UNIVERSITY OF NATAL

AN EVALUATION OF NEEDLESTICK INJURIES AMONGST STAFF AT A LARGE URBAN HOSPITAL

DR GD MUNRO - 1993

AN EVALUATION OF NEEDLESTICK INJURIES AMONGST STAFF AT A LARGE URBAN HOSPITAL

DR G D MUNRO

Dissertation submitted in partial fulfilment of the requirements for the degree of M Med in the Department of Community Health, University of Natal, Durban.

1993

DECLARATION

This dissertation is the candidate's original work and has not been submitted in any form to another University.

The sources of data have been duly acknowledged in the text.

ACKNOWLEDGEMENTS

The assistance of Dr K Naidoo for supervising this research, Sr Barnado and Sr Shabalala for assistance in data collection and Ms E Gouws for statistical assistance is gratefully acknowledged.

DEDICATION

This dissertation is dedicated to the memory of ALICE LINDSAY MUNRO who died in Addington Hospital during the period of data collection. In common with many health care workers throughout the world, she dedicated much of her life to the service of mankind.

CONTENTS

1. INDEX OF TABLES

Table number and Title — Page

2. SUMMARY

The consistently high rate of needlestick injuries has been a source of concern to the Infection Control Committee at Addington Hospital. A descriptive epidemiological study of the last three years data in the needlestick injury report book was conducted. Results were validated by administering a questionnaire to a stratified random sample of staff. In addition, the hospital computerised information system was used to estimate the number of invasive procedures performed during this time period.

The results indicate an average incidence of needlestick injury of 174.8 per 1 000 staff members per year, which is three times greater than the number recorded in the injury report book. There has been an increasing secular trend of needlestick injuries in the last three years, but comparison of the annual injury rate to workload indicates that the rate has in fact virtually remained constant (38.8 - 43.7 per 100 000 Equivalent Patient Days).

No seasonal variation in the number of injuries was evident (39.9 - 44.8 per 100 000 Equivalent Patient Days) or significant variation by day of the week (74.8 - 87.6 per 100 000 invasive procedures). The injury rate was slightly higher after hours (92.2 vs 80.1 per 100 000 invasive procedures).

Student nurses and Doctors have the highest rate of needlestick injuries (226.3 and 197.0 per 1 000 staff per year respectively). Casualty and Obstetrics are the areas of highest risk. Resheathing of needles accounts for 14.1% of injuries and compliance with hospital policy in this regard is poor. Negligence of staff members is responsible for a further 15 - 20% of injuries. Injuries with hollow-bore intravenous needles accounts for just under one-half of all injuries (42.2%).

The average patient HIV sero-positive rate for the last three years is 7.2% (range of 0.0 - 11.0%). It is expected from the results of this study that one staff member may become occupationally infected with HIV every four years.

Two-thirds of the sample perceived themselves to be at high risk of occupationally acquired HIV infection. Staff suggestions with regard to intervention indicate that more "active" intervention procedures were preferred than the more traditional interventions such as education. These included improved facilities for the disposal of needles, improved reporting procedures and increased punishment of negligent staff.

Recommendations are made on the basis of the findings of this study regarding needlestick injury monitoring, reporting and prevention.

3. INTRODUCTION

Numerous occupational hazards exist in the work place of most if not all health care workers.[30] Historical reviews of these risks describe the risk to the health worker in the pioneering days associated with the birth of roentgenology and the initial identification and culture of organisms. More recently attention has been focused on the risks associated with the spread of blood-borne organisms from patients to health care workers such as haemorrhagic fevers and hepatitis B.[16] From the researchers experience it appears that much of the focus on occupational hazards in the health care work place has been limited and guidelines to staff have often been ignored.

The discovery of the Human Immunodeficiency virus (HIV) in the 1980's, the rapidly increasing number of HIV infected patients in recent years, the "silent" unobservable nature of the disease and the demonstration of occupationally acquired HIV infection amongst health care workers from needlestick injuries has stimulated renewed vigour and enthusiasm in the prevention of spread of blood-borne disease to health care workers.

Guidelines, protocols, education and other intervention programmes and the monitoring and recording of needlestick injuries have been initiated in many hospitals throughout the world.[16] The Infection Control Committee of Addington Hospital in Durban has implemented and maintained procedures for the reporting of needlestick injuries since 1990. In addition the Committee has been actively involved in the education of all categories of staff with the aid of lectures, audio-visual material, demonstrations and reading matter, as well as attempting to improve facilities for the disposal of needles. Standard protocols for invasive procedures and blood spills have also been adopted.

The relatively high incidence of reported needlestick injuries (up to 100 / 1 000 staff members per year) and the suspected high rate of non-reporting of injuries has been the source of much concern to the Infection Control Committee. The education programmes and directives to staff appear to have had little impact on the secular trend of these injuries.

There is a need for the determination of all personal and environmental factors associated with the incidence of needlestick injuries in any hospital.[18] These can be identified by a thorough epidemiological assessment of all reported and unreported needlestick injuries. In addition, the assessment of the extent of under-reporting of injuries, the reasons for under-reporting, as well as the determination of the feelings and suggestions of the staff members themselves in any intervention programme are essential elements to such a study. In a review of international literature, it was discovered that these aspects are grossly under-researched.

As Chairman of the Infection Control Committee, the researcher identified the need to conduct an epidemiological study of needlestick injuries at Addington hospital which incorporated the above elements so that the establishment of an appropriate, acceptable and measurable intervention programme could be facilitated.

4. REVIEW OF LITERATURE

4.1 Incidence

Injuries caused by sharp instruments and subsequent nosocomial acquired infections have been an occupational hazard of medicine for centuries. A variety of infections can result from needlestick injuries and some of the documented cases in the literature during the past 50 years include[16]:-

Acquired Immune Deficiency Syndrome (AIDS)
Blastomycosis
Brucellosis
Cryptococcosis
Diphtheria
Ebola Fever
Gonorrhoea (cutaneous)
Hepatitis B
Herpes
Leptospirosis
Malaria
Mycoplasmosis
Rocky Mountain Spotted Fever
Scrub Typhus
Sporotrichosis
Staphlococcus aureus
Streptococcus pyogenes
Syphilis
Toxoplasmosis
Tuberculosis

It is only during the last decade that needlestick injuries have become of increasing importance to the health care worker. Collins and Kennedy (1987) suggest that the reasons for this are:-

i) the high and rapidly increasing proportion of HIV positive patients.

ii) the demonstration of HIV seroconversion in health care workers after a needlestick injury involving an HIV positive patient[27]

iii) the emphasis on the prevention of health care worker infection via inhalation has decreased with the improvement in control measures, with the emphasis being currently placed on contact injuries

iv) contact injuries are generally more difficult to prevent and control[16]

Holloway (1992) in a study of occupational injuries in a tertiary hospital reports that 35% of all reported hospital injuries to staff are due to needlestick injuries.[30]

The control of needlestick injuries in health care workers is thus receiving increasing attention. Many researchers have recognised the need to identify the epidemiological aspects and types of needles involved to enable the development of appropriate strategies aimed at prevention. There is a continued need for the development, refinement and evaluation of strategies to prevent not only needlestick injuries but in addition all other injuries which result in occupational exposure to bloodborne pathogens.[11,38]

Research of the epidemiology of needlestick injuries has generally been either a retrospective review of the injury report books common in most hospitals, or a retrospective or prospective review of a sample of the staff. Most of these studies have confined their scope to the identification of incidence rates of needlestick injuries

for certain categories of staff, the degree of under-reporting of injuries, or the evaluation of certain intervention control measures. No study reviewed did both, which would enable the researcher to verify not only the needlestick injury report book, but also the accuracy of the estimated number of injuries which are unreported.

Incidence rates of needlestick injury among different categories of staff varies considerably. Albertoni et al (1992) administered questionnaires to all health care workers in a hospital who were undergoing Hepatitis B vaccination. The results from this study revealed that 47.7% of the doctors, 71.1% of nurses, 55.5% of the laboratory workers and 71.9% of the ancillary workers recalled a needlestick injury in the previous year. Rates were generally higher in those with less than five years employment or work experience.[1]

Collins and Kennedy (1987), in their review of needlestick injuries in hospitals found that nurses have higher rates of injury than other staff categories as they are most likely to be the staff involved with intervention procedures on patients. This does however differ according to custom, policy and practice in different hospitals and different countries. Student nurses generally have double the risk of trained nurses in Britain.[16] Eisenstein and Smith (1992) in an epidemiological review of the needlestick injury report book in an 1112 bed hospital found a total of 233 reported puncture wounds during a 12 month period, with 68% of these occurring among nursing staff.[18] Smith et al (1992) reported on the constant proportion of needlestick injuries amongst nurses in a tertiary hospital over a 3 year period (20.5%, 23.2% and 21.8% of the total injuries).[55]

English (1992), in a survey of seventeen hospitals in

Washington DC found that 45.8% of needlestick injuries occur among registered nurses and 25.0% to "downstream" individuals like housekeepers.[19]

Domestic staff are not immune to injury and are often the "innocent victims" as they are almost always injured by the improper handling, use or discarding of a needle by another health care worker. Although legal liability of staff responsible for these negligence related injuries is discussed in the literature[33], there are no documented cases of legal action having been pursued against such employees.

Among medical staff, Collins and Kennedy (1987) suggest that surgeons and pathologists are probably more likely to injure themselves with a scalpel than with a needle. In contrast to this much research has been undertaken assessing the incidence of needlestick injuries in the operating theatre. Camilleri et al (1991) in a prospective study amongst surgeons in a tertiary hospital found the incidence of needlestick injuries to be 1.55% per surgeon per operation (95% C.I. 0.6 - 2.5), and in an assessment of the incidence of glove perforations after surgery, found that an average of 23% of surgeons gloves were perforated after each surgical procedure. In addition junior surgeons acting as the principle surgeon had the highest incidence of glove perforation after surgery.[13,14]

Blind needle palpation, digital guidance in procedures with poor exposure or handling needle tips during suturing predispose doctors to needlestick injury.[16] Arena et al (1991) in a prospective study involving the checking of surgical gloves after 100 elective and 100 emergency caesarian sections concludes that principle surgeons are at greatest risk during surgery compared with other theatre staff and particularly during emergency surgery.[6] Anaesthetists are also not immune to needlestick injuries.[10]

The incidence rates amongst medical students in their clinical years is considered to be high but will vary considerably according to individual hospital and academic policy and practice. Choudhury and Cleator (1992) report an incidence of 0.3 needlestick injuries per medical student per year, while Gaffney et al (1992) report a 72% annual incidence among medical students, with 23% of the injuries involving an HIV or Hepatitis B positive patient.[15,22] Goetz et al (1992) reports a 40% annual incidence amongst interns.[25] In an anonymous retrospective survey among medical students in a teaching hospital, 71% of the 550 respondents had had an injury in their training year. Students in surgical wards were six times more likely to sustain an injury than students in the medical wards (O'Neill et al 1992).[45] Stotka et al (1991), in a prospective study in two tertiary hospitals in Richmond USA, found that amongst medical staff, students and interns had a much higher incidence of needlestick injury than other doctors (42.4% vs 15.2%).[56]

Other health care workers such as radiographers and laboratory workers are infrequently injured. Hansen et al (1993), in a prospective study of staff involved in radiological procedures found that 2.0% of 729 radiological staff were exposed to a needlestick injury during a 10 week period.[29] The incidence in paramedics is usually high due to the nature of their work. Klontz et al (1991) chose a systematic random sample of paramedics and administered a questionnaire to the sample. A total of 23% of 300 paramedics had a history of a needlestick injury in the previous year.[36]

In a detailed and extensive study McCormick et al (1991) reports on a 14 year prospective study of needlestick injuries in a tertiary hospital during the pre-AIDS and AIDS era. This study revealed a three fold increase in the

annual number of reported injuries over the 14 years (60.4 per 1 000 health care workers to 187.0 per 1 000). This increase is probably as a result of improved levels of reporting of needlestick injuries. The annual incidence rates for the various staff categories in this study were 196.5 / 1 000 for nursing personnel, 169.9 / 1 000 for laboratory staff, and a very high rate of 407.0 / 1 000 among members of the phlebotomy team although their risk of needlestick injury per procedure was very low (1 / 26,871 draws).[39]

Circadian and seasonal trends in needlestick injury rates are generally under-researched but English (1992) reported on his finding that the time when the highest rate of needlestick injury occurs is during the first two hours of work after being off duty the previous day, and on Sundays and Mondays.[19] Stotka et al (1991) in a study in two tertiary hospitals, reported that 81.0% of all injuries occurred during "day-duty" (7am - 7pm).[56]

4.2 Reporting of needlestick injuries

The reporting of needlestick injuries by health care workers is important to evaluate efficacy of established intervention programmes and to enable the appropriate design of work protocols or devices to decrease the incidence of injury.[10]

The availability of post-exposure prophylaxis is another important reason for reporting needlestick injuries. Various studies reveal a high incidence of under-reporting especially amongst doctors. Reporting rates are usually higher when the patient concerned has or is perceived to have a potentially transmissible infection.[16]

Collins and Kennedy (1987), in reviewing work by

Jacobsen et al (1983) commented on reporting rates amongst different staff categories. While most of the housekeeping / domestic staff reported their injuries, only eight out of 379 physicians reported their injury in the hospital population studied.

