

Development of a disinfection protocol for the public sector Emergency Medical Services in the eThekweni District of KwaZulu-Natal

A dissertation submitted in fulfilment of the requirements for the degree of
Master of Technology: Emergency Medical Care in the Faculty of Health
Sciences at the Durban University of Technology

Natalee Jean Williams-Claassen

(Student No. 20200418)

Master of Technology: Emergency Medical Care

November 2012

Department of Emergency Medical Care & Rescue

Durban University of Technology

SUPERVISOR: Dr. M.N. Sibiyá

CO-SUPERVISOR: Mr.S.Naguran

DECLARATION

This is to certify that the work is entirely my own and not of any other person, unless explicitly acknowledged (including citation of published and unpublished sources). The work has not previously been submitted in any form to the Durban University of Technology or to any other institution for assessment or for any other purpose.

Signature of student

Date

Approved for final submission

Dr MN Sibiya

Date

RN, RM, D Tech: Nursing

Mr S Naguran

Date

M Tech: Emergency Medical Care

ABSTRACT

Background

In the Emergency Medical Services (EMS), paramedics play a vital role in the treatment of critically ill or injured patients, as they are often the first link or point of contact for the patient in the healthcare setting. They may therefore also play a vital role in the prevention and control of the transmission of communicable diseases, provided that proper infection control measures are in place.

The objectives of the study

There is presently no national policy on communicable diseases and infection control that is specifically designed for use in the South African prehospital environment. Given the paucity of research in the area, qualitative multiple case studies were conducted to develop an ambulance specific disinfection protocol and to evaluate its effectiveness in the public sector EMS in the eThekweni District of KwaZulu-Natal.

Methodology

The study comprised of three phases. In the first phase focus group discussions were conducted to identify the factors needed to develop a disinfection protocol. The study population consisted of both operational and management staff from the EMS under study. The first four focus groups consisted of eight to ten EMS operational staff each and the fifth focus group consisted of five EMS management staff. Thereafter, the information gathered was used in conjunction with internationally accepted guidelines to develop an ambulance specific disinfection protocol (Phase Two). The third phase entailed the implementation of the protocol at seven ambulance bases in the eThekweni health district and the evaluation of the protocol with the use of an open-ended questionnaire at two weeks and four weeks after implementation. A single ambulance crew and their immediate supervisor from each base were utilized in this phase.

Conclusion and recommendations

An ambulance specific disinfection protocol was developed and implemented in the EMS under study. During the development, implementation and evaluation of the protocol, many themes with regard to infection control in EMS were identified. These themes were used to better understand the present situation in EMS in relation to infection control and in the formulation of recommendations to assist in the improvement of the present situation.

The researcher recommended that all EMS staff require training and education with regard to infection control and prevention. The development and implementation of a protocol and policy document for infection control specifically for EMS is required. There is a need for the deployment of more ambulances and the employment of more operational EMS staff together with the appointment of Infection Control Supervisors at all ambulance bases. Without adequate infrastructure needed to meet infection control and prevention requirements, there may be a serious risk to both staff and the patients they serve.

DEDICATION

This study is dedicated to my amazing husband Emile, thank you for believing in me, supporting me and loving me from the moment we met.

To my beautiful son Gabriel, you truly are a blessing. Thank you for reminding me what this is all for and for being my motivation.

And to my father and mother, Keith and Heather Williams, thank you for always believing in me and for all the sacrifices that you made so that I can have the opportunities in life that I have now.

ACKNOWLEDGEMENTS

Firstly I would like to thank my mentor, boss and co-supervisor Sageshin Naguran for his support, supervision and mentoring of me. I couldn't have done it without you.

I would like to acknowledge with gratitude the following people who contributed to the success of this study:

- Dr MN Sibiya, who supervised the project, for her continuous support and guidance
- My fellow colleagues at the Department of Emergency Medical Care and Rescue, for their support, guidance and understanding throughout the study.
- Melanie Kuster, the Product Manager / Biomedical Scientist at Steritech, for their substantial donation of cleaning agents.

I would also like to thank the management and the paramedics of KwaZulu-Natal Emergency Medical Rescue Services for their participation in this study. This research would not have been possible without them.

TABLE OF CONTENTS

i	
ii	
iv	
v	
OF CONTENTS	vi
OF TABLES.....	xii
OF FIGURES.....	xiii
OF ANNEXURES	xv
OF TERMS.....	xvi
1 1	
OF THE STUDY	1
.1 STUDY BACKGROUND AND INTRODUCTION	1
.2 STATEMENT OF THE PROBLEM.....	2
.3 PURPOSE OF THE STUDY	3
.4 THE OBJECTIVES OF THE STUDY	3
.5 SIGNIFICANCE OF THE STUDY	3
.6 STRUCTURE OF THE DISSERTATION	4
.7 CONCLUSION.....	4
2 6	
REVIEW	6
.1 INTRODUCTION	6
.2 THE NEED FOR AN EMS SPECIFIC DISINFECTION PROTOCOL.....	7

.3	INTERNATIONAL LITERATURE ON INFECTION CONTROL IN THE PREHOSPITAL ENVIRONMENT	8
.4	INTERNATIONALLY ACCEPTED GUIDELINES FOR INFECTION CONTROL IN THE PREHOSPITAL ENVIRONMENT	15
.4.1	Cleaning and disinfection of ambulances	15
.4.2	Hand hygiene	16
.4.3	Personal protective equipment (PPE)	17
.4.4	Daily ambulance disinfection.....	19
.4.5	Ambulance disinfection after each patient.....	19
.4.6	Cleaning of equipment	19
.4.7	Deep clean/ weekly cleaning of ambulance.	20
.4.8	Management of bio hazardous spills.....	20
.4.9	Decontamination of cleaning equipment	21
.5	INFECTION CONTROL IN THE PUBLIC HEALTH SECTOR OF SOUTH AFRICA.....	22
.5.1	The National Infection Prevention and Control Strategy : a situational analysis.....	22
.5.2	Action plan for the development, implementation and surveillance of the national infection control and prevention strategy.....	24
.6	CONCLUSION	28
3	29	
	29	
.1	INTRODUCTION	29
.2	RESEARCH DESIGN	29
.3	CASE STUDY PROTOCOL	29
.3.1	Part 1: An overview of the case study project	30

.3.2	Part 2: Project objectives	33
.3.3	Part 3: Access to sites and data collection procedures.....	33
.4	PHASE ONE: FOCUS GROUP DISCUSSIONS TO IDENTIFY FACTORS THAT NEEDED TO BE TAKEN INTO ACCOUNT TO DEVELOP AN AMBULANCE SPECIFIC PROTOCOL (OBJECTIVE ONE)	33
.4.1	Pilot study for Phase One	34
.4.2	Sampling strategy for Phase One	34
.4.3	Data Collection for Phase One: The focus group discussion	35
.4.4	Data Analysis and interpretation for Phase One	37
.5	PHASE TWO: DEVELOPMENT OF THE DISINFECTION PROTOCOL (OBJECTIVE 2).....	38
.5.1	Pilot study	38
.6	PHASE THREE: IMPLEMENTATION AND EVALUATION OF THE DISINFECTION PROTOCOL (OBJECTIVE 3)	39
.6.1	Pilot study.....	40
.6.2	Sampling strategy.....	41
.6.3	Data collection for Phase Three.....	41
.6.4	Data analysis and interpretation for Phase Three	42
.7	TRUSTWORTHINESS.....	43
.7.1	Credibility	43
.7.2	Transferability.....	44
.7.3	Dependability	44
.7.4	Confirmability	44
.8	ETHICAL CONSIDERATIONS.....	45
.8.1	Respect.....	45
.8.2	Beneficence	45

