mindak reported that there were only 2699 dental assistants in South Africa, assisting more than 5619 clinicians (dentists - 4377, dental therapists -368 and oral hygienists – 874 *appendix G: Oral Health Manpower in South Africa)*. Sixteen years later, the Health Professional Council of South Africa (HPCSA), 2006, estimated that more than 8000 dental assistants were working in both the public and private sectors in South Africa. The majority of these (60-80%) had no formal training. A substantial number of the assistants (40-57%) acquired their dental assistant certificates from unregistered institutions (HPCSA, 2006).

Reports from dental clinicians in Limpopo Province support the HPCSA's findings. The problems experienced by clinicians working with untrained assistants ranged from being given the wrong instrument to instruments not being properly sterilised (Ayo-Yusuf, 2001; FOHL, 2005). As a result, dental clinicians have been providing onsite and hands-on training to their dental assistants. Indications are that some of the onsite-trained assistants had the scope of their duties extended to include those of receptionist and messenger, especially those employed in the private sector. Dental assistants feel that by being registered with the HPCSA, they will have more job security and a clearly defined scope of duties applicable to dental assistants (HPCSA, 2006).

The HPCSA has recognised the urgent need of regulating the training of dental assistants and to register dental assistants. A number of challenges have, however, emerged. In the period of six months in which this study was carried out (November 2005-April 2006), the HPCSA received hundreds of applications for registration from

technikon-trained, onsite-trained, and untrained assistants. According to the HPCSA, the majority of applicants were trained onsite and had more than five years' working experience, followed by newly appointed assistants with certificates from unrecognised institutions. However, very few applicants were suitably qualified to be registered as dental assistants (HPCSA, 2006).

The accredited recognised training institutions that provide a two-year part-time training course for dental assistant are located in three metropolitan cities (Durban, Pretoria and Cape Town) and are not easily accessible to the majority of dental assistants.

The institutions' tuition fees (between R 10 000 - R14 000 per year) were perceived to be prohibitive by many dental assistants, especially when their salaries are taken into account (HPCSA, 2006). As a result, many of the dental assistants will have to rely on their employers to subsidise their tuition fees and have to negotiate study leave to travel to the cities where the courses are held.

5.2. COMPLIANCE WITH UNIVERSAL PRECAUTIONS

Several studies have shown that knowledge alone does not change behaviours. A combination of various factors – circumstances, risk perceptions, conflicts etc; influences how human beings behave (Henry et al, 1994; Gershon et al, 1995; Nelsing et al, 1997).

According to the health belief model, factors such as an individual's personal characteristics, previous experiences, social pressures, and barriers to undertaking behaviour determine the likelihood of compliance with recommended self-protective behaviours (Rosenstock, 1974).

From the results of this survey, the knowledge dental assistants had of UPs did not always translate into compliance with UPs. Some aspects of UPs were well understood by DAs. These include the need to: use barrier protection (masks, gloves, and eye protection), dispose sharps waste separately, promptly clean up blood spills, and wash their hands. It was, however, of concern that almost half of the respondents (48%) indicated that they needed to protect themselves from blood only if the patient treated had an infectious disease such as HIV/AIDS. Half the survey respondents (50%) held the view that it was not practical to treat the blood of all patients as infectious, which may in part explain the selective application of UPs **(Table 4.3**).

Nevertheless, these findings are somewhat contradicted by the 88% who agreed that UPs involve treating the blood of all patients as potentially infectious, which implies that knowledge had not been translated into compliance.

The findings also demonstrate a low level of overall compliance with UPs among assistants, as only 11% reported full compliance with all components of UPs. It was encouraging to find that more than 90% of respondents reported that they were compliant with the safe disposal of used needles and sharps and other blood-contaminated items and with the washing of hands after the removal of gloves, and by

taking extra care when handling used needles and sharps. In spite of this, an alarming 100% of DAs were still using the two-handed technique to recap used needles, given the strong association between needle recapping and percutaneous injuries.