Gaffney et al (1992) found that less than 5% of interns reported their injuries, while Goetz et al (1992) found that 58% of medical students had reported their needlestick injury.[22,25]

The most common reasons for not reporting needlestick injuries include:-

i) trivial / small wound
ii) needle was sterile / appeared clean
iii) too time consuming
iv) unaware of need to report[16]

4.3 Place of injury

Health care workers employed in certain areas of a hospital are considered to be at higher risk of needlestick injury. Albertoni et al (1992) reports that injury rates are lower in hospitals with less than 300 beds compared with larger hospitals, and that rates are higher in Intensive Care Units and surgical wards (34.0% vs 16.7% in infectious disease wards). Eisenstein and Smith (1992) in their study in a tertiary hospital found the highest rates to be in the Emergency room and Intensive Care Units.[1,18]

4.4 Relationship of injuries to work volume

While incidence rates by category of staff, place of employment and type of procedure are well documented, little research has been undertaken which accurately

relates the incidence to the volume of work or the number of procedures performed. Camilleri (1991) found the incidence rate among surgeons in a hospital in Glasgow to be 1.55% per surgeon per operation, while Eisenstein and Smith (1992) found that the injury rate in a hospital was 3.2 per 100 000 needles purchased.[13,18]

4.5 Type of injury

Knowledge of the circumstances occurring at the time of injury and the manner of injury are important aspects of research of needlestick injuries. In their 14 year prospective study, McCormick et al (1991) found that 19.7% of injuries occurred during waste disposal, 15.7% during the administration of IV infusions or drugs, 13.3% while drawing blood from patients and 10.1% from the resheathing of needles.[39] The annual report of the USA National Institute of Occupational Safety and Health, as reported by Collins and Kennedy (1987); included details of occupational injuries amongst health care workers. Finger injuries accounted for 25.7% of the total number of injuries. Lacerations with scalpels accounted for 10.4%, and 9.4% were due to hypodermic needle punctures.[16]

English (1992), in his hospital based study found that 4.2% of injuries occurred whilst disposing of needles in needle boxes and 9.9% occurred because the disposed needle was protruding from inappropriate refuse bags.[19] The occurrence of injuries during surgical procedures has been emphasized by many studies.

Arena et al (1991) in his study of post-caesarian section glove checking, found that the surgeons gloves were perforated in 39/100 (37.2%) elective sections and after 43/100 (44.8%) emergency sections.[6] Greco et al (1993) found that the surgeon was more likely to sustain a glove

perforation than the assistant (38.3% vs 22.5%) and that only 15% of surgeons were aware of these perforations during surgery. Most (44%) of the perforations involved the index finger of the non-dominant hand, while 90.6% occurred in cases that lasted longer than 2 hours.[26]

In a study of over 1 300 surgical procedures, an observable needlestick injury occurred in 6.9% of surgical procedures. In 77% of cases a suture needle was the cause of the injury and mostly affected the distal fore-finger of the non-dominant hand. Using logistic regression models the researchers found that a vaginal hysterectomy had the highest risk of needlestick injury with an Odds Ratio of 3.5 compared with 12 other standard operations (Tokars et al 1992).[57]

Other procedures implicated in needlestick injuries include radiological procedures where an injury is significantly more likely to occur during certain types of procedures and in procedures lasting a longer time.[29]

It must be remembered however that certain injuries occur in a manner which is unexpected and to a larger extent unavoidable e.g. violent, confused or aggressive patients. A purposeful syringe attack on a health care worker by an HIV infected patient has been documented.[2]

4.6 Resheathing of needles

Perhaps one of the most preventable causes of needlestick injuries are those sustained by the health care worker during the resheathing of needles. The practice of resheathing of needles was officially discouraged by the Centre of Disease Control in 1986.[16] Collins and Kennedy (1987) cite numerous studies where it was demonstrated that resheathing of needles substantially increased the risk of

needlestick injuries (McCormick and Maki 1981, Patterson et al 1985; Wormser et al 1985 and Jaggar et al 1986).

Problems caused by not resheathing include the danger of walking to the disposal box with an unprotected syringe and the risk of injury when disposing of needles in already full disposal boxes. The use of a tray or kidney dish to carry unguarded syringes and the better placement and replacement of disposal boxes are some of the suggested solutions to these problems.[16]

Compliance with hospital policy regarding non resheathing of needles is usually poor. In a review by Dalton et al (1992), 45% of needlestick injuries in a hospital occurred during resheathing in spite of intensive education of staff. The incidence of resheathing related injuries were highest in the Intensive Care Units, Emergency units and medical wards.[17] Other studies have revealed that resheathing is practised by 77% of interns, 63% of medical students and more than one-third of paramedics.[15,22,36]

Reasons for the continued practice of resheathing are varied and include the disposal box or sharp containers being too far away and the perceived need to dispose of the needle immediately. Many health care workers persist in this practice in spite of being aware of the risk.[17] The need for intensive, consistent and behavioral related education has been emphasized.[8]

4.7 Administrative procedures

Virtually all hospitals now have defined protocols and administrative procedures to be followed after a needlestick injury. This usually involves the reporting of the injury, the testing of the patient and health care worker involved, the completion of accident / injury

reports and if necessary, the use of prophylaxis. Choudhury and Cleator (1992) reported that among medical students in the clinical years of study, there was an almost universal ignorance of procedures to be followed in the event of a needlestick injury.[15] The use of azido-deoxythymidine (AZT) following needlestick injury has become increasingly controversial. Jones (1991) describes HIV transmission in a health care worker by needlestick injury in spite of adequate, early AZT therapy.[35] Ramsey and Nettleman (1992) undertook a cost effectiveness evaluation of prophylactic AZT use. They concluded that the use of AZT can be cost effective if it is used only where the source is known to be HIV positive. Indiscriminate use amongst staff decreases cost-effectiveness when the cost per year life saved is calculated.[46]

4.8 Determination of risk

Perhaps the most interesting aspect of needlestick injury research has been the attempts to calculate the risk of sero-conversion following an injury involving an HIV positive patient. Friedland and Klein (1987) in their comprehensive review of research performed by Hirsch et al (1985), Weiss et al (1985), Henderson et al (1986) and McCray (1986) on the nosocomial risk of seroconversion of health workers after a needlestick injury involving HIV positive patients; report risks of 3.9 per 1 000 health care workers exposed (1 / 256), and in other studies a risk of 1 / 200 exposures. When the risks calculated in all of these studies are combined, the upper 95% confidence limit for the risk is 0.76% of health care workers exposed (1 / 132). In comparison the risk of seroconversion after a needlestick injury with a Hepatitis B infected needle is 12 - 17% [20]

O'Neill et al (1992) in his study on medical students and

residents calculated an injury related HIV exposure rate of 9.5% per person per year. Based on this exposure rate, the proportion of HIV infected patients in the hospital and the risk of sero-conversion following injury, he concluded that the hospital involved should expect an annual rate of HIV seroconversion as a result of needlestick injury of 27 - 46 per 100 000 or one student or resident every two - three years. This rate is similar to the death rate of motor vehicle accidents in the USA, the leading cause of death in this age group.[45]

It is widely accepted in the literature that the amount of blood transferred during a needlestick injury will directly affect the rate of sero-conversion. Gaughwin et al (1991) and Shirazian et al (1992) utilised radiolabelled blood in simulated needlestick injury experiments to quantify the amount of blood transferred to recipients. While the results varied widely, up to 0.75 microlitres of blood is transferred during injury with a 30-fold higher volume from 20 gauge needles than 27 gauge needles. Knowledge of the size of the needle involved is therefore important in ascertaining the risk of sero-conversion.[24,53]

It is important to remember however that health care workers are as equally susceptible as the rest of the population to sexually transmitted HIV infection. Studies involving health care workers revealed HIV infection rates comparable to other occupational groups. In addition, 95% of health care workers with HIV infection reported a history of high risk sexual behaviour.[20]

4.9 Perceptions of risk

Another under-researched area relating to needlestick injuries is the determination of perceptions of risk among staff and the relating of this perception to procedural

practices. Sheehy and Trudeau (1992) evaluated perceptions and fears of staff regarding HIV and found that in spite of extensive educational interventions, negative attitudes about HIV risk and fear may contribute to non-compliance and under-reporting. Organisational structures, work place tensions and the manner in which injuries are managed in a hospital are influencing factors.[52]

4.10 Prevention of needlestick injuries

Different methods of preventing needlestick injuries among health care workers are widely reported in the literature. Involvement of health worker unions in demands for improved occupational safety, as well as legal liability of employers has emphasized the need for intervention programmes, particularly in hospitals.[3,4] Eisenstein and Smith (1992) suggest that intervention programmes must be based on sound epidemiological research and must target personnel at highest risk of injury.[18]

Needle devices that require some form of assembly /disassembly pose an increased risk to health care workers. (Rowe and Giuffre 1991).[47] The development of shielded safety devices on syringes, needlefree intravenous access systems and recessed needles have all been shown to decrease the incidence of needlestick injury.[9,12,21,23,31,47,58,59] In addition the cost effectiveness and high level of staff satisfaction in the utilisation of these devices has been demonstrated.[7,9,54] Younger et al (1992) evaluated the impact of the introduction of shielded safety syringes on the incidence of needlestick injuries. The reported reduction in incidence was from 14 / 100 000 to 2 / 100 000 procedures.[59] Montz et al (1991) describes the development of blunt needles that can be used in fascial closure during surgery, and which offers further protection to staff.[41]

The need for puncture resistant needle disposal boxes which are amenable to incineration has been widely accepted as an important part of needlestick injury prevention.[10,16] Sellick et al (1992) reports on the problem of needles protruding from the top of disposal boxes. In a study involving the replacement of boxes with clear (see-through) boxes, a significant decline in this type of injury was demonstrated.[50] Contrary to the findings of other studies, Smith et al (1992) demonstrated a constant injury rate over three years in spite of an impenetrable sharps disposal system in hospital.[55] The incorporation of devices on the lids of these boxes to facilitate the easy removal of needles from re-usable or large syringes has been suggested, as well as the need for new disposal boxes to be readily available at all times to prevent over-filling (Collins and Kennedy 1987).[16]

The need for appropriate placement of needle disposal boxes is also emphasized in the literature. Haiduven et al (1992) in a yearly analysis of epidemiology of reported needlestick injuries in a Californian hospital, communicated results of the analysis to staff annually, instituted an annual education drive and placed disposal boxes as close to the procedural area as possible. A 45% decrease in reported needlestick injuries over a two year period and a 53% decrease in resheathing injuries was demonstrated.[28] Makofsky and Cone (1993) compared the incidence of recapped needles in disposal boxes in two different hospitals before and after the installation of mounted needle disposal boxes on walls near the patients' beds. This resulted in a reduction of resheathing (32.6% to 27.0% in one hospital and 27.4% to 18.2% in the second hospital).[37] McCormick et al (1991) reports on the results of placing disposal units at the bedside in a tertiary hospital. The rate of disposal related injuries declined by two-fold over a four year period.[39] Ng et al (1991) reported

that the placement of needle disposal boxes at the bedside did not significantly reduce the needlestick injury rate and that staff continued to resheath needles in spite of education.[43]