.8.3	Justice	46
.9	CONCLUSION.....	46
4	47	
	AND DISCUSSION OF THE FINDINGS	47
.1	INTRODUCTION	47
.2	THEMES EMERGING FROM THE FOCUS GROUP DISCUSSIONS (PHASE ONE– Objective One).....	47
.2.1	Need for better infrastructure and resources.....	48
.2.1.1	Access to water.....	48
.2.1.2	Access to wash bays	51
.2.1.3	Access to cleaning equipment and detergents.....	52
.2.1.4	Access to Personal Protective Equipment	56
.2.1.5	Improved ventilation in the patient compartment of the ambulance ..	59
.2.1.6	Access to Support Services	61
.2.2	Time required for disinfection.....	64
.2.2.1	Communication Centre (Control Room).....	65
.2.2.2	Caseload.....	67
.2.3	Quality improvement.....	69
.2.3.1	Ambulance Disinfection Protocol	70
.2.3.2	Infection Control Supervision	71
.2.3.3	Staff involvement and accountability	73
.2.4	Revisiting the first objective.....	74
.3	DEVELOPMENT OF AN AMBULANCE SPECIFIC DISINFECTION PROTOCOL (PHASE TWO).....	74
.3.1	Revisiting the second objective.....	74

.3.2	Hand Hygiene	76
.3.3	Cleaning of Vehicle	77
.3.3.1	At the start of each shift cycle (deep cleaning, once a week).....	78
.3.3.2	At the start of each shift or after visible soiling has occurred or after every third patient	79
.3.3.3	After every patient with no visible soiling.....	80
.3.3.4	Cleaning of bio-hazardous spill	81
.3.4	Waste management.....	81
.3.5	Decontamination of cleaning equipment after every use	83
.4	EVALUATION OF THE NEW AMBULANCE SPECIFIC DISINFECTION PROTOCOL (PHASE THREE)	84
.4.1	Effectiveness of the Ambulance Disinfection Protocol	85
.4.1.1	Participants' stance towards to the protocol.....	86
.4.1.2	Implementation of the protocol.....	86
.4.1.3	Ease of use	87
.4.1.4	The prevention of cross-contamination	88
.4.2	Factors to improve implementation of the protocol	90
.4.2.1	The need for better infrastructure and resources in EMS	90
.4.2.2	Time required for disinfection.....	91
.4.2.3	Education and training	93
.4.2.4	Staff involvement and accountability	94
.4.3	Revisiting the third objective	96
5	96	
	, RECOMMENDATIONS AND LIMITATIONS OF THE STUDY	
	96

.1	INTRODUCTION	96
.2	STRENGTHS OF THE STUDY.....	97
.3	LIMITATIONS OF THE STUDY	98
.4	RECOMMENDATIONS.....	98
.4.1	Recommendations regarding quality improvement	98
.4.2	Recommendations regarding improvement of infrastructure and resources	99
.4.3	Recommendations regarding time restrictions	100
.5	CLOSING STATEMENT	101

LIST OF TABLES

Tables	Page
Table 3.1: Number of participants and FGDs	35

LIST OF FIGURES

Figure	Page
Figure 3.1: Map showing eThekwini District EMRS Bases	32
Figure 3.2: Mind map of the themes, categories and sub-categories in the first phase	37
Figure 3.3: Conceptual map for the development of the protocol	38
Figure 3.4: Mind map of the themes and categories in the third phase	42
Figure 4.1: Themes emerging from Phase One of the data collection	47
Figure 4.2: The theme – The need for better infrastructure and resources and its categories	49
Figure 4.3: The primary water source for ambulance base in the eThekwini District	51
Figure 4.4: A mop considered ready for use at an ambulance base in the eThekwini District	56
Figure 4.5: The theme – Time required for disinfection and its categories	65
Figure 4.6: The theme – Quality improvement and its categories	69
Figure 4.7: Development of the ambulance specific disinfection protocol	75
Figure 4.8: Themes emerging from the third phase of the study.	85
Figure 4.9: The theme – effectiveness of the Ambulance Disinfection Protocol and its categories	85

Figure 4.10: An ambulance patient compartment (of the rear) after the implementation of the developed ambulance specific disinfection protocol at an ambulance base in the eThekweni District	89
Figure 4.11: An ambulance patient compartment (from the front) after the implementation of the developed ambulance specific disinfection protocol at an ambulance base in the eThekweni District	90
Figure 4.12: The theme - Factors to improve implementation of the protocol and its categories	90

LIST OF ANNEXURES

Annexure	Page
Annexure 1: Ethical Clearance certificate	106
Annexure 2: Department of Health Research Approval letter	107
Annexure 3: Letter of information and informed consent	108
Annexure 4: Permission Letter to the Department of Health	111
Annexure 5: Permission Letter to the Emergency Medical Services	114
Annexure 6: Focus Group Discussion Guide (FGD) for the development of a Disinfection Protocol: Operational Staff	117
Annexure 7: Focus Group Discussion Guide (FGD) for the development of a Disinfection Protocol: Management Staff	119
Annexure 8: The Developed Ambulance Disinfection Protocol	121
Annexure 9: Questionnaire on the implementation and evaluation of an EMS specific disinfection protocol.	140

GLOSSARY OF TERMS

Advanced Life Support (ALS) is used to describe a paramedic that is registered with the Health Professions Council of South Africa at ALS level. Their scope of practice includes advanced airway management, electrocardiography, external cardiac pacing, defibrillation, intravenous therapy and various drugs for administration in the incidence of multiple forms of resuscitation, overdose, pain relief and sedation as well as other authorised procedures including all BLS and ILS skills

Basic Life Support (BLS) is used to describe a paramedic that is registered with the Health Professions Council of South Africa at BLS level. Their scope of practice includes basic airway management, defibrillation with an automated external defibrillator, Cardiopulmonary Resuscitation and other non-invasive care.

Cleaning in the context of this study is the method where dirt and debris is removed from a surface with soap or detergent thus removing articles of contamination. Cleaning is not the removal or destruction of micro-organisms. (Ontario Ministry of Health and Long-Term Care, 2007: 30).

“Control” or “Control room” are the terms used to describe the Communication Centre that receives emergency calls of the public and dispatches the appropriate personnel and vehicles to an emergency.

Disinfection can be defined as the process used on an in/animate item to reduce the amount of micro-organisms present and thus remove the potential for that item to cause probable infection. Disinfectant can be appropriately applied to an inorganic item or material as well as in the treatment of any organic material such as body tissues (Hoffman, Bradley and Ayliffe, 2004: 01).

Emergency Medical Services (EMS) describes an agency that provides trained personnel and relevant equipment in response to any emergency

situation in regard to patient treatment and transport to the appropriate facility.

Emergency Service Vehicle (ESV) is the term used to describe an operational ambulance in the Emergency Medical Services.

Healthcare associated infection (HCAI) is defined as an infection that was acquired while in a healthcare setting.

Infection Control can be described as any procedure, process, protocol or measure used with the purpose of reducing or preventing infections in the healthcare environment. These measures range from hand and personal hygiene, to the use of aseptic techniques and disinfection procedures (Department of Health, 2007:6).

Intermediate Life Support (ILS) is used to describe a paramedic that is registered with the Health Professions Council of South Africa at ILS level. Their scope of practice includes basic airway management, basic electrocardiography, defibrillation, intravenous fluid therapy and limited medication, as well as other authorised procedures including all BLS.

Operational staff describes staff that work on ambulances that provide basic, intermediate or advanced life support to patients.

Standard precautions means a combination of the major features of Universal Precautions (UP) and Body Substance Isolation (BSI) and applies to all persons coming into contact with potentially infected persons or animals and/or animal products and potentially contaminated blood and other body fluids in healthcare facilities or elsewhere and –

- (a) Apply to:
 - i. All blood;
 - ii. All bodily fluids, secretions, and excretions except sweat, regardless of whether they contain visible blood;
 - iii. Non-intact skin;

- iv. Mucous membranes
 - v. Tissues;
- (b) Are designed to reduce the risk of transmission of HBA from recognised and unrecognised sources of infection in workplaces” (Republic of South Africa, 1993).