In comparison to the results of other studies of health professionals, the recapping of used needles using the two-handed techniques in this study was very high(27% of HCWs in US- Gershon et al, 1995; 17% of interns in Soweto-Karstaedt and Pantanowitz, 2001).

Relative to other studies (Naidoo, 1997 -87%; Mc Carthy et al, 1998 -92%; Kopsala, 2000- 100%; Yengopal et al, 2001 -97.1%; Rudolph et al, 2002 -97.1% and De Kock and Van Wyk, 2001 - 97%), the compliance with protective barriers in this study was found to below 70%.

There are indications that assistants were ambivalent towards infection –control practices and possibly did not comprehend the principles underlying the practice of UPs. Various reasons could be put forward for their knowledge and compliance with UPs: limited onsite training of unqualified assistants by clinicians, a lack of in-service training to reinforce infection-control protocol, and the unavailability of protective materials could result in poor compliance with UPs. Several strategies are needed in order to inform and train assistants about the importance of full compliance with UPs in the dental setting.

5.2.1. HBV vaccination

As early as 1975, Mosley and others (1975) reported that the risk that dental staff might acquire hepatitis B was at least 3 times greater than for the general population.
In 2002, Araujo and Andreana found that oral health care workers had a 10 times' greater risk of becoming chronic hepatitis B carriers through occupational exposures than the average citizen had. A year later, the CDC recommended that all dental health care workers who might be exposed to blood or blood-contaminated substances in an occupational setting be vaccinated for HBV (CDC, 2003). Emphasis should therefore be placed on the consistent adherence to recommended infection-control strategies, on the use of HBV vaccinations, and on the use of protective barriers and of appropriate methods of sterilisation and disinfection.

In the present study, 28.8% of respondents were fully immunised against hepatitis B, 8.5% had received one or two doses of immunisation and the majority (62.7%) were not informed about vaccinations or vaccinated against hepatitis B. A similar study among oral hygienists in Bloemfontein by De Kock and Van Wyk, 2001, reported that 93% were vaccinated against hepatitis B. In the same year, Yengopal et al, (2001), surveying infection control among dentists in private practice in Durban, reported that 88.2% of dentists were vaccinated, whilst 62% off their staff members (likely to include dental assistants) had not received HBV vaccinations. Hepatitis B vaccination cover among dental staff did not compare well with other studies to be found in the literature.

The same study (Yengopal et al, 2001) reported that the vaccination figures for dental staff were very low when compared to the immunisation rate reported for dentists (88.2%).

Several studies in the literature reported hepatitis B immunisation rates of between 46% and 92% (Gibson and Noble, 1995 -77.3%; Scully, et al, 1991 -50.3%; McCarthy, et al, 1998 -92% and Noble, et al 1991 -46%). Yengopal et al (2001) reported that dentists, although well informed about immunisation, did not inform their dental staff about the risks of contracting hepatitis in dental clinics. In this study, 62.7% of dental assistants were not informed about vaccinations.

Gerberding (1995) indicated that almost all cases of hepatitis B infection among health care workers could be prevented if every health care provider were immunised. Oral health workers, including dental assistants, would be better protected if they adhered to the new Center for Disease Control and Prevention guidelines on infection control, which state that all dental facilities must develop a written, comprehensive policy on immunising workers and on needle stick protocol (Palenik and Govoni, 2004a).

5.2.2. Gloves

More and more patients are becoming aware of the need for OHCWs to practise proper infection control when treating dental patients. In a study to assess patients' perceptions and awareness of cross-infection preventive methods used in dentistry, 60 % of the respondents were aware that OHCWs should wear gloves routinely (Samaranayake and McDonald, 1990). In the same study, two in three respondents were not willing to be treated at dental clinics if gloves and mask were not used.