Continuous education of staff is essential in any intervention programme.[16] Camilleri (1991) identified the need for compulsory training of junior surgeons regarding theatre policies.[14] The establishment of protocols is essential in all areas of the hospital and for many different types of procedures, including the need for staff to obtain assistance from others before attempting invasive procedure on uncooperative or confused patients.[16] McKeown and Williamson (1992) undertook an assessment of awareness of HIV guidelines in a psychiatric hospital. Their conclusions were that guidelines were generally not read by staff (especially by junior medical staff), and that there was no difference in behavioral practices whether guidelines were read or not.[40] Collins and Kennedy (1987) suggest the use of cartoons and posters for educational purposes and that these are likely to be far more effective than lists of policies.[16] The need for uniform data reporting with regard to needlestick injuries is also essential.[5]

The main aim of guidelines is to establish uniform and safe work procedures. Berry and Greene (1992) recommend that anaesthetists need to reduce needle use in theatre (more efficient use) and must constantly review and evaluate safer devices. If needles are to be resheathed, then the one-handed method is essential.[10] Collins and Kennedy (1987) suggest the use of a cork as a needle guard where no disposal box is available, the needle being imbedded into the cork after use with a one-handed spearing technique. The use of needlecutters is discouraged because of the risk of blood splash whilst cutting.[16]

The use of personal protective equipment is another fundamental aspect of needlestick injury prevention. Jackson and McPherson (1992) recommended various risk reduction strategies for operating theatres, including the use of two pairs of puncture resistant gloves, face protection, impermeable gowns, clear protocols for handling sharp instruments and incorporation of manufacturers in the process of designing and manufacturing more comfortable and "user-friendly" protective equipment.[32] Johnson et al (1991) conducted an experiment where a needle containing HIV infected blood was passed through different combinations of gloves into a culture medium. HIV infection of the culture dish was greater than 90% with a single latex glove, 23 - 60% with double or triple gloves and 0 - 8% with two latex gloves and an intermediate cotton or Kevlar glove impregnated with 4% nonoxynol-9.[34] The findings of this experiment negate the common statement by staff that gloves are not worn as they provide no protection from needlestick injury.

Other methods of intervention mentioned in the literature include the necessity of compulsory Hepatitis B vaccination for all health care workers (Choudhury and Cleator 1992), and the need for proper lighting in areas of the hospital where blood is taken and invasive procedures are performed.[15,16]

While sophisticated high technology computer software programmes are available for tracking needlestick injuries in hospitals (Worthington 1993), Nusbaum (1992) states that it is possible to obtain substantial reductions in needlestick injury rates with the use of low technology intervention.[44,58] Whatever methods are utilised in a prevention programme in any health care setting, it is essential that this is based on an holistic and comprehensive approach, including psycho-social tensions

among staff regarding needlestick injuries and AIDS, and that the programme is appropriately evaluated as frequently as possible.[49,51,52]

5. AIM

To determine the incidence and factors associated with the occurrence of needlestick injuries at Addington hospital, the extent and reasons for under-reporting of injuries and to determine staff perceptions regarding these injuries to facilitate the establishment of intervention programmes.

6. OBJECTIVES

6.1 To determine the incidence and circadian, seasonal and secular trends of reported needlestick injuries at Addington Hospital during a three year period (October 1990 - November 1993).

6.2 To determine the extent of under-reporting of needlestick injuries and the reasons for under-reporting.

6.3 To determine the categories of staff involved in these injuries and to calculate staff specific incidence rates.

6.4 To determine the incidence rates in the various wards and departments of the hospital.

6.5 To relate the number of needlestick injuries per year, season, day, time and area concerned (Objectives 6.1 and 6.4) to Equivalent Patient Days and to relate the number of injuries excluding those caused by suture needles and lancets to the estimated total number of invasive procedures performed at Addington hospital from October 1990 - October 1993.

6.6 To determine the type of injury incurred and the manner in which it occurred.

6.7 To ascertain staff practices with regard to resheathing of needles.

6.8 To review the administrative procedures followed after needlestick injuries

6.9 To determine the proportion of needlestick injuries involving HIV + patients and to assess perceptions of risk of occupationally acquired HIV amongst staff at Addington Hospital.

6.10 To determine staff perceptions regarding prevention of needlestick injuries.

6.11 To make recommendations based on the findings of this study.

7. DEFINITIONS

7.1 Needlestick injury

The occurrence of an injury in the course of occupational duty with a needle, hypodermic syringe, lancet or suturing device that causes a break in the skin lining, where such needle has previously been in contact with a patient or in contact with bodily fluids.

7.2 Hospital staff

All permanent and temporary staff who are employed by the hospital, voluntary workers and students fulfilling practical curriculum criteria. This will include all medical, nursing, laboratory and auxiliary staff as well as students.

7.3 Addington Hospital

A Regional State hospital situated in the city of Durban with a total of 701 general hospital beds and providing general medical, surgical, maternity (87 beds), geriatric, outpatient, emergency, specialist, rehabilitative and laboratory services.

7.4 Negligence

Negligence implies any needlestick injury or puncture wound from an object used by another employee that was not discarded after use/was improperly discarded or handled carelessly by the other employee.

7.5 Equivalent Patient Days (EPD)

The hospital performance statistic - total number of inpatient days + 1/3 (outpatient attendances).

8. METHOD

8.1 Authority to conduct this study was obtained from the Chief Medical Superintendent, Addington Hospital, the Ethics Committee and the Post-graduate Development Committee, Faculty of Medicine, University of Natal.

8.2 Objective 1, 3, 4, 6, 8, 9

A reporting procedure for needlestick injuries was instituted at Addington Hospital in October 1990, which involved the entry of various aspects of the incident in a "Needlestick injury report book". The first part of this study involved a record review by the researcher of all entries in this book (404) from 01/11/90 - 31/10/93 utilising a checklist (APPENDIX A).

8.3 Objective 2, 3, 6, 7, 9, 10

The total staff complement at Addington Hospital constituted the sampling frame (1 869). The total number of different categories of staff at Addington Hospital as well as their location was obtained from Personnel records. No distinction was made with regard to part-time or full-time employees as both groups were considered to be at risk of a needlestick injury. The total number of staff required for statistical significance was calculated by a Bio-statistician to be 320. A further 10% was sampled to compensate for non-participation or inadequately completed questionnaires. The total size of the sample was thus 352. Staff members were numbered and stratified into staff categories. A random selection of staff using random number tables was then obtained. The number of staff sampled in each staff category was of the same proportion as in the sampling frame (17.2 - 17.6% of each staff category).

A pilot study involving 30 staff members was performed. No modifications of the questionnaire were necessary. The researcher was assisted by two nursing Sisters who were thoroughly briefed on all aspects of the methodology of the study and on the process of data collection. Sampled staff members were visited in their work place by the researcher and the two assistants over a four week period and requested to complete a questionnaire (APPENDIX B).

Assistance was available at all times from the researcher and assistants. The questionnaire consisted of ten closed and three open-ended questions. In addition, questionnaires were available in the Zulu language and these interviews were conducted by the one assistant proficient in the use of the language.

Repeat visits to each area of the hospital was necessary to ensure that staff who were too busy during the first visit

could complete the questionnaire. Participation in the study was entirely voluntary and confidentiality was assured at all times. Names of the respondents was not recorded. A random sample of 10% of interviews not conducted by the researcher was validated immediately after the completion of the interview.

8.4 Objective 5

The monthly statistical returns (Natal Provincial Administration, Health Services - Statistical Information) were reviewed from November 1990 - October 1993 to determine the Equivalent Patient Days over the 36 month period. With the use of random number tables, six months during this three year period were randomly selected. The computerised Hospital Information System was accessed to determine the total number of samples received by the Laboratory during these months. In addition, one week of each of these months was randomly selected using random number tables.

The Hospital Information System provided print-outs of all blood-samples received by the laboratory during the days of these weeks by name of patient, ward, test required and time of collection. The number of blood-letting procedures could be ascertained from the print-out by correlating the number of samples with the time of collection for each patient. (All staff utilise the "Vacutainer Barrel" when taking blood, thus enabling the withdrawal of multiple vials of blood during one procedure of blood-letting. If four samples originated from the same patient at the same time, only one procedure was recorded).

8.5 All data was entered and analysed using the EPI-INFO version 5 programme. The chi square test of significance was utilised where appropriate.

9. LIMITATIONS OF STUDY

9.1 This study is a retrospective review and is thus subject to all the limitations associated with such a review:-

- Data obtained from the use of the questionnaire regarding needlestick injuries during the past three years is subject to recall-bias.
- The study only identifies factors associated with needlestick injuries and no inferences regarding causality can be made.
- Staff members sampled in this study only represent the current worker population in the hospital.

9.2 Part of this study is dependent on the accuracy of records in the injury report book. Consistency of data could not be guaranteed as more than one staff member had entered details of injuries into this book.

9.3 The determination of the proportion of patients involved in needlestick injuries who are HIV positive may not be accurate as one HIV positive patient may be the source of more than one injury.

9.4 The estimation of the total number of invasive procedures and the calculation of subsequent rates does not include the number of injuries caused by suture needles and lancets as it was not possible to enumerate the frequency of use of suture needles and lancets. Injuries caused by these instruments are therefore excluded in the calculation of rates of injury per 100 000 invasive procedures. In addition data on invasive procedures was not available for Theatre, Laboratory and the Radiology Department.

Furthermore, the interpretation of rates of injury per 100 000 procedures is limited to a means of comparison between different areas of the hospital and different times of injury occurrence only.

10. RESULTS

10.1 Objectives 1 and 5 : Incidence and trends of reported needlestick injuries

A total of 404 entries in the Needlestick Injury Report book were reviewed. The total size of the sample for the questionnaire was 352 staff members. One staff member refused to participate in the study and a further 25 questionnaires were rejected by the researcher as they were incorrectly completed. The total sample numbered 326, representing a 92.7% response rate.

The incidence of reported needlestick injuries at Addington hospital during the three year period is represented in TABLE I. After an initial decline in the incidence of needlestick injuries, the rate of injury has increased steadily during the last two years. The total number of Equivalent Patient Days (EPD) and total number of invasive procedures for the three year period was 963 473 and 278 316 respectively. The number of reported needlestick injuries per 100 000 EPD is represented in TABLE II.

No seasonal variation was apparent in reported needlestick injuries when related to the number of invasive procedures (TABLE III). Injuries occurred uniformly throughout the month. During the week there were fewer injuries on Saturdays and Sundays but injury rates per 100 000 invasive procedures were comparable (TABLE IV).With regard to the time of injury, 258 (86.3%) of injuries occurred during day duty and 41 (13.7%) occurred during night duty, excluding those injuries caused by suture needles and lancets. When compared with the number of invasive procedures, the injury rate during night duty was slightly higher than the day duty injury rate (92.2 and 80.1 per 100 000 invasive procedures respectively. (TABLE V).

TABLE I

NUMBER OF REPORTED NEEDLESTICK INJURIES AND INJURY RATE PER YEAR

YEAR	NUMBER OF REPORTED NEEDLESTICK INJURIES	NUMBER OF DAYS RECORDED PER YEAR *	NEEDLESTICK INJURY RATE	
			PER DAY	PER YEAR
1990	30	63	0.48	173.8
1991	118	365	0.32	118.0
1992	129	366	0.35	129.0
1993	127	302	0.42	153.5
TOTAL	404	1096	0.37	134.7

Note:

* Column 3 refers to the number of days of each year that the "Needlestick injury book" has been utilised to record needlestick injuries up to the time of the study.