CHAPTER 1

OVERVIEW OF THE STUDY

1.1 STUDY BACKGROUND AND INTRODUCTION

This chapter will contain information that is necessary for the reader to have an overall understanding of the research study. It will present the background of the study, the problem statement, the purpose of study and its objectives.

Ambulance personnel play a vital role in the treatment of critically ill or injured patients, as they are often the first point of contact with patients. Very little is known about the Emergency Medical Service's (EMS) role in the prevention and transmission of healthcare associated infection (HCAI). By the very nature of their work, ambulance personnel are at increased risk of exposure to infection (Ontario Ministry of Health and Long-Term Care, 2007: 1).

In terms of the National Health Act 61 of 2003 (Republic of South Africa, 2004) and the Occupational Health and Safety Act 85 of 1993 (Republic of South Africa, 1993), healthcare providers are to be protected from these varying hazards with the implementation of policies and guidelines. However, there is presently no national policy on infection control that is specifically designed for use in the prehospital environment in South Africa (SA) (Mahomed, Jinabhai, Taylor and Yancey, 2007: 498).

Infectious diseases have historically been a leading cause of death globally. The majority of these deaths occur in developing countries where little or no infection control or disease prevention policies and guidelines are being implemented as there is often no, or minimal, government funding to implement and sustain such policies. Developing countries vary greatly from more developed countries with regard to infection control. This is due to the limited resources which are available in these healthcare settings and can often be attributed to poor funding and allocation of funds (Raka, 2009: 292-293).

Healthcare associated infections (HCAs) are a major cause of concern as they impact negatively on patients, reducing their quality of life and increasing the risk for morbidity and mortality. HCAs are also a burden for healthcare facilities as they increase the duration of hospitalization and increase patient treatment expenses. HCAI occurs in over 40% of hospitalizations in developing countries. It is essential that the national authorities in healthcare develop and implement guidelines and policies for infection control. It is also essential that these policies and guidelines be consistently updated and monitored (Raka, 2009: 293-295).

Raka (2009: 296-297) recommends that healthcare workers are educated with regard to standard precautions and the prevention and control of infectious disease transmission. This should include suitable methods of decontamination, cleaning, and disinfection of soiled equipment as healthcare providers and patients are both at risk of contracting a HCAI. By applying more focus and resources to infection control, developing countries can improve the quality of healthcare provided to the public.

A recent study conducted in the province of KwaZulu-Natal (KZN) showed that there is a high prevalence of contamination in ambulances in the service under study (Naguran, 2008). However, to date, the researcher has not been able to find any published research studies in the SA context that have investigated the development and implementation of an effective ambulance disinfection protocol. This, therefore, highlighted the need for the development and implementation of an ambulance disinfection protocol in the EMS

1.2 STATEMENT OF THE PROBLEM

Presently, there is no national or provincial policy on infection control specifically for the prehospital environment in South Africa (Mahomed et al., 2007: 497-500). Furthermore, there is a paucity of research in this area and the researcher, to date, has not been able to find any published research

studies in the SA context which investigates the development of and/or the effectiveness of any ambulance disinfection protocol.

A recent study conducted in the province of KZN showed that there is a high prevalence of microorganism contamination in ambulances, as well as poor staff knowledge and practice on infection control. The study highlighted the need for the development and implementation of an ambulance disinfection protocol in the Emergency Medical Service (EMS) (Naguran, 2008).

1.3 PURPOSE OF THE STUDY

The purpose of this study was to develop a public sector ambulance specific disinfection protocol and evaluate its effectiveness by eliciting the participants perceptions and opinions of the ambulance disinfection protocol, in its implementation and use in the eThekweni District of KZN, in order to reduce the risk of communicable disease transmission among ambulance staff and patients during the delivery of public health services to the community.

1.4 THE OBJECTIVES OF THE STUDY

The objectives of the study were to:

- Identify factors that needed to be taken into account to develop the ambulance specific disinfection protocol.
- Develop an ambulance specific disinfection protocol taking into account internationally accepted guidelines and the information identified in the first objective.
- Implement and evaluate the effectiveness of the new disinfection protocol.

1.5 SIGNIFICANCE OF THE STUDY

This study will hopefully benefit the staff of the EMS and their patients by the proper use of an ambulance specific disinfection protocol, as it will contribute towards the reduction of HCAI and its associated adverse effects. This

reduction could assist in shortening hospital stays and the overall quality of patient care. It is also hoped to improve the staff's working conditions and thus, possibly, their morale.

1.6 STRUCTURE OF THE DISSERTATION

This dissertation is structured as follows:

Chapter 1 provides the introduction, the background to the study, its purpose and its significance.

Chapter 2, the literature review, presents a detailed review of controversies, gaps and shortcomings in general knowledge in the literature on infection control in EMS.

Chapter 3 explains the methodology of the research and discusses the design, the study population, the sample size and method of sampling and the selection criteria. Data collection, data analysis, trustworthiness of the study and the ethical considerations will also be discussed.

Chapter 4 presents the findings of the study and the developed protocol. It also contains a discussion of the results

Chapter 5 discusses the strengths and limitations of the study and presents the researcher's recommendations.

1.7 CONCLUSION

In conclusion, research in the field of infection control and disinfection in the healthcare environment is mainly hospital based. Very little research had been undertaken in the prehospital environment in regard to infection control. As discussed above, there is a definite need for this type of research. The development, implementation and evaluation of an ambulance specific protocol could have a significant effect on disease transmission to both EMS staff and the patients they serve.

This concludes the introduction to the research study, which has presented the background of the study and the study's significance. In the following section, literature pertaining to infection control in the prehospital environment will be discussed in detail, thus contextualizing the study. This discussion will include international and local research concerning infection control in the prehospital environment and the review of internationally accepted guidelines for incorporation into the design for an ambulance specific disinfection protocol.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

For any form of disinfection procedure to be successful there needs to be a break in the chain of infection transmission. This chain consists of six links, the infectious agent, the reservoir, the portal of exit, the susceptible host, the portal of entry and the mode of transmission (Ontario Ministry of Health and Long-Term Care, 2007: 3-4).

An infectious agent is classified as the source of infection or an infecting micro-organism. The reservoir refers to an environment that is supportive to the survival and growth of the infectious agent. The portal of exit refers to how the infecting micro-organism leaves the reservoir (Ontario Ministry of Health and Long-Term Care, 2007: 4).

The susceptible host is a human that is exposed to an infectious agent for which they do not have an effective immune response or resistance. Immune resistance is influenced by age, immune status, nutritional status and various other factors such as occupation, family and social associations and behaviour (Mayhall, 1996: 5). The portal of entry is path for which the infectious agent gains entry into the body of the susceptible host (Ontario Ministry of Health and Long-Term Care, 2007: 4)

The mode of transmission or the route of transmission is defined as the method of transfer of the infectious agent to the portal of entry of a susceptible host. There are three primary modes of transmission that can occur in the health care setting, contact transmission, airborne transmission and common vehicle transmission (Ontario Ministry of Health and Long-Term Care, 2007:4, 7).

Prevention and control measures such as disinfection directly target three of the six links in the chain of infection transmission. Reservoirs containing infectious agents are reduced, eliminated or contained, further modes of transmission are prevented from occurring and the susceptible hosts are protected against infection and disease (Mayhall, 1996: 8). Prevention and control measures also include compliance, surveillance and education, all of which can be addressed in an infection control policy (Department of Health, 2007).

In the EMS, paramedics play a vital role in the treatment of critically ill or injured patients, as they are often the first link or point of contact for the patient in the healthcare setting and they therefore should also play a vital role in the prevention and control of the transmission of communicable diseases with the use of infection control measures (Ontario Ministry of Health and Long-Term Care, 2007: 1).

In this chapter, literature with regard to infection control in the prehospital environment, both internationally and locally, is presented and discussed. Emphasis is placed on the factors required to develop, implement and evaluate an ambulance specific disinfection protocol to ensure adequate disinfection and prevention of HCAI for patients and EMS staff.