Gloves, whilst protective, do not protect against the careless use of instruments, as they are easily punctured (Palenik, 2004). The majority of respondents (91.5%) in this study reported that they routinely wore gloves, although 20% stated that they did not regularly change their gloves for each new patient treated. Approximately half (54.2%) of the respondents indicated that they washed their hands before putting on gloves and 50.8% when removing gloves. The results of this study compare well with other studies reported in recent dental literature, in terms of the routine use of gloves. Routine use ranged from 65% to 100% (Naidoo, 1997 -87%; Mc Carthy et al, 1998 – 92%; Kopsala, 2000- 100%; Yengopal et al, 2001 -97.1%; Ogunbodede and Rudolph, 2002 -97.1% and De Kock and Van Wyk, 2001 - 97%). Several authors indicated that the use of gloves reduced the risk of cross-infections between patients and oral health workers (Hardie, 1999; Miller, 2004; CDC, 2004). However, the wearing of gloves does not eliminate the need for appropriate hand disinfection (Miller, 1997).

5.2.3. Masks

Several authors have recommended the use of facemasks during procedures that are likely to generate splashing or spattering of blood (Palenik and Govoni, 2004b; Runge, 2005). It has been further suggested that orientation education on infection-control procedures (including face masks) must be provided to all employees on initial employment.

Routine mask use during patient treatment was reported by 76.3% of the respondents. When the results of the present survey are compared with those of de Kock and van Wyk (2001), who showed a usage rate of 88% among oral hygienists, and those of Yengopal et al (2001), whose survey showed s usage rate of 82.4% among dentists in private practice, the routine use of masks among DAs was slightly lower (76.3%). These figures compare well with survey reports written by Kopsala (2000), in which more than 70% of dental assistants reported wearing a face mask for every patient treated in Gauteng. Rudolph et al (1998) reported a higher percentage (87.3%) of dental assistants using face masks. These results, although higher than those of the present study, were comparable to those reported by other authors: 85% (Ter Host, 1993), 82.4% (Yengopal et al, 2001) and 65% (Naidoo, 1997).

5.2.4. Protective eyewear

Sander et al (1998), in their study on the dispersion of micro-organisms in the course of dental surgery, found that spatter resulting from a triple syringe and high rotation turbine could reach a distance of 1.82m from a point on the dental chair corresponding to the position of the patient's mouth. This splatter might contain a patient's blood and saliva and could thus cause cross-infection, hence confirming the need for the protection of operators', assistants' and patients' faces (eyes, nose, and skin) from contact with splatter. For this reason, protective eyewear should form an essential component of barrier protection during routine dental assisting.

This study found that about a quarter of the respondents (28.2%) used protective eyewear routinely. Results from other South African studies have reported significantly higher rates of the routine use of protective eyewear: de Kock and van Wyk (2001) reported 50.6% among oral hygienists, and Yengopal et al (2001) reported that more than half (52.9%) of the dentists in Durban were using protective eyewear. Two years later, Oosthuysen (2002) in the Free State Province reported a decreased rate to 50.6% among oral hygienists.

Protective eyewear not only prevents infection, but also prevents physical injury from aerosols and splatter, accidental trauma or from flying debris (Harrel and Molinari, 2004). The use of protective eyewear needs to be encouraged to further improve the use of barrier protection devices among dental assistants in Limpopo Province.

It is generally accepted from the patients' point of view that barrier protection such as the use of gloves, masks and protective eyewear is the most visible precaution that can be taken by oral health worker to prevent cross-contamination in a dental surgery (Miller, 2004; CDC, 2004; Harrel and Molinari, 2004). It is clear from this study that protocols that recommend the routine use of barrier protection do not exist at most dental facilities or are not adhered to at these facilities in Limpopo Province.

5.2.5. Sterilisation

Most instruments used during dental procedures come into contact with oral tissues and/or penetrate tissues. It is essential that instruments that will be re-used are thoroughly cleaned and sterilised with the use of acceptable methods that are routinely checked and monitored (Harrel and Molinari, 2004). Hardie (1992) holds the view that instruments that are not invasive should not be subjected to the rigours of heat sterilisation. He argued that disinfectants are capable of destroying all significant micro-organisms.