TABLE II

REPORTED NEEDLESTICK INJURY RATE PER 100 000 EQUIVALENT PATIENT DAYS (EPD): 1990 - 1993

YEAR	EPD	NUMBER OF REPORTED INJURIES	INJURY RATE (per 100 000 EPD's)
1990	42 950	30	69.8
1991	297 348	118	39.7
1992	332 654	129	38.8
1993	290 521	127	43.7
TOTAL	963 473	404	41.9

TABLE III

REPORTED NEEDLESTICK INJURIES PER MONTH AND PER 100 000 EQUIVALENT PATIENT DAYS (EPD) : NUMBER AND (%)

MONTH	NUMBER OF INJURIES (%)	TOTAL EPD	RATE PER 100 000 EPD
January-March	102 (25.2)	242 248	42.1
April-June	99 (24.6)	243 554	40.6
July-September	112 (27.7)	249 814	44.8
October-December	91 (22.5)	227 857	39.9
TOTAL	**404 (100.0)**	963 473	41.9

TABLE IV

REPORTED NEEDLESTICK INJURIES PER DAY OF THE WEEK AND PER 100 000 INVASIVE PROCEDURES: NUMBER AND (%)

DAY OF THE WEEK	NUMBER OF INJURIES (%)	TOTAL NUMBER INVASIVE PROCEDURES	RATE PER 100 000 PROCEDURES
Monday	53 (17.8)	69 888	75.8
Tuesday	56 (18.8)	65 988	84.9
Wednesday	45 (15.1)	57 876	77.8
Thursday	55 (18.3)	63 648	86.4
Friday	41 (13.6)	48 672	84.2
Saturday	23 (7.7)	30 768	74.8
Sunday	26 (8.7)	29 676	87.6
TOTAL	**299 (100.0)**	366 516	81.6

TABLE V

NEEDLESTICK INJURIES BY TIME OF DAY PER 100 000 INVASIVE PROCEDURES : NUMBER AND (%)

TIME OF DAY	NUMBER OF INJURIES (%)	TOTAL NUMBER INVASIVE PROCEDURES	RATE PER 100 000 PROCEDURES
Day duty	258 (86.3)	322 065	80.1
Night duty	41 (13.7)	44 451	92.2
TOTAL	299 (100.0)	366 516	81.6

Note: i) Injuries caused by suture needles and lancets excluded for the purpose of calculation of rates

ii) Details on number of invasive procedures not available for Theatre, Laboratory and Radiology Department

10.2 Objective 2: Extent of under-reporting of needlestick injuries

One-hundred and nine staff members (33.4%) of the total number sampled (326) had a history of 171 needlestick injuries in the last three years. A total of 68 (62.3%) had reported the injury.

Doctors and Nursing Sisters were less likely to report their injury than other staff categories (40.0% and 55.2% reported respectively) (TABLE VI).

The more needlestick injuries incurred by an individual the less likely they were to report their injuries, Odds Ratio (OR) = 1.00, 0.38 and 0.11 for a history of one, two and three needlestick injuries (chi square for trend = 16.77, $p < 0.0001$).

Analysis of reporting of needlestick injuries according to the number of injuries in each staff category reveals that 91 (53.2%) of the 171 injury incidents were reported. Thus while 62.3% of staff report their injuries, only 53.2 % of injuries are actually reported.

The most common reason for not reporting a needlestick injury was the perception that the patient was "low risk". (TABLE VII).

TABLE VI

HISTORY OF INJURY AND REPORTING BY STAFF CATEGORY: NUMBER AND (%)

STAFF CATEGORY	NUMBER OF STAFF WITH HISTORY OF INJURY	NUMBER REPORTED (%)
Doctor	10 (9.2)	4 (40.0)
Sister	29 (26.6)	16 (55.2)
Student Nurse	35 (32.1)	23 (65.7)
Enrolled/Staff Nurse	16 (14.7)	12 (75.0)
Laboratory Technician/ Radiographer	1 (0.9)	1 (100.0)
General Assistant	18 (16.5)	12 (66.7)
TOTAL	109 (100.0)	68 (62.3)

TABLE VII

REASONS FOR NOT REPORTING INJURIES : NUMBER AND (%)

REASON	NUMBER (%)
Low risk patient	9 (22.0)
No reason / not important	7 (17.1)
Needle appeared clean	6 (14.6)
Too busy	5 (12.2)
Did not realise implications	3 (7.3)
Fear of remonstrations	3 (7.3)
Injury slight / minor	3 (7.3)
Patient known HIV negative	2 (4.9)
Too much administrative bother	2 (4.9)
Did report to Sister - not interested	1 (2.4)
TOTAL	41 (100.0)

10.3 Objective 3: Determination of injury rates per staff category

According to the records in the injury report book as well as the history obtained from the sample of staff, Doctors and Student/Pupil nurses had the highest rates of needlestick injury (TABLE VIII and TABLE IX).

TABLE VIII

FREQUENCY OF REPORTED INJURIES AND ANNUAL INJURY RATE BY CATEGORY OF STAFF : NUMBER

STAFF CATEGORY	NUMBER OF INJURIES	TOTAL NUMBER OF STAFF	INJURY RATE PER STAFF CATEGORY PER YEAR (X1000)
Doctor	42	125	112.0
Pupil/Student Nurse	129	464	92.7
Sister	125	457	91.2
Enrolled /Staff Nurse	65	355	61.0
Laboratory Technician/ Radiographer	13	128	33.9
General Assistant	17	340	16.7
Other	2	-	-
Unknown	11	-	-
TOTAL	**404**	**1869**	72.1

TABLE IX

DISTRIBUTION OF SAMPLE BY STAFF CATEGORY AND HISTORY OF INJURY: NUMBER AND (%)

STAFF CATEGORY	TOTAL NUMBER OF STAFF	SAMPLE SIZE	HISTORY OF INJURY
Doctor	125	22	10 (45.5)
Student Nurse	464	81	35 (43.2)
Sister	457	80	29 (36.3)
Staff/Enrolled Nurse	355	61	16 (26.2)
Laboratory Technician/ Radiographer	128	22	1 (4.5)
General Assistant	340	60	18 (30.0)
TOTAL	1 869	326	109 (33.4)

While 109 (33.4%) of the sample had a history of injury, a total of 171 injuries had been incurred over a three year period. A higher proportion of General Assistants and Staff/Enrolled nurses had had multiple injuries than other staff categories (TABLE X).

The annual needlestick injury rate per 1 000 staff members can be calculated for each staff category from both the injury report book and the sample of staff members with a history of injury. The difference in the rate utilising these two sources is marked (TABLE XI).

TABLE X

REPORTED FREQUENCY OF INJURY BY STAFF CATEGORY : NUMBER AND (%)

STAFF CATEGORY	NUMBER OF INJURIES			TOTAL (STAFF)	TOTAL (INJURIES)	AVERAGE NUMBER INJURIES PER STAFF CATEGORY
	1	2	3+			
Doctor	8 (80.0)	1 (10.0)	1 (10.0)	10 (100.0)	13	1.3
Student Nurse	21 (60.0)	8 (22.9)	6 (17.1)	35 (100.0)	55	1.6
Sister	18 (62.0)	8 (27.6)	3 (10.4)	29 (100.0)	43	1.5
Staff/Enrolled Nurse	10 (62.5)	2 (12.5)	4 (25.0)	16 (100.0)	26	1.6
Laboratory Technician/ Radiographer	1 (100)	-	-	1 (100.0)	1	1.0
General Assistant	8 (44.4)	5 (27.8)	5 (27.8)	18 (100.0)	33	1.8
TOTAL	66 (60.6)	24 (22.0)	19 (17.4)	109 (100.0)	171	1.6

TABLE XI

ANNUAL INJURY RATE (X 1 000) PER STAFF CATEGORY: COMPARISON OF INJURY REPORT BOOK AND SAMPLE

STAFF CATEGORY	INJURY RATE PER YEAR (X 1 000)	
	INJURY REPORT BOOK	SAMPLE OF STAFF
Doctor	112.0	197.0
Pupil/Student Nurse	92.7	226.3
Sister	91.2	179.2
Enrolled/Staff Nurse	61.0	142.1
Laboratory Technician/Radiographer	33.9	15.2
General Assistant	16.7	183.3
TOTAL	72.1	174.8

10.4 Objective 4 and 5: Determination of incidence rates per area of the hospital

Almost half of the injuries reported (41.8%) in the injury report book had occurred in the medical and surgical wards. (TABLE XII). However, when the number of injuries is related to the number of invasive procedures performed per area of the hospital, the Obstetric and Gynaecology wards and Casualty have the highest rate of needlestick injuries. (TABLE XIII).

A comparison of place of injury for different staff categories reveals that Enrolled/Staff nurses, Student nurses and doctors are more likely to injure themselves in

the medical and surgical wards. Almost three-quarters of reported injuries occurring in theatre and more than 80% of injuries in the Intensive Care Unit involve nursing sisters (TABLE XIV).

TABLE XII

NUMBER OF REPORTED INJURIES BY AREA OF THE HOSPITAL : NUMBER AND (%)

AREA	NUMBER OF INJURIES (%)
Medical	93 (23.0)
Surgical	76 (18.8)
Obstetrics & Gynaecology	51 (12.6)
Casualty	47 (11.6)
Outpatients	27 (6.7)
Theatre	19 (4.7)
Laboratory/ X-ray	15 (3.7)
Haemo-dialysis unit	11 (2.8)
Paediatric	14 (3.5)
ICU	6 (1.5)
Other/Unknown	45 (11.1)
TOTAL	**404 (100.0)**

TABLE XIII

REPORTED NEEDLESTICK INJURY RATE BY AREA PER 100 000 INVASIVE PROCEDURES

PLACE	TOTAL NUMBER PROCEDURES	NUMBER OF INJURIES	INJURY RATE/100 000 PROCEDURES
Obstetrics & Gynaecology	14 796	43	290.6
Casualty	19 620	43	219.2
Haemo-dialysis unit	6 048	11	181.9
Paediatric	14 004	14	100.0
Surgical	73 512	71	96.6
Medical	96 660	87	90.0
ICU	9 576	6	62.7
Outpatients	44 100	24	54.4
TOTAL	278 316	299	107.4

Note: i) Data pertaining to the number of invasive procedures for Theatre, Laboratory and Radiology not available.

ii) Injuries caused by suture needles and lancets excluded for the purposes of calculation of rates.

TABLE XIV

AREA OF REPORTED INJURY BY CATEGORY OF STAFF : NUMBER AND (%)

STAFF	NURSING			OTHER				TOTAL
AREA	Enrolled/ Staff	Pupil/ Student	Sister	Doctor	General Assistant	Lab/ X-ray	Other/ Unknown	
Medical ward	16 (17.2) (24.6)	40 (43.0) (31.0)	17 (18.3) (13.6)	14 (15.1) (33.3)	4 (4.2) (23.5)	-	2 (2.2) (15.4)	93 (100.0
Surgical ward	15 (19.7) (23.1)	35 (46.1) (27.2)	18 (23.7) (14.4)	8 (10.5) (19.1)	-	-	-	76 (100.0
Obstetrics & Gynaecology	4 (7.8) (6.2)	17 (33.3) (13.2)	24 (47.1) (19.2)	4 (7.8) (9.5)	1 (2.0) (5.8)	-	1 (2.0) (7.7)	51 (100.0
Casualty	11 (23.4) (16.9)	16 (34.0) (12.4)	17 (36.2) (13.6)	2 (4.3) (4.8)	1 (2.1) (5.8)	-	-	47 (100.0
Outpatients	7 (25.9) (10.8)	7 (25.9) (5.4)	12 (44.4) (9.6)	1 (3.8) (2.4)	-	-	-	27 (100.0
Theatre	2 (10.5) (3.1)	1 (5.3) (0.8)	14 (73.7) (11.2)	2 (10.5) (4.8)	-	-	-	19 (100.0
Laboratory /X-ray	-	-	-	3 (20.0) (7.1)	-	11 (73.3) (84.6)	1 (6.7) (7.7)	15 (100.0
Haemodialysis	2 (18.2) (3.1)	-	9 (81.8) (7.2)	-	-	-	-	11 (100.0
Paediatrics	3 (21.4) (4.6)	4 (28.6) (3.1)	1 (7.1) (0.8)	4 (28.6) (9.5)	2 (14.3) (11.8)	-	-	14 (100.0
Intensive care	-	-	5 (83.3) (4.0)	1 (16.7) (2.4)	-	-	-	6 (100.0
Other/Unknown	5 (11.1) (7.6)	9 (20.0) (6.9)	8 (17.8) (6.4)	3 (6.7) (7.1)	9 (20.0) (53.1)	2 (4.4) (15.4)	9 (20.0) (69.2)	45 (100.0
TOTAL	65 (100.0)	129 (100.0)	125 (100.0)	42 (100.0)	17 (100.0)	13 (100.0)	13 (100.0)	404 (100.0 (100.0)

10.5 Objective 6: Type of injury

A total of 21.9% of injuries reported in the needlestick injury report book had occurred as a result of the negligence of other staff members (TABLE XV).