2.2 THE NEED FOR AN EMS SPECIFIC DISINFECTION PROTOCOL

In terms of the National Health Act 61 of 2003 (Republic of South Africa, 2004) and the Occupational Health and Safety Act 85 of 1993 (Republic of South Africa, 1993), policies and guidelines should be implemented to protect healthcare providers from the transmission of communicable diseases. However, there is currently no national policy in South Africa on communicable diseases and infection control that is specifically designed for use in the prehospital environment (Mahomed et al., 2007: 498). Therefore, in providing care, paramedics are often at risk of exposure to varying hazards.

The lack of infection control protocols and training in the prehospital environment in the public sector was evident in a recent study undertaken in the province of KZN. The study aimed to assess ambulance infection control in an EMS by determining the levels of bacteria and fungi found present in the ambulances and assessing the staff's knowledge and practices of infection control. The study found that the levels of bacteria and fungi found in the ambulances were unacceptably high and that these ambulances may be considered as reservoirs for the transmission of infections to both the staff and patients. The study also found that there was indeed a lack of training in infection control as many of the staff that took part in the study were unaware of any infection control policies or procedures and their knowledge of infection control and cleaning procedures was very poor. Personal protective equipment (PPE) and staff immunization were also frequently found to be inadequate (Naguran, 2008).

2.3 INTERNATIONAL LITERATURE ON INFECTION CONTROL IN THE PREHOSPITAL ENVIRONMENT

A limited number of international studies have been conducted in the prehospital environment relating to infection control in general and disinfection in particular. The researcher was able to find six relevant studies pertaining to the investigation of microbial contamination in the prehospital environment. The first was a study on the assessment of the prevalence of pathogenic micro-organisms in a Rotor Wing Air Ambulance (RWAA) in Jackson, Mississippi. The study investigated the possibility of transmission of communicable diseases during transportation of patients in the RWAA and determined the effectiveness of the current infection control policy. This study found that 12 of the 14 swabs taken on the RWAA after initial cleaning had bacterial growth and the sites with the largest amount of bacterial growth were found in the patient compartment in the RWAA. The study concluded that there was a definite possibility of infection transmission in the vehicle

and that the disinfection procedures being utilised were inadequate. (Gatelli, Deschamp and Rogers, 2006: 81-83).

The study had various shortcomings, however. The researchers failed to specify who was responsible for collecting their samples, what training, both theoretical and practical, how the samples were delivered to the laboratories, as well as the length of time that was taken, from the time of sample collection to sample delivery at the receiving laboratory. Further omissions by these researchers were their failure to collect samples before the cleaning process for analysis, as this would have allowed for a comparison of before and after the cleaning process to gauge the effectiveness of the present cleaning routine

A similar study was conducted by Nigam and Cutter (2003) to determine the levels of bacterial contamination present in Welsh ambulances and to assess the effectiveness of the disinfection procedures being put into practice in these ambulances. The researchers examined seven key sites in the ambulances. A swab was taken at each of these sites before and after disinfection. This study was conducted over a 12 month period and the sampling was performed monthly by the on-call paramedic. This study found that the majority of the sites assessed were contaminated with bacteria and that the level of bacterial contamination was almost halved after cleaning. However, in some incidences, there was no reduction in the level of bacterial contamination after cleaning and in several incidences there was an introduction of new bacteria to a site after cleaning. The researchers also found that none of the three regions that participated in the study had implemented a standard cleaning protocol or had dedicated cleaning equipment and materials. This led the researchers to believe that the introduction of the new bacteria at some sites was due to the fact that the equipment being utilised in the decontamination of the vehicles was not being decontaminated after use (Nigam and Cutter, 2003: 479-482).

The study highlighted the need for the examination of cleaning processes used when cleaning the ambulances and the implementation of regulations to reduce the level of bacterial contamination and prevent further bacterial contaminations by cleaning equipment (Nigam and Cutter, 2003: 479-482). Although this study did specify that various paramedics had collected the samples over a 12 month period, the authors also failed to mention what training, both theoretical and practical, the paramedics had received, how the samples were delivered to the laboratories, as well as the length of time that was taken from the time of sample collection to sample delivery at the receiving laboratory.

A third study was conducted in the western United States of America by Roline, Crumpecker and Dunn (2007). This cross-sectional study was an initial screening of Methicillian resistant *Staphylococcus aureus* (MRSA) contamination in the ambulance fleet operating in the western region of the United States of America. Two thirds of the fleet, which totalled 21 ambulances, were used as part of the study due to their availability for the research. Five key areas of the ambulances were swabbed for analysis. Of the 21 ambulances that were tested, 13 samples of 10 (47.6%) isolated ambulances were found positive when tested for MRSA. Thus, the researchers concluded that ambulances could be considered as significant reservoirs in the transmission of MRSA to patients due to the high levels of MRSA contamination found during this study. It was suggested, therefore, that MRSA should not only be a concern in the hospital environment, but also in the prehospital environment and that further studies needed to be conducted to evaluate the effectiveness of methods used to prevent the contamination and spread of MRSA in the ambulance environment (Roline, Crumpecker and Dunn, 2007).

Like the study undertaken by Galtelli et al. (2006) these authors failed to identify who was responsible for the collection of samples, what training, both theoretical and practical, those collecting the samples had received, how the

samples were delivered to the laboratories, as well as the length of time that was taken from the time of sample collection to sample delivery at the receiving laboratory (Roline, Crumpecker and Dunn, 2007).

The fourth study was conducted in the United Kingdom in 2004 by Lee, Levy, and Walker (2006). Six emergency departments and three regional ambulance services were included in the study to forensically identify blood contaminated trauma equipment. Over the course of two weeks, various items of equipment from each facility that were ready for patient use, such as spinal boards, cervical collars, straps, bow splints, head blocks, and headboards, were tested for blood contamination at each facility. The Kastle-Meyer technique was the forensic technique used to identify the blood contamination (Lee, Levy and Walker, 2006).

Convenience sampling was performed and standardised areas were tested. Each piece of equipment was tested at a maximum of four areas which were the most likely to have been in direct contact with the patients. In the event that the equipment was visibly contaminated, the stain was tested to verify the presence of blood. If the presence of blood was confirmed on any item of equipment, it tested positive for contamination (Lee, Levy and Walker, 2006).

Of the equipment tested, 15% was visibly stained with blood. Of the equipment not visibly contaminated with blood, 42% tested positive for blood contamination. This resulted in a total of 57% of the equipment testing positive for blood contamination. After questioning the healthcare providers, the researchers concluded that they had a definite lack of understanding regarding the Department of Health's guidelines for the decontamination of blood contaminated equipment. The results of this study also highlighted the possibility of cross-infection between patients by using this contaminated equipment (Lee, Levy and Walker, 2005).

A shortcoming of the study was that although the authors identified themselves as the individuals collecting the samples, they failed to mention,

as with the all of the studies identified, what training, both theoretical and practical, they had received, how the samples were delivered to the laboratories, as well as the length of time that was taken from the time of sample collection to sample delivery at the receiving laboratory (Lee, Levy and Walker, 2005)

The fifth study was conducted by Alves and Bissell (2008) in the United States of America. These researchers hypothesized that there is a discrepancy in the expected standard of disinfection on reusable equipment in the EMS verses the cleaning of this equipment that actually occurs. Specimens were collected from five key areas in the ambulances that are commonly overlooked and often difficult to disinfect. These included the in-unit oxygen flow regulator control knob; the bench seat; the communication radio microphone transmit knob (in the incidence of there being no radio in the patient compartment); the seatbelt buckle release button on the rear-facing seat; the inside door handle of the driver's door; and the lower track of the sliding cabinet door or the lower aspect of a swing door closest to the patients head when lying on the stretcher.

Four ambulances were selected for specimen collection by their availability for testing and thus their convenience. All the ambulances were operationally ready (cleaned and disinfected) when the specimens were collected. None of the crews had prior knowledge of the study or that specimens were to be collected (Alves and Bissell, 2008).