Most respondents (84.7 %) indicated that they made sure that hand-instruments were sterilised before they were used. The use of liquid chemicals was common among DAs [more than two thirds of the respondents (71.2%) were still using liquid chemicals to sterilise hand pieces and attachments]. Several South African studies have reported similar results: 53.5% (Oosthuysen, 2002); 80% (Kopsala, 2000); 79.7% (Yengopal et al, 2001); 68% (Naidoo, 1997). This common practice of using liquid chemicals to sterilise hand pieces and attachments is not safe. Lewis and Boe (1992) reported that it poses a high risk to patients treated with such instruments.

Further, Acosta-Gio et al (2005) discouraged the use of liquid chemicals because there are no monitors for liquid disinfectants/sterilants to effectively determine whether proper sterilisation was achieved. Thus, they cannot be used reliably to process instruments between patients.

The CDC (1993) recommends the routine between-patient use of a heating process capable of sterilisation (i.e. steam pressure, autoclaving, dry heat or heat/chemical vapour) for all high-speed dental hand pieces, low-speed hand piece components used intra-orally, and reusable prophylaxis angles.

Results from the present survey clearly indicated that the infection control of hand pieces falls short of acceptable standards recommended by the CDC. The majority of respondents (71.2%) used liquid chemicals as a method of sterilising hand pieces.

The nature of instruments used and dental procedures that are performed in dental settings require that all oral health care workers, including dental assistants, comply with infection control measures and reduce the risks of cross-infection (Samaranayake & McDonald, 1990). Results from this survey indicate most of respondents were not taking adequate steps to prevent cross-infection during dental practice (Naidoo, 1997).

5.3. BARRIERS TO THE PRACTICE OF UNIVERSAL PRECAUTIONS

Studies from the United States have consistently demonstrated a relationship between compliance with UPs and a perceived climate of safety (Gershon et al, 1995; Michalsen et al., 1997; Cleveland and Cardo, 2003) and barriers to safe practices (Cleveland and Cardo, 2003). The burden of infectious diseases may be reduced by adopting effective infection-control measures.

Some of these are dependent on the provision of adequate and safe water supplies for the maintenance of basic standards of personal, domestic and healthcare hygiene.

In 2001, Ayo-Yusuf reported that poor working conditions and low support for oral health programmes from provincial and national department was also a contributing factor in the shortages of health workers in the public sector. Six years later, Nemutandani et al (2006) reported in a study conducted among community-service doctors that the majority (56%) of these stated that improved working conditions would motivate them to remain in public hospitals.

Results from the current study indicate that there were dental facilities (12%) in Limpopo Province without running water. Availability of water in more than 67% of South African municipal hospitals and primary health care facilities does not necessarily guarantee that its quality is good enough for it to be safely utilised. Water is delivered by a water tanker in 12.5% of satellite clinics; 5% of water is taken from rivers or dams; 12.4% of clinics rely on rainwater. In Limpopo Province and Mpumalanga, water needs to be purified prior to usage in 14.4% and 33% of satellite clinics respectively (Duse et al, 2003).

In some dental facilities shortages of consumables, instruments, and non-functional equipments such as sterilisers contributed as barrier factors to the non-compliance with UPs. Other factors were related to individual knowledge and their perception of risk. These factors were unacceptably very high. Of concern is the fact that 75% of respondents agreed that it was not possible for assistants to protect themselves from blood exposures in an emergency situation, and 56% said they were too busy to protect themselves. It was therefore not surprising that a large proportion of DAs showed a low compliance to UPs

These reasons for non-compliance overlap with those reported in studies among both American (Gershon et al, 1995**;** Michalsen et al, 1997; Kelen et al, 1990; Erasmus et al, (2005) and Thai nurses (Picheansathian, 1995).

It was interesting to note that compliance was not associated with having received UP training. Thus, interventions to improve UP compliance that focus on the provision of information alone are unlikely to be successful. There is need to train DAs on the importance of infection control and on compliance with UPs in dental clinics

These findings suggest that training will be most effective if it not only provides information about UPs and blood-borne pathogen transmission but also highlights the relevance of UPs to the everyday practice of assistants in LP and provides them with specific strategies and resources for overcoming perceived barriers to compliance. Perceived barriers to the implementation of UPs may have clearly influenced assistants' ability and willingness to comply with them in practice.