With regard to the sample of staff, a total of 50 (15.3%) had had a needlestick injury as a result of another staff members negligence. This represents 29.2 % of the sum total of injuries obtained from this sample (total = 171 injuries).

All of the General Assistants with a history of needlestick injury (18) had been injured through negligence. Between 25.0 and 37.9% of nursing staff had been injured through negligence. Only one (10.0%) of the doctors with a history of injury had been injured in this manner.

Student Nurses, Sisters, Laboratory workers and General Assistants were more likely than other staff categories to be injured through other peoples negligence (27.9% vs 7.8%; OR = 4.59, 95% C.I. [1.78 ; 12.54], $p < 0.001$).

The Outpatients Department, Casualty and ICU had the highest rate of negligence related needlestick injuries (30.2% vs 19.7%), but this finding was not statistically significant.

Student Nurses, Staff and Enrolled Nurses were more likely to injure themselves during resheathing of needles than other staff categories (19.2% vs 9.6%; OR = 2.24, 95% C.I. [1.02 ;4.96]; $p < 0.05$).

A total of 42.2% of all injuries were with Intravenous needles (TABLE XVI). Excluding staff members who were injured as a result of other staff members negligence,

Doctors and Nursing sisters were more likely to obtain an injury with an intravenous or suture needle than other staff categories (OR = 2.78, 95% C.I. [1.35 ; 5.74], $p < 0.004$).

Student nurses, Enrolled and Staff nurses were more likely to obtain an injury with a IM needle than other staff categories (OR = 2.38, 95% C.I. [1.03 ; 5.87], $p < 0.04$.

Staff with an intravenous needle injury were not more likely to report their injury than after injuries with other needle types ($p = 0.90$).

TABLE XV

METHOD OF REPORTED INJURY : NUMBER AND (%)

METHOD	NUMBER OF INJURIES (%)
Accidental prick (needle)	186 (46.1)
Negligence	89 (21.9)
Resheathing	57 (14.1)
Suturing	19 (4.7)
Other/ Unknown	23 (5.8)
Patient aggressive/ confused	19 (4.7)
Accidental prick (lancet)	11 (2.7)
TOTAL	**404 (100.0)**

TABLE XVI

TYPE OF NEEDLE INVOLVED IN INJURY : NUMBER AND (%)

TYPE OF NEEDLE	NUMBER (%)
Intravenous needle	46 (42.2)
Suture needle	11 (10.1)
Intra-muscular needle	36 (33.0)
Other	16 (14.7)
TOTAL	109 (100.0)

10.6 Objective 7: Staff practices with regard to resheathing of needles

Reported resheathing practices of staff members was ascertained from the questionnaire administered to staff. A total of 60 (18.4%) staff members (General Assistants) were excluded from this question as they did not deal with needles in their occupational capacity. Greater than 60% of the sample still claimed to resheath needles (TABLE XVII).

TABLE XVII

REPORTED RESHEATHING PRACTICES AMONG SAMPLED STAFF : NUMBER AND (%)

RESHEATHING PRACTICE	NUMBER (%)
Never	102 (38.3)
Sometimes	107 (40.2)
Often	57 (21.5)
TOTAL	266 (100.0)

Doctors were more likely to report resheathing of needles "often" than all other staff categories (OR = 13.2, 95% C.I.[4.50 ; 40.51], $p < 0.0001$).

After controlling for those injuries reported to have been caused by negligence of other staff members, a linear trend existed between frequency of resheathing and a history of needlestick injury - OR = 1.00 , 2.02 and 2.27 for "never" , "sometimes" and "often" respectively (chi square for linear trend = 5.10, $p < 0.03$).

Staff members who reported that they practised resheathing of needles were also more likely not to report their needlestick injury - OR for reporting = 1.00, 0.49 and 0.30 for "never", "sometimes" and "often" respectively (chi square for linear trend = 3.86,
$p < 0.05$).

Those who did not report the practice of resheathing of needles were far less likely to perceive themselves to be at high risk of HIV (OR = 0.56, 95% C.I. [0.33 ; 0.96], $p < 0.03$).

10.7 Objective 8: Review of administrative procedures

A total of 357 (88.4%) of reported injuries were reported within 24 hours (TABLE XVIII).

A record of a Workman Compensation Act form being completed was present in 245 cases (60.6%).

In 42 reported cases (7.2%), the staff member received a course of AZT prophylaxis.

TABLE XVIII

RESPONSE TO INJURY: TIME TAKEN TO REPORT INJURY (DAYS)

TIME IN DAYS	NUMBER OF INJURIES (%)
1 day or less	357 (88.4)
2 - 5 days	37 (9.1)
more than 5 days	10 (2.5)
TOTAL	**404 (100.0)**

10.8 Objective 9: Proportion of needlestick injuries involving HIV positive patients and determination of perceptions of risk

The total and annual number of patients involved in needlestick injuries who tested HIV positive after the injury is represented in TABLES XIX and XX.

TABLE XIX

HIV STATUS OF PATIENTS INVOLVED IN NEEDLESTICK INJURIES: NUMBER AND (%)

HIV RESULT	NUMBER OF PATIENTS (%)
positive	29 (7.2)
negative	256 (63.3)
not recorded	119 (29.5)
TOTAL	**404 (100.0)**

TABLE XX

HIV POSITIVE PATIENTS INVOLVED IN NEEDLESTICK INJURIES PER YEAR: NUMBER AND (%)

YEAR	NUMBER OF INJURIES	NUMBER POSITIVE PATIENTS (%)
1990	30	0 (0.0)
1991	118	2 (1.7)
1992	129	13 (10.1)
1993	127	14 (11.0)
TOTAL	404	29 (7.2)

Doctors and Nursing sisters were significantly more likely to record a needlestick injury from an HIV positive patient than other staff categories (12.8% vs 4.4% ; OR = 2.91, 95% C.I. [1.24 ; 6.94], $p < 0.01$).

The areas of the hospital which recorded the highest number of HIV positive needlestick injuries were Casualty and the Intensive Care Unit. (15.2% vs 6.7%, $p = 0.08$, NS).

With regard to staff perceptions of risk from occupational HIV, only 27 (8.2%) of staff stated that their occupation placed them at no or minimal risk of contracting HIV. Eighty-four (25.8%) thought that they were at moderate risk and 215 (66.0%) stated that they were at a high risk of occupationally acquired HIV infection. Perceptions of "high" risk by staff category is represented in TABLE XXI.

There was no correlation between reported history of injury and perception of risk even after controlling for frequency of injury.

Staff who perceived themselves at high risk were not more likely to report their injuries (p = 0.17).

TABLE XXI

PERCEPTIONS OF "HIGH" OCCUPATIONAL AIDS RISK BY STAFF CATEGORY: NUMBER AND (%)

STAFF CATEGORY	TOTAL NUMBER SAMPLED	PERCEPTION OF "HIGH RISK" NUMBER AND (%)
General Assistant	60 (18.4)	59 (98.3) (27.5)
Doctor	22 (6.8)	15 (68.2) (7.0)
Sister	80 (24.5)	51 (63.8) (23.7)
Student Nurse	81 (24.8)	51 (63.0) (23.7)
Enrolled/Staff Nurse	61 (18.7)	36 (59.0) (16.7)
Laboratory Technologist/ Radiographer	22 (6.8)	3 (13.6) (1.4)
TOTAL	326 (100.0)	215 (66.0) (100.0)

10.9 Objective 10: Staff perceptions regarding prevention of needlestick injuries.

A total of 269 (82.5%) of the sample felt that more could be done to protect staff from needlestick injuries in the work setting. Staff with higher perceptions of risk were increasingly more likely to be of this opinion (OR = 1.00, 1.76, 4.28 for "no/minimal risk", "moderate risk" and "high risk" respectively, chi square = 14.72, $p < 0.001$). There was a non-significant correlation between history of negligent injury and this opinion (OR = 1.14, $p = 0.055$).

Specific staff perceptions regarding the prevention of needlestick injuries is recorded in TABLE XXII.

TABLE XXII

METHODS OF PROVIDING IMPROVED PROTECTION FOR STAFF : NUMBER OF TIMES CITED BY SAMPLE AND (%).

METHOD	NUMBER (%)
HIV testing of all patients	204 (62.6)
Improved facilities for needle disposal	184 (56.4)
Punishment for staff who do not obey procedures (negligence)	128 (39.3)
Talks and lectures	115 (35.3)
Improved procedures for reporting / follow up of injuries	96 (29.4)
Employment of professional blood letters	89 (27.3)
Audiovisual material and demonstrations	73 (22.4)
More reading material / literature	69 (21.2)
Other	20 (6.1)

10.9.1 Pre-admission HIV testing of patients

Testing of patients was the most commonly cited method, although numerous respondents commented on the difficulty of doing this and the sense of false security which may prevail if this was instituted.

Doctors were the least likely staff category to choose this method (45.5%), while Student Nurses (67.9%) and Enrolled/Staff nurses (68.9%) were the staff categories which chose this method most often.

10.9.2 Disposal of needles

A total of 51 (85.0%) of General Assistants suggested that improved facilities for the disposal of needles were needed in the hospital.

Those who perceived themselves to be at high risk of HIV in their work setting were more likely to want improved disposal methods than other staff members (62.8% vs 44.1%, $p < 0.01$).

General comments from staff members regarding needle disposal included the siting of disposal boxes (containers should be where blood is taken), the misuse of containers, and the need for management to investigate alternative types of needles such as those which were retractable until the time of use.

10.9.3 Increased punishment of negligent staff members

Laboratory workers, Radiographers and General Assistants were more likely to agree with punishment for negligence than other respondents (51.2% vs 35.2%, OR = 1.93, 95% C.I. [1.13 ; 3.30], $p < 0.01$).

Those staff members who had been injured through negligence quoted "punishment" more frequently than other respondents (56.0% vs 36.2%, OR = 2.24, 95% C.I. [1.16 ; 4.34], $p < 0.015$).

Staff members who practised resheathing of needles were less likely to cite punishment as a method of protecting staff (OR = 1.00, 0.65, 0.37 for "never", "sometimes" and "often" resheathing needles, chi square for trend = 7.99, $p < 0.005$).

A general comment frequently cited by nursing staff was the number of doctors who left used needles in procedure trays / packs after use. The responsibility for clearing these trays was thus left with the nursing staff.

10.9.4 Reading material, audio-visual demonstrations and lectures

None of the doctors wanted more reading material. The majority of staff within each staff category did not want more reading materials, lectures or audiovisual materials. A total of 39 (48.3%) of General Assistants quoted more talks and lectures in preference to audiovisual material (21.7%) or reading material (11.7%).

10.9.5 Improved procedures for reporting injuries

Student nurses quoted improved reporting procedures more frequently than other staff members (40.1% vs 25.7%, OR = 1.99, 95% C.I. [1.13 ; 3.48], $p < 0.02$). General comments from staff members in this regard included the lack of confidentiality following a

needlestick injury, including the results of patient and staff members HIV tests. It was suggested that too many people are involved in the handling of needlestick injuries. Student nurses frequently cited their reluctance to report injuries because of the fear of chastisement by senior staff.

10.9.6 Phlebotomists / Blood letters

The employment of professional blood letters as a means of combatting the high incidence of needlestick injuries was quoted mainly by professional staff - doctors and nursing sisters (89.9% vs 22.4%, OR = 3.97, 95% C.I. [2.30 ; 6.87], $p < 0.0001$).