Various bacteria were identified in the samples collected. Four of the species identified were significant nosocomial pathogens, three of which had significant patterns of antibiotic resistance. The researchers highlighted that all of the bacteria identified in the samples collected were vulnerable to the disinfection agents in use in the ambulances. The researchers also highlighted the historical low compliance rates in hand-hygiene practices by healthcare providers. The researchers suggested that this study be used in EMS training to stress the amount of various pathogens present in

ambulances and, therefore, possibly improve compliance with infection control practices by healthcare providers (Alves and Bissell, 2008).

Although this study provided the particulars regarding how the specimens were collected, how they were transported, that they arrived at the laboratory within four hours of being collected and also how they were analysed, the researchers failed to specify who was responsible for the collection of their samples. They also failed to mention what training, both theoretical and practical, that those collecting the samples had received.

A sixth study was done on the prevalence of Methicillin-resistant *Staphylococcus aureus* (MRSA) on the stethoscopes of Emergency Medical Services Providers in the United States of America. None of the EMS providers had prior knowledge of the study and convenience sampling was used to identify participants. As the EMS providers entered or exited the Emergency Department of an academic hospital, their stethoscopes were swabbed and each EMS provider was asked when last their stethoscope had been cleaned (Merlin, Wong, Pryor, Rynn, Marques-Baptista, Perrita, Stanescu and Fallon, 2009).

Fifty samples were taken and incubated. The samples were categorized by the reported length of time since they had last been cleaned. After a period of 72 hours the samples were tested for MRSA. They found that 16 of the 50 samples tested positive for MRSA. The researchers noted that the longer the length of time since the stethoscopes were reported to have been cleaned, the more likelihood of a positive MRSA result. The researchers also noted that 32% (16/50) of samples taken could not be categorized as the EMS providers could not remember when last their stethoscopes had been cleaned (Merlin, et al., 2009).

The findings emphasized the prevalence of MRSA in the prehospital environment and the lack of action on the part of the EMS professionals to keep their equipment clean between patients. As the results of that study

highlighted the prevalence of MRSA on the stethoscopes, the researchers ensured that alcohol wipes would be available at the entrances of the academic hospital for EMS providers to clean their stethoscopes. The researchers also recommended that in the future, EMS should be evaluated as vectors of patient infections and therefore be included in the hospital infection control policies (Merlin, et al., 2009).

Although this study was relevant to the current research, there were still shortcomings in the literature presented. It also failed to specify who was responsible for the collection of their samples and to mention what training, both theoretical and practical, those collecting the samples had received, how the samples were delivered to the laboratories, as well as the length of time that was taken from the time of sample collection to sample delivery at the receiving laboratory (Merlin, et al., 2009).

As all the studies failed to mention or elaborate on critical areas in the research, the reliability of their findings cannot be regarded as conclusive. Furthermore, the author was unable to locate any published research with regard to an ambulance disinfection protocol in the South African context, hence motivating this research.

Although there is no specific ambulance disinfection policy or protocol for the prehospital environment, the Occupational Health and Safety Act (Act no. 85 of 1993) is very relevant in ensuring the safety of healthcare personnel and thus their patients. It is a framework for decision making with regard to health and safety for all employers and employees and places emphasis on what is needed to prevent and protect staff from ill health caused by working conditions. It also promotes a hazard free working environment. Regulations included in this Act, which are relevant to the prehospital environment, will be discussed later in Chapter 4.

2.4 INTERNATIONALLY ACCEPTED GUIDELINES FOR INFECTION CONTROL IN THE PREHOSPITAL ENVIRONMENT

2.4.1 Cleaning and disinfection of ambulances

A fundamental factor in infection control and prevention is the maintenance of the highest standards of cleanliness of all surfaces and equipment. The major risk associated with infection control is contact with surfaces and equipment that have been contaminated with bodily fluids such as blood and secretions. This risk is even greater when the contact is with mucous membranes or broken skin. Thus, all surfaces and equipment must be meticulously cleaned and disinfected to prevent cross contamination and infection of patients and healthcare providers. (South Western Ambulance Service, NHS Trust, 2007).

Disinfection is the method used to decrease the number of micro-organisms present and thus prevent possible cross infection. There are three main levels of disinfection: low level disinfection, intermediate level disinfection and high level disinfection. The higher the level of disinfection, the greater is its intensity. The level of disinfection required for equipment or surfaces depends on its degree of contact with a patient and therefore disinfection of medical equipment has been categorised into three groups: critical items, semi-critical items and non-critical items (Ontario Ministry of Health and Long-Term Care, 2007: 30).

Critical items are items of equipment that enter sterile body cavities or the patients' vascular system and thus carry a high risk of infection to the patient. These would include surgical equipment, catheters and needles. Thus, this equipment needs not only to be cleaned, but sterilized as well. Fortunately, all sterilized medical equipment used in the prehospital environment are single use (disposable) items and have therefore been sterilized by the manufacturer (Ontario Ministry of Health and Long-Term Care, 2007: 30).

Semi-critical items are items of equipment that come into direct contact with damaged skin and mucous membranes and thus have a moderate risk of infection. Examples of semi-critical items found in an ambulance include bag-valve-masks, Magil forceps and laryngoscope blades. All medical equipment categorised as a semi-critical item require a high level of disinfection before they can be reused. This method will ensure the annihilation of the majority of the micro-organisms present on the item (Ontario Ministry of Health and Long-Term Care, 2007: 30).

Non-critical Items are medical equipment or surfaces that only come in contact with the intact skin of the patient, and not their mucous membranes, and thus have a low risk of infection. In an ambulance, such items would include stretchers, bunk cushions, stethoscopes, blood pressure cuffs, cardiac monitors and the interior of the patient transport compartment. These items would only require low level disinfection (Ontario Ministry of Health and Long-Term Care, 2007: 31).

2.4.2 Hand hygiene

Two different forms of micro-organisms can be present on the skin. The first, referred to as resident flora, is bacteria that is commonly found on skin and is not typically harmful. The second form is transient bacteria, which refers to the micro-organisms that have been transferred to the skin by contact with an infected patient or a contaminated object and are the frequent cause of nosocomial infections. This hazard can be easily dealt with proper hand hygiene, which is considered the most efficient method to reduce the occurrence of nosocomial infections (South Western Ambulance Service, NHS Trust, 2007); (Ontario Ministry of Health and Long-Term Care, 2007: 14).

Proper hand washing techniques, including use of alcohol based hand rubs and moisturizing of the skin, should be undertaken to ensure effective hand hygiene. This will not only prevent cross contamination from paramedic to

patient, but also prevent the paramedic from acquiring an infection (Ontario Ministry of Health and Long-Term Care, 2007: 14).

The World Health Organisation (WHO) recommends the “WHO Five Moments of Hand Hygiene” algorithm according to which hands should be cleaned:

- Before patient contact;
- Before aseptic technique;
- After body fluid exposure risk;
- After patient contact; and
- After contact with patient surroundings (World Health Organisation, 2012)

It is also suggested that hand hygiene is practiced, at the start and end of shifts, during and after removal of personal protective equipment (PPE), before invasive procedures, after cleaning/disinfecting of equipment and vehicle, before leaving the hospital, before and after handling food, before and after smoking, after using the restroom, after other personal body functions (coughing, sneezing) and any time when the paramedic’s hands are visibly dirty (Ontario Ministry of Health and Long-Term Care, 2007: 14).

According to Siegel, Rhineheart, Jackson and Chiarello, (2007: 8-9), the Centre for Disease Control (CDC) advocate alcohol-based hand-rubs as the primary mode of hand hygiene in healthcare providers as it causes less hand irritation, requires less time to decontaminate the hands and can be facilitated at the patients’ bedside. In the incidence of visibly soiled hands or when the healthcare provider has been in contact with a patient with infectious diarrhoea, they recommend washing of hands with soap and water.