The promotion of safe climate factors is probably the most effective way to achieve greater compliance with UPs. It is arguably difficult to establish hospital-wide compliance with UPs without the structural supports provided by a centrally coordinated infection-control programme, commitment on the part of senior staff, and the provision of adequate safety equipment.

Simple strategies such as putting up infection-control protocols in clinics, creating an infection-control logbook, and the proper stock management of consumables required for infection control would make compliance easier for all oral health workers.

5.4. OCCUPATIONAL EXPOSURES AND THEIR MANAGEMENT

Despite the publication of the national Occupational Health and Safety Act (OHSA) and infection-control guidelines, the message about the compliance with UPs and sharps handling safety appears not to have reached many health care workers. It thus came as no surprise to find that a significant proportion (44.1%) of respondents had experienced an occupational injury of one type or another.

Other surveys have similarly reported that unqualified assistants experienced a higher rate of occupational injuries (35% and 41% respectively), especially when handling dental instruments (McDonald et al, 1997; Newsom & Kiwanuka, 2002). The survey results indicate that 44.1% (26) of the respondents reported that they had experienced OEs in the previous six months. A significant number (38.4%) indicated that they had been injured more than twice in the previous six months. Most of the incidences were reported (77%).

Fifteen were reported immediately, 5 were reported later, whilst 6 were not reported at all. The type of treatment offered ranged from retroviral therapy (19.2%) and wound cleaning (38.4%) to ‘no treatment at all’ (42.3%).

This data demonstrates that percutaneous injuries and mucocutaneous blood contact occur frequently among DAs in various dental facilities in Limpopo Province.

The data from the study highlights the following trends:

- Firstly, occupational exposures occurred regularly among DAs in public dental facilities. More than one third (35.6%) of the respondents had sustained a percutaneous injury within the previous 6 months, which is comparable to results from earlier studies (Hersey & Martin, 1994 (50%); Aiken et al, 1997(was 45.8%); 39.2% in Ramos-Gomez et al, 1997). The results suggest that percutaneous injury rates have not declined measurably over time. The above results also suggest that occupational injury is common in both trained (36.4%) and untrained dental assistants (64.3%).
- Secondly, the risk of injury is directly related to the precautions used. The practice of recapping needles using the two-handed technique was associated with an overall increased risk of percutaneous injury. All the respondents recapped the used needles.
- Thirdly, several studies have shown inadequate adherence to preventive measures, such as recapping needles using special containers, routinely wearing gloves, and hand washing after glove removal (Saghafi et al, 1992; Henry et al, 1994; Kennedy and Hasler, 1999; Doebbeling et al, 2003). Forty-four percent of respondents in our study had experienced mucocutaneous blood exposures in the previous 6 months.

Retraining individuals with such exposures in standard precautions and in the safe performance of invasive procedures would be likely to reduce the number of percutaneous injuries and blood exposures experienced.

- Fourthly, blood exposure reporting also varied by occupation; untrained and distance-trained assistants report exposures infrequently (19.5% - 39.9% in Rattner et al, 1994; underreporting sharps injuries (22% - 62%) in Doebbeling et al, 2003). Although there is evidence that the reporting of blood exposures has increased over time in some settings, reporting remains inadequate (CDC, 1997; Doebbeling et al, 2003). The workers who are most frequently exposed are least likely to document injuries. Further study of the determinants of underreporting and identification of effective approaches to decrease it are needed to provide effective, timely prophylaxis and educational interventions.

CHAPTER SIX

CONCLUSIONS

6.1. CONCLUSIONS

More than 90% of the respondents had no formal training for their occupation and only a very small percentage was suitably qualified to work as a dental assistant. Some of the contributing factors include:

- The failure by HPCSA to recognize the importance of DAs duties and regulate training of DAs;
- Unmonitored private colleges which continue to award certificates;
- Poor planning for oral health human resource by Health Department in Limpopo Province;

Most of the DAs were overworked, exposing them, especially untrained assistants, to high risk of occupational exposures. This finding was consistent with others studies.