10.9.7 Combinations of suggestions

Staff members who perceived themselves at lower risk of HIV were more likely to choose the more "passive" interventions of "more reading material", "talks / lectures" and "audiovisual material and demonstrations" (OR = 1.00, 1.18, 1.68, 3.92 for high, moderate, low and no risk respectively; chi square for linear trend = 9.40, $p < 0.003$).

Conversely, those who perceived themselves to be at higher risk were more likely to choose the more "active" interventions of "better disposal facilities for needles", "enforced testing of patients", "employment of phlebotomists" and "improved reporting procedures for needlestick injuries" (OR = 1.00, 1.49, 1.76, 2.04 for no, low, moderate and high risk respectively; chi square for linear trend = 4.70, $p < 0.035$).

No significant correlation existed between perception

of risk and increased punishment of staff for negligence ($p = 0.58$).

10.9.8 Alternative suggestions (open-ended question)

Alternative suggestions from staff included:-

i) Education of doctors regarding their responsibility to dispose of their own needles (4x)

ii) Improved methods of submitting blood samples to the laboratory (sans needle) (3x)

iii) Improved communication with the laboratory (3x)

iv) Increased supervision and control (2x)

v) Use of stronger gloves / improved protective clothing (2x)

vi) Use of retractable needles

vii) Decreased work load

viii) Restriction of blood taking to certain staff categories

ix) Institution of "danger pay"

x) Decrease and/or planning of invasive procedures on HIV positive patients

xi) education of all patients at the time of admission regarding the need for HIV testing following needlestick injuries

11. DISCUSSION

The need to identify and epidemiologically assess the factors associated with needlestick injuries is an essential component of the planning and development of strategies aimed at prevention.[30]

The number of needlestick injuries at Addington hospital as recorded in the needlestick injury report book ranged from 118 - 174 per year (average of 134.7) for a staff complement of 1 869 people. This represents an average incidence rate of 72.1 injuries per 1 000 staff per year. The annual incidence rate based on the reported needlestick injuries of the sampled staff is much higher viz.- 174.8 per 1 000 staff (142.4% higher than the report book). The overall incidence of injury compares favourably to other studies, although cognisance must be taken of the fact that most other research has limited the scope of the determination of incidence rates to certain categories of staff (eg. medical students).[6,13,22]

The results of this study are comparable with the 14 year prospective study performed by McCormick et al (1991) where the annual incidence rate ranged from 60.4 - 187.0 per 1 000 heath care workers over a 14 year period.[39]

The calculation of rates using the number of injuries in the report book compared with that in the sample population may highlight the extent of under-reporting of injuries. A total of 91 injuries (53.2%) were reported by respondents. It could thus be surmised that if only half of the injuries are reported, then the injury rate obtained from the sample population should be double that obtained from the injury report book (100% difference). The difference is in fact much higher (142.4% difference). It is obvious from the results of this study that staff may not be entirely truthful in their responses regarding the under-reporting

of injuries - thus even incidents of not reporting injuries are under-reported. It is however important to accept that other factors may account for or contribute towards this discrepancy, such as information bias associated with the use of a questionnaire.

Under-reporting of injuries has been perceived as a major problem in combatting needlestick injuries.[16,22,25] As no other study reviewed actually validated their results by comparing the injury report book with a sample of staff, it is difficult to compare these results to other literature. The results of this study are compatible with the suggestion that the true number of needlestick injuries in Addington hospital may be about three times greater than that reported in the injury book, and that staff may often conceal the fact that they did not follow hospital procedure in reporting the injury.

Reasons cited in this study for not reporting injuries are comparable to other studies.[16] It is of interest to note that almost 40% of staff who did not report their injury, claimed that they did not do so because the patient was "low risk" or that the needle "looked clean." It is unfortunate that some staff feel that they have the ability to assess the sexual proclivities, behaviour and risk of HIV infection of patients. This emphasizes the need for continued basic education of staff with regard to susceptibility and spread of HIV.

Consistent with the findings in other studies, doctors had the lowest rate of injury reporting (40.0%) compared with other staff categories.[16,22] The fact that 7.3% of the sample with a history of injury did not report their injury for fear of remonstrations and that there was a significant decrease in injury reporting among staff with multiple injuries, must be evidence of the staffs negative

association with injury reporting. (Staff members with a third needlestick injury were ten times less likely to report this injury than their first injury). The need to educate more senior levels of staff such as the Matrons with regard to the manner in which they themselves perceive needlestick injuries and deal with affected staff members is evident. Negative attitudes towards AIDS and fear of consequences of needlestick injuries will contribute to non-compliance in reporting.[52]

With regard to secular, seasonal and circadian trends of needlestick injuries, the initial high number of reported needlestick injuries in 1990 may have been due to the novelty of the initiation of the needlestick injury report book, especially as the procedures for compensation for occupationally acquired HIV had been instituted at a similar time. This was followed by an initial drop in 1991 and a rising trend since. The rate of needlestick injuries from 1991 - 1993 when compared to 100 000 Equivalent Patient Days has remained relatively constant. Therefore the increase in the number of needlestick injuries over the last three years can be attributed to an increased work load.

The lack of seasonal variations of injuries is similar to other studies.[56] A greater proportion of injuries occur during weekdays and during day-duty, yet when compared to the number of invasive procedures the injury rate is relatively constant during the days of the week and higher during night duty. The increased rate of injury after hours may be due to the higher proportion of "emergency" patient testing as opposed to "routine" blood tests. The lack of adequate lighting may also be a contributing factor.[16]

The variation in the reported injury rate by category of staff may be a reflection of the variation in risk for

different staff members (15.2 - 226.3 per 1 000 staff per year). McCormick et al (1991) reports a risk of 196.5 per 1 000 staff per year for nursing personnel.[39] This is comparable with the rates obtained in this study from the sample population - 226.3, 179.2 and 142.1 per 1 000 for Student nurses, Sisters and Enrolled/Staff nurses respectively. The high rate among Student nurses indicates the need for extensive education and training with regard to HIV for this group and the need for more controlled supervision over their involvement with invasive procedures.

The apparent high incidence of exposure to needlestick injury among General Assistants (183.3 per 1 000) is cause for concern. These staff members should never be exposed to needlestick injuries and their injury rate is indicative of the extent of negligence associated with the disposal of waste in the hospital. All staff in charge of the disposal of waste (eg. ward Sisters) must be advised of possible serious legal consequences if these activities continue unchecked.[16,33]

An evaluation of the number of needlestick injuries by area of the hospital spuriously indicates that the medical and surgical wards have the highest rate of injuries. While the number of needlestick injuries is greatest in these two areas, the risk per 100 000 invasive procedures is less in these two areas than in other parts of the hospital. The comparison of needlestick injuries (excluding suture needles and lancets) to the number of invasive procedures performed indicates higher rates of injury in the Obstetrics and Gynaecology wards and in the Casualty Department. This may be indicative of staff exposure to a higher proportion of emergency and "restless" patients. The high rate of injury in Casualty (219.2 per 100 000 invasive procedures) is similar to other studies.[1,18]

While it is accepted that the comparison of injuries to the number of procedures is crude and may be best interpreted in terms of assessing areas of highest risk rather than determining actual rates; it does nevertheless represent a unique way of comparing needlestick injury rates to appropriate workload. Although the determination of this workload is significantly easier in hospitals with access to computerised information, the same details can be obtained manually from laboratory records. A more accurate reflection of actual rates can be determined by relating the invasive procedure workload to needlestick injuries involving hollow-bore / intravenous needles only.

The reported rate of injury in the Intensive Care Unit (ICU) is much lower than that in other studies.[1,18] This may be a reflection of the small size of the Addington ICU.

Any intervention and education must take cognisance of which area in the hospital poses the greatest risk to the various staff categories. Thus the high incidence of General Assistant injuries (23.5%) and Student nurse injuries (31.0%) in the medical wards must be further evaluated. Similarly, 73.7% of all injuries in theatre involve Nursing Sisters. Procedures and protocols for handling sharp instruments in theatre must be reviewed. In this manner the data included in TABLE XIV can be an extremely useful aid in prioritising areas of the hospital for intervention. It is recommended that any epidemiological assessment of needlestick injuries in a hospital includes this information.

The circumstances that lead to the occurrence of needlestick injuries could not be determined accurately in this study as the needlestick injury report book only started accurately recording these details from the beginning of 1992. Nevertheless, according to the record

review of the report book as well as the sample of staff, roughly 15 - 20% of injuries are as a result of negligence of other staff members. Various staff categories are at higher risk of negligence related injuries e.g. General Assistants and nursing staff. Literature on this aspect of needlestick injuries is limited and therefore no comparison can be made with international literature. It must be noted however that stricter control on staff compliance with regard to procedures and protocols could reduce the incidence of needlestick injuries by as much as 20%.

Only 5 - 10% of reported injuries appear to be caused by suture needles; thus the threat imposed to staff by suturing is limited apart from Theatre and Obstetrics.[6,26,57] Many of the problems relating to needlestick injuries in theatres are area specific and an in-depth study aimed specifically at the theatre and theatre staff may be necessary. Many studies have previously been performed in other hospitals where gloves have been checked post-operatively for tears.[26,57]

Resheathing of needles is probably one of the more contentious issues relating to needlestick injuries.[16] In a total of 14.1% of injuries in the report book, the staff member admitted that the injury was a result of resheathing of a needle. The finding that less than 40% of staff comply with hospital policy with regard to resheathing of needles is comparable to other studies.[17] The fact that doctors are 13.2 times more likely to resheath needles than other staff categories is similar to other studies.[15-17,22] It is expected by the Infection Control Committee that intervention to change the behaviour with regard to the resheathing of needles in this staff category will be extremely difficult.

Perhaps one of the most interesting findings in this study is the significant linear trend between resheathing

practices and incidence of injury. The knowledge that those who resheathed needles were 2.02 - 2.27 times more likely to have a needlestick injury than staff members who did not resheath needles must be imparted to staff members who continue this practice. The fact that staff members who sustain needlestick injuries as a result of resheathing are less likely to report their injuries implies again that fear of remonstrations may prevent reporting of injuries.

Staff members who reported that they did not resheath needles were more likely to perceive themselves at a lower risk of occupationally acquired HIV. This may imply that the practice of health care workers in handling used needles may influence perceptions of vulnerability to HIV infection. The exploration of the effect of a change in behaviour on perceptions (and vice-versa) is undoubtably a research topic on its own.

Less than 5% of injuries are "unavoidable". These are injuries where the patient is confused, restless or aggressive. The issue of "unavoidability" is also questionable. Staff should at all times request assistance when performing an invasive procedure on a restless patient.[16]

A review of the administrative procedures involved in the reporting of needlestick injuries at Addington Hospital indicate a high compliance with procedure amongst those staff members who report their injury (88.4% report within 24 hours). Initial problems relating to injuries which occur after hours has already been addressed. The injury report book must however always include details on the staff category, area of hospital and nature of injury. Inconsistency in completing the reports is compounded by staff changes in Staff Sick Parade where the book is kept. The Sister in charge of this area must also ensure that a

record of compliance with the Workman Compensation Act regulations is maintained. All staff members who sustained an injury involving an HIV positive patient were correctly offered a course of AZT, although this practice is presently under review.

Although the prevalence of HIV sero-positivity in the hospital patients involved in needlestick injuries is 7.2%, the rapid rise in patient sero-positivity (0 - 11% in three years) is cause for concern. It is however expected that this rate is higher than the rate in the general population as the hospital population represents an "ill" population. Furthermore this rate may be higher than the rate in the general hospital population as:-

i) one HIV positive patient may be the source of more than one needlestick injury and thus be counted more than once in this study

ii) staff are more likely to report an injury if the patient is or is perceived to be HIV positive, or has a history of high risk behaviour.[16]

The risk of HIV sero-conversion amongst staff at Addington Hospital as a result of needlestick injuries is not easy to determine. The rate of sero-conversion after an HIV infected needlestick injury is dependent upon inter alia, the volume of blood transferred, the type of needle involved and the depth and extent of the injury.[24,53] Various studies which have attempted to quantify this risk have suggested many differing sero-conversion rates. A review by Friedland and Klein (1987) of these studies revealed that the upper 95% confidence limit for sero-conversion was 0.76% or 1 / 132 injuries.[20]

The highest risk for sero-conversion occurs with hollow-

bore intravenous needles as the volume of blood transferred in injuries with these needles is greater.[24,53] Almost half of the injuries in the sample population in this study involved hollow-bore intravenous needles (42.2%).