2.4.3 Personal protective equipment (PPE)

PPE is essential in the prevention of cross contamination from the patients’ bodily fluids to healthcare providers and includes gloves, eyewear, aprons,

face-shields and, if available, sleeve and shoe protectors (South Western Ambulance Service, NHS Trust, 2007).

Gloves are essential and should be fitted just before the healthcare provider comes into contact with a patient and should not be worn on route to a call. Gloves should be worn whenever the healthcare provider is likely to come into contact with bodily fluids, mucous membranes or broken skin. They should also be worn when touching contaminated equipment and cleaning the vehicle and its contents. In cases where there is high risk of the gloves becoming damaged, it is strongly recommended that the healthcare provider wears double gloves as a precaution. Gloves should not be worn as an alternative to hand hygiene, however. Gloves should be replaced after each procedure and hands must be cleaned after their removal, which can be done with the use of an alcohol hand-rub. Contaminated gloves are to be disposed of as clinical waste (South Western Ambulance Service, NHS Trust, 2007).

Eyewear or eye protection such as glasses or goggles is an essential part of PPE as it protects the eyes from contamination from microorganisms and self-contamination. Eye protection should be worn whenever there is a possibility of a communicable disease being transmitted through airborne droplets from the patient's respiratory system, such as coughing and sneezing, in the incident of suctioning and intubation and in the likelihood of bodily fluid splashes. It is also recommended when removing and cleaning bodily fluids. All reusable forms of eye protection must be cleaned and disinfected after each patient, as with all other contaminated equipment. Disposable face shields can also be worn as additional protection when performing procedures that involve airway management and in the likelihood of bodily fluid splashes. These disposable face shields must be disposed of after use (Ontario Ministry of Health and Long-Term Care, 2007: 24).

Aprons should be worn when incidences of bodily fluid splashes can be expected, such as in the delivery of a neonate and in the event of

uncontrolled haemorrhaging. Aprons must be disposed of directly after each patient and should not be worn in the driver's compartment of the vehicle (Ontario Ministry of Health and Long-Term Care, 2007: 25).

2.4.4 Daily ambulance disinfection

It is recommended that the ambulance must be completely cleaned at the start of each shift. All dust and dirt should be removed from the floor and surrounding areas. The floors must be cleaned and disinfected with the prescribed detergents and disinfectants using the designated mop and bucket and all surfaces and equipment must be wiped clean and disinfected, if necessary. The driver's compartment of the vehicle should also be wiped down at the start of the shift. At the end of each shift, all waste must be removed from the vehicle and put into the nearest clinical waste bin. The interior of the vehicle should also be inspected for sharps (South Western Ambulance Service, NHS Trust, 2007).

2.4.5 Ambulance disinfection after each patient

After the transportation of each patient, areas that were touched or were at risk of being touched by the patient need to be wiped clean. Any areas that were touched or at risk of being touched by the attending ambulance staff member also need to be wiped clean. Examples of these areas are the stretcher, bunk cushion and the cardiac monitor (South Western Ambulance Service, NHS Trust, 2007).

2.4.6 Cleaning of equipment

As identified by Lee, Levy and Walker (2006), there is definite potential risk of cross infection occurring in patients that are exposed to contaminated equipment. It is recommended that all equipment used in the treatment and transferring of patients and equipment that has come into contact with the patients must be cleaned with a detergent or wiped down with a detergent wipe. The equipment must then be allowed to dry or be wiped dry with clean

paper towels. Special attention must be given to any equipment soiled with bodily fluids. This equipment must be cleaned and disinfected before further use. Contaminated linen must be removed and replaced for every patient (South Western Ambulance Service, NHS Trust, 2007).

2.4.7 Deep clean/ weekly cleaning of ambulance.

At least once a week or once a cycle the ambulance is to be completely emptied of all removable contents, for example all equipment and consumables. The floor, side door track, stretcher rail and any risk areas for debris build-up must be carefully inspected. Any hazardous spills that have been identified must be dealt with accordingly. All dust and dirt must be removed from the floor and walls. The door frames and wall edges must be thoroughly cleaned. All other surfaces, including equipment, must be wiped down with detergent, disinfectant and dried as needed. The floors must be clean and disinfected with the prescribed detergents and disinfectants, using the designated mop and bucket. (South Western Ambulance Service, NHS Trust, 2007); (Ontario Ministry of Health and Long-Term Care, 2007: 32).

The driver's compartment must be cleared of dust and debris, all surfaces wiped clean and, if applicable, the floor must mopped and disinfected (South Western Ambulance Service, NHS Trust, 2007).

2.4.8 Management of bio-hazardous spills

An important part of preventing cross contamination of infection is the efficient disposal and removal of bio-hazardous spills. The risk can be significantly reduced with timely management by cleaning and disinfecting the area of the spill as soon as possible (South Western Ambulance Service, NHS Trust, 2007).

It is essential that full PPE be worn in the management of a spill. This includes gloves, eye protection, or preferably a face shield, and an apron. In incidences involving organic matter, the spill should first be covered with

disposable paper towels which will contain and absorb it. The contaminated paper towels and all the removed matter must then be disposed of as clinical waste in the appropriate bags. The contaminated area must be washed with warm water and the prescribed cleaning agents and left to air dry or be dried with paper towels. Once dry, a disinfection agent must be applied to the affected area and then it must be left to air dry (Welsh Healthcare Associated Infection Programme, 2010)

2.4.9 Decontamination of cleaning equipment

It is essential to decontaminate and clean all soiled items, especially cleaning equipment, as these are effective methods to reduce and prevent the risk of transmission of infection to both operational staff and patients. Decontamination is crucial before the cleaning of heavily soiled equipment. This can be done cheaply and effectively by placing soak-able items (e.g. mop and bucket) in 0.5% chlorine solution (bleach) for 10 minutes. This will destroy the majority of viruses present, thus making it safer for the operational staff to handle and clean the heavily soiled equipment (Tietjen, Bossemeyer and McIntosh, 2003: 16-9-10).

Once decontamination has taken place, the equipment must be thoroughly rinsed with water before cleaning to remove any organic matter that might still be attached to it. The equipment must then be washed thoroughly with liquid cleaning detergent and water to remove any further organic matter and debris. Once washed, it must be rinsed with water to remove any detergent residue and debris. All equipment must dry completely before further use (Tietjen, Bossemeyer and McIntosh, 2003: 16-9-10).

2.5 INFECTION CONTROL IN THE PUBLIC HEALTH SECTOR OF SOUTH AFRICA

2.5.1 The National Infection Prevention and Control Strategy: a situational analysis

In order to develop a national infection prevention and control strategy, the Department of Health for the Republic South Africa conducted various workshops throughout the country in 2005 to identify challenges that were being experienced with regard to infection control (Department of Health, 2007: 28). Various challenges were identified in relation to education and training, infrastructure, environmental cleaning and surveillance.

Education and Training

A severe shortage of properly trained and experienced Infection Control Practitioners (ICPs) was identified. Furthermore, there was a serious shortage of training and education in regard to infection control practices and a definite lack of capacity to implement and manage an infection control programme. Many of the ICPs lacked confidence in the training that they had received. They felt that they had no authority to act and run the required infection control programmes, thus rendering them ineffective in their role as ICPs (Department of Health, 2007: 28-29).

In-service training in infection control was generally considered poor. Staff identified staff shortages, lack of funds and lack of resources as possible causes for the poor utilization of training opportunities. They also found the need for the development of standardised training programmes for infection control and prevention (Department of Health, 2007: 28-29).

The Occupational Health and Safety Act (Act no. 85 of 1993) provides regulations for employers with regard to education and training of employees that are, or may be, exposed to hazardous biological agents (HBA). It states that the employer shall inform and provide these employees with training in

regard to the contents and regulations of the Occupational Health and Safety Act, which should include:

- The potential risks of being exposed to HBA;
- How the employer will ensure that the employee is protected from exposure;
- The importance of personal hygiene and keeping the work environment clean;
- The precautions that should be undertaken by the employees to protect themselves from exposure, including the use of PPE;
- The need, use and care of safety equipment and the facilities provided;
- The need for medical surveillance of employees;
- Safe working procedures with regard to HBA in the workplace; and
- What procedures to follow in the event of exposure to HBA and what procedures to follow when decontaminating or disinfecting contaminated areas.