The knowledge, understanding and awareness of universally accepted guidelines for infection control remain low, especially among untrained dental assistants, amid a climate of an ever-increasing HIV pandemic. Compliance with UPs by dental assistants in Limpopo Province was relatively low.

There were a high number of blood exposures and sharps injuries experienced by dental assistants, and a significant number of these were not reported.

6.2. RECOMMENDATIONS

The following recommendations should be considered among others to address the shortages of dental assistants, the high percentage of occupational exposures, the low compliance with universal precautions and under reporting of exposures:

- There is a strong need to regulate and standardise the training of DAs according to criteria that must be determined by the HPCSA. Recognise and register the current assistants as dental assistants; liaise with accredited institutions which provide training for dental assistants to provide training course for them.

- Training workshops for dental assistants on infection-control practices and the handling of dental instruments.

- A supportive environment needs to be created to enable safe and sound compliance with universal precautions in all dental facilities.

- A system of written protocols for the prompt reporting, evaluation, counselling, treatment, and the follow-up of occupational exposures must be available in all dental facilities. Post Exposure Prophylactic (PEP) agents must be made available – either on site or must be easily obtainable – for timely administration.

- The Limpopo Department of Health to create more posts of dental assistants in line with WHO recommended ratio of approximately two dental assistants per one clinician.

- The provincial government should consider giving assistance (financial and study leave) to those assistants who have registered with accredited training institutions.

6.3. LIMITATIONS OF THE STUDY

Several potential limitations and some unique strengths of this study should be noted. The fact that compliance and exposure data was obtained concurrently, made it difficult to ascertain cause and effect. Recent percutaneous injuries could have increased standard-precaution adherence.

The study was limited to dental assistants in Limpopo Province, which is an understaffed, largely rural province with relatively few dental facilities. Even so, data from dental facilities suggests that sharps injury rates are comparable in the facilities in all six districts, in urban and in rural areas. In addition, participation or response bias is possible. However, concern over this potential bias is lessened by the response rate.

This type of study design presents the tendency for an overestimation of compliance via the self-report method and the inherent limitations of self-administered questionnaires.

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APPENDIX A

OCCUPATIONAL EXPOSURE QUESTIONNAIRE

Please answer all questions as fully as possible. The survey will be completely confidential.

All responses will be recorded and analyzed anonymously.

Many questions ask you to circle a single appropriate response. Others ask that you record short written answers. When you have finished, please return the completed questionnaire in the attached envelope to the sender's address.

Thank you very much for participating in this project.

Please circle the appropriate response.

Please circle the appropriate response.

A. DEMOGRAPHIC INFORMATION

1 Gender: A. Male B. Female

2 Race: A. Black B. White C. Coloured D. Indian

3 District: A. Bohlabela B. Capricorn C. Mopani
D. Sekhukhune E. Vhembe, F. Waterberg

4 How old are you? ----------

5 Which hand do you normally use? A. Right B. Left hand?

6 How long have you been working as a dental assistant?

A. Less than 3 months,
B. 3-6 months
C. 6-12 months
D. more than 12 months

7

How many other dental assistants are working with you in the same facility?

0 1 2 3 4 5 6 or more

8

On average, how many patients are treated per day

A. Fewer than 15. B. Between 15-25. C. Between 26-40. D. More than 40

9

How many clinicians (dentist, dental therapist, oral hygienist) do you normally assist?

1 2 3 4 5 6 or more

10

I am a _____

A. Dental Assistant (through distant learning)
B. Dental Assistant (trained in technicon or university)
C. Auxiliary nurse
D. Not trained in dental assisting
E. Other (please explain)----------

11

Have you been vaccinated against Hepatitis B virus?

A. Yes, all three injections received.
B. Yes, received one or two injections.
C. No or Not been informed about vaccination.