On the basis of the findings of this study it may be assumed that the proportion of HIV positive patients involved in needlestick injuries at the hospital in 1993 is at least 10% of the total number of injuries. The needlestick injury rate in this hospital is known to be 174.8 per 1 000 staff members per year or 326 injuries per year (total staff complement is 1 869). Thus it may be estimated that there are 33 needlestick injuries involving HIV positive patients each year at Addington Hospital. If the sero-conversion rate mentioned above is used in the calculation (1 / 132), it could be expected that one staff member at Addington Hospital would sero-convert and become HIV positive on the basis of a needlestick injury every four years. This is equivalent to an annual sero-conversion rate of 13.4 per 100 000 which is less than that reported by O'Neill et al (1992) in their study in Los Angeles.[20,45]

The following factors must be considered before interpreting the result of this calculation:-

i) This figure represents the upper 95% confidence limit, and the risk of sero-conversion may well be less.

ii) The calculation is based upon an HIV sero-positive rate of 10% in the hospital population involved in needlestick injuries. If some of the predictions regarding the increase in infection rates in the general population are realised, the risk of sero-conversion could become much higher.

iii) The risk is dependent on the type of needle involved

and volume of blood transferred.

iv) The calculated risk is the average risk for staff at Addington Hospital. Various staff categories are at a higher risk. It can be expected from the results of this study that there is a 32% chance that this staff member would be a Student nurse, a 25% chance of being a Sister and a 7% chance of being a doctor. The real proportional chances of sero-conversion for Sisters and doctors may however be much higher as this study reveals that they are more likely to be injured with a hollow-bore intravenous needle than other staff categories.

Utilising the stated odds ratios for frequency of injury, place of injury, type of needle involved, as well as the factors mentioned above and actuarial life table functions; it could be possible to formulate models for various staff categories to accurately determine annual risks of sero-conversion; but this is beyond the scope of this study.

The fact that two-thirds of the sampled populations perceived themselves to be at a high risk of occupationally acquired HIV infection indicates the importance of the issue to most health care workers. This perception may well affect staff compliance with protocols and procedures.[52]

With regard to staff suggestions and choices on intervention programmes, it is unfortunate that more than 60% of the sample felt that pre-treatment testing of all patients would protect them from HIV infection. While this is not feasible in terms of testing time, cost, "window" period and the rights of all patients to adequate and appropriate health care, it does indicate the need for basic education of non-professional staff. It could however be suggested that if a known or suspected HIV positive

patient requires any invasive procedure that this be performed by more experienced staff.

Suggestions by staff concerning improved facilities for needle disposal are similar to suggestions by other authors.[28,39,50] The most commonly cited intervention both in the literature and in discussion with staff members was the placing of disposal boxes closer to the area of the invasive procedure. Disposal boxes at the bedside may however create a risk for visitors and patients, particularly in the paediatric wards. The cost effectiveness and usefulness of recessed needles and needle guards has also been quoted in the literature.[7,9,12]

The issue of increased punishment for negligent staff members appears to be controversial. It is of interest to note that those staff members who are not following hospital policy regarding resheathing of needles are less likely to cite this method. It is expected that it would be very difficult to implement such a policy and may well increase the already abundant negative sentiment amongst staff regarding needlestick injuries. It is not however unfeasible that "punishment" may occur when a staff member, injured with an HIV infected needle through the negligence of another staff member, considers legal action.

The effect of education through the use of literature, lectures and demonstrations on behaviour change appears to be limited in a needlestick injury prevention programme. The suggestion that the use of cartoons and posters may be more effective, should be noted.[16] The fact that many staff, and in particular Student nurses, will not report injuries because of fear of chastisement and lack of confidentiality indicates the need for a more "user-friendly" service.

The employment of phlebotomists as a means of preventing

needlestick injuries was cited by less than 30% of the sample. However this may have been due to a lack of understanding of the concept of phlebotomists as it remained a popular choice among professional staff (89.9%). It is expected that the employment of phlebotomists would not be within the bounds of hospital management and would need to be initiated at the Provincial authority level.

The results of this study indicate that staff want more "active" methods of intervention. Cognisance must be taken of staff perceptions and suggestions if an intervention programme is to succeed.

12. CONCLUSION AND RECOMMENDATIONS

It appears that both the perceived and the calculated risk of occupationally acquired HIV infection is high, and it is expected that this risk will increase substantially as the proportion of HIV infected individuals in the general population increases.

There is thus a need to re-evaluate the approach of the Infection Control Committee of Addington Hospital to the reporting, monitoring and preventing of needlestick injuries.

12.1 Recommendations - reporting of injuries

12.1.1 Reporting procedures must be streamlined. The Sister in charge of the Sick Parade, a doctor and one of the hospital counsellors must be given the sole responsibility of dealing with the reporting, testing and follow up of injured staff. This will ensure consistency and confidentiality in handling these staff members.

12.1.2 Senior hospital staff must be advised of the effects of chastisement of staff on reporting procedures. The reporting of injuries direct to the staff members mentioned above may obviate the need to involve Senior hospital staff in this issue.

12.1.3 Staff members who are injured and have blood taken for HIV testing should have the opportunity to use a non-de-plume for themselves and the patient concerned. This will not affect subsequent Workman Compensation Act claims if a record of names is maintained in Sick Parade. The results of the test on the staff member and the patient must be sent to the Sick Parade and only be opened by one of the three staff members

mentioned above (12.1.1).

12.1.4 Flow-diagrams showing the exact procedure to be followed after needlestick injuries should be clearly visible in all wards, including procedures to be followed after-hours.

12.1.5 Data recorded in the injury report book must include details relating to staff category, place of injury, time of injury, type of needle involved and manner of injury.

12.1.6 A record must be kept in Sick Parade of pre-test counselling, testing of patient and staff member, post-test counselling, completion of Workman Compensation Act forms and the use / non-use of AZT for each needlestick injury.

12.1.7 The staff involved in dealing with needlestick injuries must at all times ensure that they promote an image of trust, confidence and support to injured staff members. The Chief Medical Superintendent should attempt to ensure consistency of placement of staff in these positions.

12.2 Recommendations - Prevention of needlestick injuries

12.2.1 Education of staff should be the sole responsibility of the Infection Control Committee and in particular the Sister in charge. Financial commitment for an education programme is essential.

12.2.2 The results of this study must be imparted to all staff and in particular the results pertaining to the

association of resheathing and needlestick injuries and the calculation of risk related to sero-conversion.

12.2.3 The process of education must be more appealing - the use of cartoons and diagrams throughout the hospital must be considered. Monthly bulletins to wards regarding needlestick injuries is another option. Diagrammatic displays of hospital policies and standing procedures should be utilised. Education on this serious matter must become more informal.

12.2.4 All new staff, and in particular Student nurses must be given formal basic education at the beginning of their career.

12.2.5 Sisters in charge of wards must ensure that junior staff are not unduly exposed to injury with known HIV infected patients - invasive procedure on these patients should be performed by more experienced staff.

12.2.6 Staff members, and in particular Sisters in charge of wards and doctors must be made aware of their possible legal liability with regard to the disposal of needles.

12.2.7 The Infection Control Committee must investigate the feasibility of placing needle disposal boxes closer to the bedside as well as the use of needle guards. (It is suggested that this be attempted on a trial basis in one or two of the high risk areas of the hospital and the effect on needlestick injury rate be monitored).

12.2.8 A separate study should be undertaken amongst theatre

staff to ascertain aspects of needlestick injuries unique to theatre.

12.2.9 The information included in TABLE XIV must be updated on a monthly basis from the injury report book. This will indicate to the Infection Control Sister priority areas for intervention.

12.2.10 Areas of high risk and preferences for intervention for different staff categories, as ascertained in this study can be utilised in an intervention programme. A framework for intervention at Addington Hospital, based on this information has been developed by the researcher (APPENDIX C). All education programmes at Addington hospital must take cognisance of the suggestions by staff included in this study on the prevention of needlestick injuries.

In conclusion it can be stated that the monitoring and intervention with regard to needlestick injuries in Addington Hospital must attain a high priority amongst the Infection Control Committee, hospital management and staff members. The epidemiological data resulting from this study must be utilised in an intervention programme to ensure appropriateness of action. It is only with an intensive, sustained, supportive and measurable intervention programme that a decrease in needlestick injuries will occur.

13. REFERENCES

1. Albertoni F, Ippolito G, Somella L et al.Needlestick injury in hospital personnel: a multicentre survey from central Italy. **Infect Control Hosp Epidemiol** 1992; **13**: 540 - 544.

2. Anonymous. Syringe attack by AIDS patient may be first documented. **Am J Nurs** 1993; **25**: 13.

3. Anonymous. Unions press for safer devices. **Todays OR Nurse** 1992 Nov: 35.

4. Anonymous. HIV-infected health worker sues care facility. **Minn Med** 1992; **75**: 51.

5. Anonymous. Uniform data reporting among health care workers in Texas. **J Tex Nurs** 1993; **67**: 5

6. Arena B, Maffulli N, Vocaturo I, Scognamiglio G. Incidence of glove perforation during caesarean section. **Ann Chir Gynaecol** 1991; **80**: 377 - 380.

7. Armstrong SE. The cost of needle-stick injuries: the impact of safer medical devices. **J Nurs Econ** 1991; **9**: 426 - 430.

8. Barnes LP. Needle recapping: do we practice what we preach? **Matern Child Nurs J** 1991; **16**: 331.

9. Beason R, Bourguignon J, Fowler D, Gardner C. Evaluation of a needle-free intravenous access system. **J Intrav Nurs** 1992; **15**: 11 - 16.

10. Berry AJ, Greene ES. The risk of needlestick injuries and needlestick-transmitted diseases in the practice of anaesthesiology. **J Anesth** 1992; **77**: 1007 - 1021.

11. Berry AJ. The use of needles in the practice of anaesthesiology and the effect of a needleless intravenous administration system. **Anesth Analg** 1993; **76**: 1114 - 1119.

12. Blackwell B, Jagger J. Shielded safety devices. **Infect Control Hosp Epidemiol** 1992; **13**: 571.

13. Camilleri AE, Murray S, Imrie CW. Needlestick injury in surgeons: what is the incidence? **J R Coll Surg Edinb** 1991; **36**: 317 - 318.

14. Camilleri AE, Murray S, Squair JL, Imrie CW. Epidemiology of sharps accidents in general surgery. **J R Coll Surg Edinb** 1991; **36**: 314 - 316.

15. Choudhury RP, Cleator SJ. An examination of needlestick injury rates, Hepatitis B vaccination uptake and instruction on "sharps" technique among medical students. **J Hosp Infect** 1992; **22**: 143 - 148.

16. Collins CH, Kennedy DA. Microbiological hazards of occupational needlestick and "sharps" injuries. **J Appl Bacteriol** 1987; **62**: 385 - 402.

17. Dalton M, Blondeau J, Dockerty E et al. Compliance with a nonrecapping needle policy. **Can J Infect Control** 1992; **7**: 41 - 44.

18. Eisenstein HC, Smith DA. Epidemiology of reported sharps injuries in a tertiary care hospital. **J Hosp Infect** 1992; **20**: 271 - 280.

19. English JF. Reported hospital needlestick injuries in relation to knowledge/skill, design, and management process. **Infect Control Hosp Epidemiol** 1992; **13**: 259 - 264.

20. Friedland GH, Klein RS. Transmission of the Human Immunodeficiency Virus. **N Engl J Med** 1987; **317**: 1125 - 1135.

21. Friedland LR, Brown R. Introduction of a "safety" intravenous catheter for use in an emergency department: a paediatric hospital's experience. **Infect Control Hosp Epidemiol** 1992; **13**: 114 - 115.