These instructions of procedures must also be given to the employee in writing (Republic of South Africa, 1993). The communication of this information and the subsequent training will ensure that the employees are able to identify potential risks in regard to HBA exposure and the precautions that need to be undertaken to prevent or minimise these risks (Republic of South Africa, 1993).

Infrastructure

Poor infrastructure was also recognized as an exacerbating factor. In the older facilities there were insufficient hand basins and taps or incorrectly designed taps. The lack of waste management facilities was also acknowledged (Department of Health, 2007: 30).

Environmental cleaning

With regard to cleaning in the healthcare settings, the workshops identified a lack of cleaning standards. It became evident that the training of those responsible for cleaning healthcare facilities was largely neglected and often poorly managed. Poor cooperation between those procuring the cleaning products and those using them resulted in the purchasing of products that were poorly understood and thus inappropriately used (Department of Health, 2007: 30).

Surveillance

Although a policy and prevention strategy was developed and published, no countrywide infection control surveillance system has been put in place in the public sector. However, there have been attempts to initiate these systems in the provinces of Gauteng and KwaZulu-Natal (Department of Health, 2007: 31).

2.5.2 Action plan for the development, implementation and surveillance of the national infection control and prevention strategy

The Department of Health has developed a strategy for national infection control and prevention to improve infection prevention and control practices; to prevent or reduce infections; and to improve surveillance. Early detection of infections through active surveillance and monitoring must include:

- Developing a national infection control surveillance system;
- Identifying key infectious diseases;
- Adverse events and nosocomial infection rates being supplied by the District Health Information System;
- Developing an appropriate feedback system to provide health facilities with data regarding infection rates.

- Developing a policy for the reporting and review of nosocomial infection in local health care facilities; and
- Establishing collaboration between laboratory services and healthcare facilities to ensure the effective use of laboratory data to identify HCAs. (Department of Health, 2007: 31-32).

This action strategy is essential in the identification of healthcare associated infection (HCAI) as presently, to the best of the researcher's knowledge, there are no national, provincial or district surveillance systems or any effective monitoring procedures. The implementation of this action strategy will provide valuable information with regard to the identification of key infections and their prevalence in various facilities, and it will evaluate the success of specific preventative methods by the comparison of previous results (Department of Health, 2007: 31).

The objectives to address healthcare workers' needs and requirements include:

- Developing standardised courses for in-service training;
- Implementing an education and training programme for healthcare providers;
- Establishing infection control teams that are facility based and providing them with the relevant training; and
- Increasing awareness with regard to infection control policies and practices among healthcare providers (Department of Health, 2007: 32).

The majority of the healthcare providers do not have formal training in infection control and thus are reluctant to participate on committees and lead the service. The implementation of this strategy would ensure a wide coverage of training and thus improve the infection control services at health care facilities (Department of Health, 2007: 32).

The objectives to reduce risk include:

- Promoting the use of present guidelines via awareness campaigns, such as workshops and wide distribution of the guidelines.
- Establishing a guideline development and review project team.
- The continuous review, development and monitoring of policies and procedures at both provincial and national level.
- Establishing an Office of Standard Compliance to investigate incidences of poor patient care and health services. (Department of Health, 2007: 32-33).

This strategy is essential in ensuring adequate infection control and prevention in the health care environment. Although these guidelines are available in most facilities, adherence and compliance is not a guaranteed (Department of Health, 2007: 32-33). The establishment of an Office of Standard Compliance would facilitate compliance and ensure quality assurance.

The objectives to reduce reservoirs of infection include:

- Provinces assessing their infection control needs and addressing them;
- Development of adequate structural capacity for air-borne isolation patients;
- Employee programmes need to be put in place to prevent employees from contracting and transmitting infectious diseases;
- Adherence to standard infection control and prevention policies by health care facilities, which would include:
 - The designing and implementation of a programme to reduce the risk of nosocomial infections;
 - Targeted surveillance of device-associated infections ;

- Identification of procedures and practices which carry the risk of cross-infection between patients and health care providers and the implementation of strategies to reduce the risk;
- The availability of protective clothing, disinfectants and other barrier techniques and ensuring that they are used correctly;
- The obtaining of laboratory cultures when required from sites that have been designated as high-risk locations at health care facilities;
- A quality management and improvement programme that is integrated into the infection control programme at facility level;
- Developed and validated infection control and environmental cleaning standards at all levels of care;
- In-service training on the use of cleaning products (Department of Health, 2007: 33).

The presence of reservoirs of infection increases the risk of infection in all health care settings. These reservoirs of infection are exacerbated by the high levels of patients, poor hygiene methods and inadequate isolation areas for highly infectious patients. With the use of this action strategy the reservoirs of infection will be greatly reduced and thus possibly improve the level of infection control and prevention within these facilities (Department of Health, 2007).

The Department of Health's National Infection Prevention and Control Policy and Strategy (2007: 34-35) also recommended the following action strategies,

- Best use of antibiotics, due to the high levels of antibiotic resistance;

- The strengthening of management committees for infection control at different levels;
- Infection Prevention and Control research and development to ensure a greater understanding of infections and increased clinical knowledge with regards to how best to reduce and manage nosocomial infections.

Although the implementation of this strategic plan in the South African health services will greatly improve the management of infectious diseases and infection control in the public sector, its implementation depends greatly on the appropriate infrastructure and resources that have been made available and the formation and management of monitoring and surveillance systems.

Monitoring and surveillance systems, such as the Office of Health Standard Compliance, would ensure that health care facilities comply with set standards through development of recommended standards for public health, monitoring and inspecting facilities, evaluating the quality control activities and measures in place, and intervening as required when standards are not being met.

2.6 CONCLUSION

This concludes the discussion on the present literature pertaining to infection control in the prehospital environment. The following section presents the research methodology of the study where the methods of data collection undertaken will be discussed in detail.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter presents a discussion of the research methodology, which will include the study design, the case study protocol, the sampling strategy used, data collection, data analysis, interpretation of the data and the ethical considerations.

3.2 RESEARCH DESIGN

According to Polit and Beck (2010: 765), a research design is the overall plan for addressing a research question, including specifications for enhancing the study's integrity. A multiple case study using a qualitative research design was used to develop an EMS specific disinfection protocol and evaluate its effectiveness in the public sector EMS in the eThekweni District of KZN. Case studies are used by researchers in order to thoroughly explore a programme, an event, an activity, a process or one or more individuals, but families, groups, institutions and other social units may also be the focus (Yin, 2009; Polit and Beck, 2010). Case studies have been shown to be very useful in health and social sciences and are used when exploring the "how and why" of a situation when variables cannot be controlled (Yin, 2009).

3.3 CASE STUDY PROTOCOL

This section outlines the case study protocol which was used to guide this research. According to Yin (2003), case study protocol has to include (a) an overview of the case project, (b) project objectives, (c) data collection procedures, and (d) guide for the report (Yin, 2003: 69). The presence of the case study protocol is another way to increase the reliability of the case study (Yin, 2003). Case study protocol was used to guide this research and informed the first and third phases of the study. It was designed as follows:

Part 1: Overview of this case study project

Part 2: Project objectives

Part 3: Access to sites and data collection procedures

3.3.1 Part 1: An overview of the case study project

This study took place in the public sector EMS in the eThekweni District of KZN. The district comprises of four sub-districts, namely the North, West, South and Central sub-districts. The data collection took place at the two bases in the North sub-district (Phoenix and KwaMashu), one base in the West sub-district (Marianhill), two bases in the South sub-district (RK Khan and Umlazi) and two bases in the Central sub-district (Central, Wentworth). Thus, seven bases in the district were utilized. See Figure 3.1 below.