SECTION B

12 **KNOWLEDGE, ATTITUDE AND PRACTICE OF UNIVERSAL PRECAUTIONS**

Items assessing knowledge of Universal Precautions	Yes	No
I am aware of Universal Precautions procedures		
Universal precautions include use of gloves , masks and gown		
Universal precautions protect against infectious diseases such as HIV		
PPE should be worn during all procedures		
Specific treatment is essential following exposure at work (eg needle stick).		
I am aware of needle-stick protocol		
I know how to protect myself from infection with blood-borne diseases (such as HIV/AIDS and hepatitis B) at work.		
I am usually too busy to follow the recommended precautions to protect myself against contact with patients' blood.		
Sometimes I don't use the recommended precautions to protect myself against contact with patients' blood because my workmates don't use them.		
If I use the recommended precautions to protect myself against contact with patients' blood, it may offend the patients.		
In emergency situations, it is not possible to protect myself against contact with patients' blood because the patients' needs come first.		
In this clinic, it is not essential for staff to protect themselves against contact with patients' blood because the patients are not infected with blood-borne viruses such as HIV/AIDS.		
I have been adequately trained in the correct use of protective equipment (eye wear, gloves, and masks).		
Wearing protective equipment (eye wear, gloves, and masks) makes me feel uncomfortable.		
Wearing protective equipment makes it difficult to do the job properly.		

13 Which of the following do you routinely practice?

Items assessing the practices of Universal Precautions	Yes	No
Wear gloves during procedure		
Wash hands before putting on gloves		
Wash hands before removing gloves		
Change gloves after each patient		
Wear a mask during procedure		
Wear protective garments (white coat, green gown, apron etc) during procedure		
Autoclave/chemoclave hand instruments		
Sterilization of hand pieces and attachments.		
Disinfect working surfaces after patient treatment		
Disinfect light handles		
Flush water lines after each patient treatment		
Immediately dispose used needles		
Wear eye protection while assisting.		
Recap used needles		

14 What are the barriers to carrying out these measures?

	YES	NO
Gloves not available		
Gloves not sufficient for changing after every patient		
Inadequate supply of water		
Face masks not readily available		
No autoclave		
Disinfectants usually not available or in short supply		
Laundered protective garments not often available(white coat, green gown, apron etc)		
No special waste disposal system for needles and other sharp instruments.		
No protective glasses (spectacles, eye protection)		

SECTION C. OCCUPATIONAL EXPOSURES

The remaining questions concern your exposure to patient body fluids. Please use the following definition of an *occupational exposure* when considering your responses.

An occupational exposure occurs when:-

1. Your skin is punctured by a used needle or other sharp instrument, referred to as **sharp or percutaneous injuries.**

2. Blood or other potentially infectious material, such as saliva, comes into contact with broken skin or mucous membrane (eye, mouth, nose), while carrying out your duties -- chairside assisting, cleaning and removing used instruments, handling soiled impressions, dentures and other similar appliances- referred to **as occupational blood exposures**.

Questions 15 to 20 concern only your past occupational exposure. If you have never experienced an occupational exposure, please stop now and return your questionnaire.

15 In the last six months,

A. How many occupational blood exposures have you experienced? --------

B. How many sharp injuries have you experienced? ----------

16 What activity were you involved in when the occupational exposure occurred?

A. Cleaning instruments.
B. Removing or loading needle
C. Cleaning the floor.
D. Assisting operator.
E . Other (please explain)----------

17 At what time of the day did your occupational exposure occur?

A. before 8 AM
B. before lunch time.
C. After lunch, before 4 PM
D. After hours
E. Do not remember

18 On what day of the week did your occupational exposure occur?

Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday,
Cannot remember

19 Did you report the occupational exposures?

A. YES.

B. NO.

20 If the answer is YES, what type of treatment was given?

A. Nothing was done
B. Advised to wash the area with water and soap
C. Referred to VCT for counselling
D. Placed on antiretroviral drugs (ARV) after counselling

Thank you very much for your help

APPENDIX B

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

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2193, South Africa

Fax: +27 11 717-2005/2594
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e-mail: **nemutandanims@sph.wits.ac.za**

SUBJECT INFORMATION SHEET

Dear Dental Assistant,

I am Dr Mbulaheni Simon Nemutandani, a registrar in the division of Public Oral Health, School of Public Health, Faculty of Health Sciences, University of Witwatersrand. I would like to establish the extent and types of occupational exposures among dental assistants in Limpopo Province. I am doing this study as part of my Masters in Community Dentistry.