22. Gaffney K, Murphy M, Mulcahy F. Phlebotomy practices/needlestick injuries/Hepatitis B status among interns in a Dublin hospital. **Ir Med J** 1992; **85**: 102 - 104.

23. Gartner K. Impact of a needleless intravenous system in a university hospital. **Am J Infect Control** 1992; **20**: 75 - 79.

24. Gaughwin MD, Gowans E, Ali R, Burrell C. Bloody needles: the volumes of blood transferred in simulations of needlestick injuries and shared use of syringes for injection of intravenous drugs. **AIDS** 1991; **5**: 1025 - 1027.

25. Goetz A, Yu CM, Muder RR. Entering first-year residents' experiences and knowledge of infection control of Hepatitis B and HIV, at five university-affiliated hospitals. **Acad Med** 1992; **67**: 275 - 276.

26. Greco RJ, Wheatley M, McKenna P. Risk of blood contact through surgical gloves in anaesthetic procedures. **J Anesth Plast Surg** 1993; **17**: 167 - 168.

27. Gurtler LG, Eberle J, Bader L. HIV transmission by needlestick and eczematous lesion - three cases from Germany. **J Infect** 1993; **21**: 40 - 41.

28. Haiduven DJ, DeMaio TM, Stevens DA. A five year study of needlestick injuries: significant reduction associated with communication, education and convenient placement of sharps containers. **Infect Control Hosp Epidemiol** 1992; **13**: 265 - 271.

29. Hansen ME, Miller GL, Redman HC, McIntire DD. Needle-stick injuries and blood contacts during invasive radiological procedures: frequency and risk factors. **A J R** 1993; **160**: 1119 - 1122.

30. Holloway J. Safety from sharps. **Br J Nurs** 1992; **1**: 389 - 390.

31. Jackson AP. Needle guards. **Br Dent J** 1992; **172**: 398.

32. Jackson MM, McPherson DC. Blood exposure and puncture risks for OR personnel. **Todays OR Nurse** 1992 Jul: 5 - 10.

33. Jenner RK, Bourke MK. Needlesticks, infection control and nurse liability. **Nat Med Leg** J 1993; **4**: 6 - 7.

34. Johnson GK, Nolan T, Wuh HC, Robinson WS. Efficacy of glove combinations in reducing cell culture infection after glove puncture with needles contaminated with human immunodeficiency virus type I. **Infect Control Hosp Epidemiol** 1991; **12**: 435 438.

35. Jones PD. HIV transmission by stabbing despite zidovudine prophylaxis. **Lancet** 1991; **338**: 884.

36. Klontz KC, Gunn RA, Caldwell JS. Needlestick injuries and hepatitis B immunisation in Florida paramedics: a statewide survey. **Ann Emerg Med** 1991; **20**: 1310 - 1313.

37. Makofsky D, Cone JE. Installing needle disposal boxes closer to the bedside reduces needle-recapping rates in hospital units. **Infect Control Hosp Epidemiol** 1993; **14**: 140 - 144.

38. Martin LS, Hudson CA, Strine PW. Continued need for strategies to prevent needlestick injuries and occupational exposures to bloodborne pathogens. **Scand J Work Environ Health** 1992; **2**: 94 - 96.

39. McCormick RD, Meisch MG, Ircink FG, Maki DG. Epidemiology of hospital sharps injuries: a 14-year prospective study in the pre-AIDS and AIDS era. **Am J Med** 1991; **91**: 301s - 307s.

40. McKeown M, Williamson D. Awareness and practice of HIV and hepatitis B guidelines in a psychiatric hospital. **Health Bull** 1992; **50**: 292 - 295.

41. Montz FJ, Fowler JM, Farais-Eisner R, Nash TJ. Blunt needles in fascial closure. **Surg Gynecol Obstet** 1991; **173**: 147 - 148.

42. Munz N. Evaluating needleless IV tubing. **Am J Nurs** 1993; **93**: 74 - 75.

43. Ng T, Volkening G, Evans S. A "point" of view - one hospital's experience in the safe handling and disposal of sharps. **Can J Infect Control** 1991; **6**: 35 - 37.

44. Nusbaum NJ. Low technology and the prevention of nosocomial AIDS. **NY State J Med** 1992; **92**: 276.

45. O'Neill TM, Abbott AV, Radecki SE. Risk of needlesticks and occupational exposures among residents and medical students. **Arch Intern Med** 1992; **152**: 1451 - 1456.

46. Ramsey SD, Nettleman MD. Cost-effectiveness of prophylactic AZT following needlestick injury in health care workers. **Med Decis Making** 1992; **12**: 142 - 148.

47. Rowe PM, Giuffre M. Evaluating needlestick injuries in nursing personnel. **Aaohn J** 1991; **39**: 503 - 507.

48. Rutowski J, Peterson SL. A needleless intravenous system: an effective management strategy. **Infect Control Hosp Epidemiol** 1993; **14**: 226 - 227.

49. Sandberg DE, Rotheram-Borus MJ, Bradley J, Martin J. Methodological issues in assessing AIDS prevention programmes. **J Adolesc Res** 1988; **3**: 413 - 418.

50. Sellick JA, Hazamy PA, Mylotte JM. Occupational needlestick injuries: educational program and mechanical opening needle disposal boxes. **Todays OR Nurse** 1992 Apr: 19 - **25.**

51. Sellick JA, Hazamy PA, Mylotte JM. Influence of an educational program and mechanical opening needle disposal boxes on occupational needlestick injuries. **Infect Control Hosp Epidemiol** 1991; **12**: 725 - 731.

52. Sheehy C, Trudeau V. AIDS education strategies: evaluating for fear response. **Aaohn J** 1992; **40**: 271 - 278.

53. Shirazian D, Herzlich BC, Mokhtarian F, Spatoliatore G, Grob D. Needlestick injury: blood, mononuclear cells and acquired immunodeficiency syndrome. **Am J Infect Control** 1992; **20**: 133 - 137.

54. Skolnick R, LaRocca J, Barba D, Paicius L. Evaluation and implementation of a needleless intravenous system: making needlesticks a needless problem. **Am J Infect Control** 1993; **21**: 39 - 41.

55. Smith DA, Eisenstein HC, Esrig C, Godbold J. Constant incidence rates of needle-stick injury paradoxically suggest modest preventive effect of sharps disposal system. **J Occup Med** 1992; **34**: 546 - 551.

56. Stotka JL, Wong ES, Williams DS, Stuart CG, Markowitz SM. An analysis of blood and body fluid exposures sustained by house officers, medical students and nursing personnel on acute-care general medical wards: a prospective study. **Infect Control Hosp Epidemiol** 1991; **12**: 583 - 590.

57. Tokars JI, Bell DM, Culver DH et al. Percutaneous injuries during surgical procedures. **JAMA** 1992; **267**: 2899 - 2904.

58. Worthington K. Computer software available for tracking needlestick injuries. **Am J Nurs** 1993; **25**: 10.

59. Younger B, Hunt EH, Robinson C, McLemore C. Impact of a shielded safety syringe on needlestick injuries among healthcare workers. **Infect Control Hosp Epidemiol** 1992; **13**: 349 - 353.

60. Natal Provincial Administration - Health Services. **Statistical Information October 1990 - October 1993.**

RECORD REVIEW QUESTIONNAIRE

TIME

1. YEAR

1	2	3	4	5
90	91	92	93	?

2. MONTH

1	2	3	4	5
J-M	A-J	J-S	O-D	?

3. WEEK

1	2	3	4	5	?

4. DAY

1	2	3	4	5	6	7	8
M	T	W	T	F	S	S	?

5. TIME

1	2	3
DD	ND	?

PERSON

6. STAFF CATEGORY

1	2	3	4	5	6	7	8	9
DR	G/A	ENA	ST/N	SR	SN	LAB	OTHER	?

PLACE

7. PLACE

1	2	3	4	5	6	7	8	9	10	11
MED	SX	PAED	O&G	OT	OPD	CAS	ICU	HDU	LAB/XR	?

HOW

8. METHOD OF INJURY

Re-sheathing	1	Prick - needle	2
Prick-lancet	3	Suturing	4
Negligence	5	Patient(agg/con)	6
Other	7	?	8

RESPONSE

9. TIME BEFORE REPORTING (DAYS)

1	2	3	4
0/1	2-5	>5	?

10. WCA FORM

1	2
Y	N

TESTS

11. PATIENT HIV

1	2	3
+	-	?

12. AZT

1	2	3
Y	N	?

NEEDLESTICK INJURY QUESTIONNAIRE

.....

A study is being conducted regarding needlestick injuries amongst staff in this hospital. The purpose of the study is to discover ways to make YOUR WORK ENVIRONMENT SAFER.

Please take 5 minutes to complete this questionnaire if you are willing to take part in this study (participation is voluntary). PLEASE BE HONEST...all information is confidential and your name is not required.

Please mark your answers with an "X" in the appropriate block.

.....

nNgenza ucwaningo ukuze kutholakale inani labasebenzi abathola ukulimala kulesibhedlela, ngehxa yokuhlatshwa izinalithi esezike zasetshenziswa kwezinye iziguli.

Kulesikhala esingezansi ngicela imibono yakho. Ngezindlela nemibono engenziwa ukuze kuvikeleke ukulimala nokwenza indawo yokusebenza ibe ngephephile.

Uma ufisa ukuphendula lemibuzo kuthatha imizuzu emihlanu ukuyiphendula ukhululeke, uthembeke ngoba ukuphendula kwakho ngeke kuphazamise umsebenzi nekusasa lakho emsebenzini.

Phezu kwalokho igama lakho alidingeki yomke imininingwane izothathwa njengemfihio.

.....

1. Staff category ☐

.....

2. Have you had an injury with a needle while working at Addington during the last 3 years? | Y | N |

[IF "NO" SKIP TO QUESTION NO. 5]

If "yes" - roughly how many times ☐

3. The last time that you had this injury, did you report at sick parade / report your injury?

Y	N

If "NO" to above question why not?_____

_____

4. The last injury that you had was it with..(SHOW NEEDLES)

IV needle (taking blood/ giving IV injection/ drip needle)	
suture needle	
IM/subcutaneous injection needle	
Other (specify)_____	
Do not know	

5. Do you think that your work places you at risk of HIV / AIDS

no risk
small risk
moderate risk
high risk

6. Do you resheath needles?

never
sometimes
often
not applicable

7. Have you been pricked in the last three years by a needle left lying around by someone else or been pricked due to another staff members negligence?

Y	N

8. Do you think that more can be done to protect staff from needlestick injuries?

Y	N

9. If a programme was initiated to protect staff from AIDS in the work setting, what 3 most important aspects <u>do you feel</u> should be covered from the list below (MARK 3 MOST IMPORTANT ONLY). Try to give your own suggestions as well.

Improved facilities for needle disposal	
Employing a team of "blood takers" for the hospital	
Enforced AIDS testing of all patients before admission to hospital	
Distribution of more literature to staff	
Lectures and educational talks	
Demonstrations and videos	
Improved reporting procedures for injuries	
Increased punishment for staff who do not properly dispose needles and therefore place others at risk	
Other (specify)_____ _____ _____	

THANK YOU FOR YOUR PARTICIPATION

APPENDIX C

AREA OF HIGH RISK AND PREFERRED PREVENTION PROCEDURE BY STAFF CATEGORY: A MODEL FOR INTERVENTION

STAFF CATEGORY	HIGH RISK AREA	PREFERRED PREVENTION PROCEDURE
Doctor	Paediatric ward Medical ward Theatre	disposal facilities phlebotomists
Sister	Intensive care Theatre Haemodialysis	disposal facilities phlebotomists
Student nurse	Surgical ward Medical ward Casualty	testing patients improved reporting punishment
Staff/Enrolled nurse	Outpatients Casualty Paediatrics	disposal facilities testing patients lectures/talks
Lab. Worker/ Radiographer	Laboratory X-Ray	punishment improved communication
General Assistant	Paediatric ward Medical ward	disposal facilities punishment lectures / talks