The risks to dentists of acquiring a serious infection from their patients have been well recognized, and much has been published regarding the incidents of occupational exposures to blood and body fluids amongst dentists. The risk to dental assistants has received less attention. Very little information is available regarding the occupational

exposures of dental assistants in South Africa. Several studies in developed countries demonstrated a higher risk of occupational injuries among dental assistants.

The attached questionnaire is designed to assess the occupational exposures among dental assistants working in public dental clinics of the Limpopo Province. The information will be used to assist in the planning of more appropriate infection control training for dental assistants and implementation of Occupational Health and Safety Act at the dental facilities.

I would greatly appreciate you taking approximately 15 minutes of your time to complete an attached questionnaire. You are completely free to take part or not to take part in the study. If you decide that you do not want to be part of the study, this will not be held against you . Your decision not to participate would not risk job loss or other institutional sanctions. All information obtained will be strictly confidential.

Kindly return the completed questionnaire in the envelope enclosed.

If you have any questions or queries or would like more information about the study please contact Dr SM Nemutandani on telephone number (011) 717 2005; fax (011) 7172625; e-mail nemutandanims@sph.wits.ac.za or after hours on 0843008645.

Thank you for your cooperation

Yours sincerely

Dr MS Nemutandani

APPENDIX C

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

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The Chairperson
Research and Quality Improvement
Department of Health and Welfare
P/ Bag X 9302
Polokwane, 0700
Limpopo Province

REQUEST FOR PERMISSION TO CONDUCT STUDY: OCCUPATIONAL EXPOSURES AMONG DENTAL ASSSISTANTS IN THE LIMPOPO PROVINCE.

I am Dr Mbulaheni Simon Nemutandani, from Vhembe District in Limpopo Province, on postgraduate training post in the Division of Public Oral Health, School of Public Health, Faculty of Health Sciences, University of Witwatersrand. I would like to establish the

prevalence and the types of occupational exposures among dental assistants in Limpopo Province. I am doing this study as part of my Masters in Community Dentistry.

The risks to dentists of acquiring a serious infection from their patients have been well recognized, and much has been published regarding the incidents of occupational exposures to blood and body fluids amongst dentists. The risk to dental assistants has received less attention. Very little information is available regarding the occupational exposures of dental assistants in South Africa. Several studies in developed countries demonstrated a higher risk of occupational injuries among dental assistants.

The attached research protocol and the questionnaire are designed to assess the occupational exposures among dental assistants working in public dental clinics of the Limpopo Province. All information collected will be treated confidential. The information may be used to assist in the planning of more appropriate infection control training for dental assistants and implementation of Occupational Health and Safety Act at the dental facilities. I would greatly appreciate an opportunity to present this protocol to your committee.

If you have any questions or queries or would like more information about the study please contact Dr SM Nemutandani on telephone number (011) 717 2005; fax (011) 7172625; e-mail nemutandanims@sph.wits.ac.za or after hours on 0843008645.

Thank you for your cooperation

Yours sincerely

Dr MS Nemutandani

South Africa

Oral Health Manpower

Number of Different Oral Health Professionals				
Category	Total Number	No./Inhabitants	Year	Source
Dentists	4 377	1:10 131	2003	1)
Dental Therapists	368	n.a.	2003	1)
Chairside Assistants	2 699	n.a.	1990	2)
Dental Hygienists	874	n.a.	2003	1)
Dental Laboratory Technicians	1 541	n.a.	2000	2)

1) South African Dental Association.
2) Zillén PA & Mindak M. World Dental Demographics, Internat Dent J, 2000; 50: 194-197.
n.a.= not available

Number of Specialists		
Speciality	Number	Year
Oral & Maxillofacial Surgery	110	2004
Orthodontics	110	2004
Periodontics	45	2004
Prosthodontics	45	2004
Oral Pathology	10	2004
Community Dentistry	50	2004