According to a report released by the public sector EMS in the eThekweni District of KZN, there are presently 37 operational ambulances in the district. Over the month of February 2012, the 37 ambulances travelled a total of 370118 kilometres and were dispatched to a total of 23 046 cases. Thus, on average, each ambulance would travel a total of 10 003 kilometres over a four week period, an average of 357 kilometres over a 24 hour period. On average, each ambulance would be dispatched to a total of 623 cases over a four week period, and an average of 22 cases over a 24 hour period (Emergency Medical Rescue Services, eThekweni District, 2012).

The national norm for ambulance to population ratio is one ambulance per population of 10 000. According to the Strategic Plan of the KZN Department of Health 2010-2014, there are currently only 219 operational ambulances in the province of KZN, though a total of 960 ambulances are required to meet the national norms in KZN (Department of Health, 2010: 92).

Therefore, it can be concluded that the EMS under study is greatly under staffed and under resourced with regard to meeting the national norms. Of the 427 operational staff employed in this district, 230 personnel have only

been trained to the basic life support (BLS) level and thus have had only one month of training in Emergency Medical Care (EMC). The 169 operational intermediate life support (ILS) providers in this district have had a total of four months of training. Both the BLS and ILS courses are presently limited to no training in infection control or prevention.

In a recent study undertaken in this EMS, the ambulance crews' knowledge and practices in infection control were assessed with use of a survey. The results showed definite shortfalls in the ambulance crews' knowledge of infection control and cleaning practices. The researcher recommended the implementation of an Infection Control Programme and further training for all operational staff in regard to infection control (Naguran, 2008)

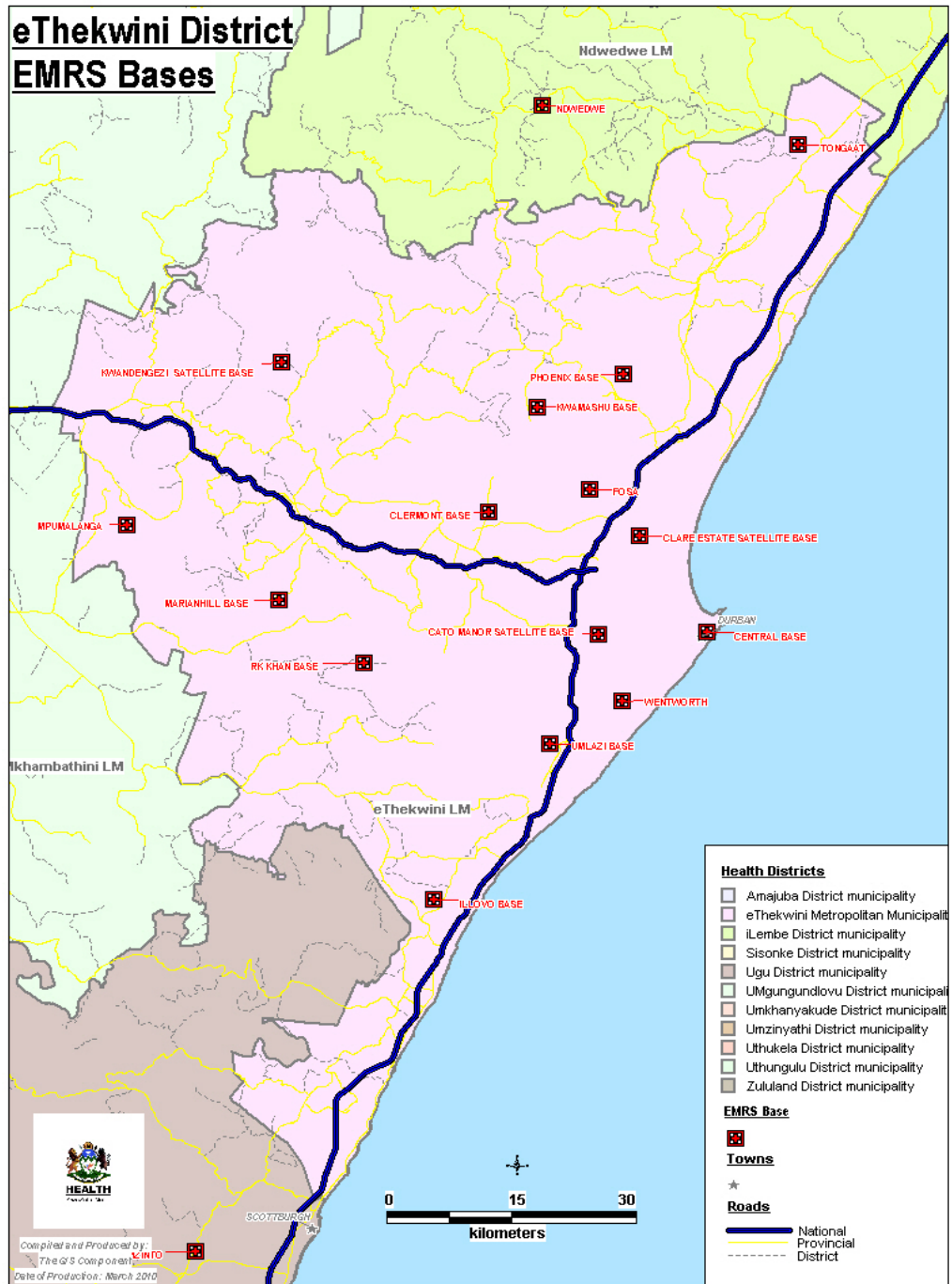


Figure 3.1: Map showing eThekweni District EMRS Bases (Geographic Information Systems Unit, 2010)

3.3.2 Part 2: Project objectives

The objectives of the study were to:

- Identify factors that needed to be taken into account to develop an ambulance specific disinfection protocol;
- Develop an ambulance specific disinfection protocol, taking into account internationally accepted guidelines and the information identified in objective one;
- Implement and evaluate the effectiveness of the developed disinfection protocol.

3.3.3 Part 3: Access to sites and data collection procedures

The study was conducted in three phases, with each phase being aligned with an objective of the study. The first and third phases are discussed below under the following headings, a) pilot study, b) sampling process, c) data collection and d) data analysis.

The second phase includes the description of the process of the development of the protocol and its pilot study, but is discussed in more detail in Chapter 4, heading 4.3

3.4 PHASE ONE: FOCUS GROUP DISCUSSIONS TO IDENTIFY FACTORS THAT NEEDED TO BE TAKEN INTO ACCOUNT TO DEVELOP AN AMBULANCE SPECIFIC PROTOCOL (OBJECTIVE ONE)

According to Polit and Beck (2010: 341) a focus group discussion is a group interview to elicit the participants' thoughts and opinions. Focus group discussions in this study were used to generate dialogue on the subject being researched. FGD supports the further construction of the ideas and opinions on what has been expressed by fellow participants.

3.4.1 Pilot study for Phase One

A pilot study is a small-scale study or 'trial run' used by researchers to test instruments for effectiveness in a larger study, using the same topic (Polit and Beck, 2010: 13). A pilot study was conducted on a smaller version of the proposed study to refine the methodology or the data collection process.

The pilot study was conducted at the Department of Emergency Medical Care and Rescue on the Ritson Campus of Durban University of Technology on the March 2012. Five operational ambulance crew members participated. The participants were required to read the letter of information and sign a confidentiality agreement and consent form. The focus group discussion (FGD) guide was tested in terms of its clarity and effectiveness of the questions in prompting discussion regarding the topic. The pilot study also assisted in determining the length of time that it took to complete the FGD (45 minutes). The results revealed that the participants had a clear understanding of the questions and the guide encouraged significant discussion regarding the topic. There were minimal changes that were made on the focus group discussion guide and these did not affect the proposed study. The data from the pilot was excluded from the final set of data.

3.4.2 Sampling strategy for Phase One

The sample consisted of local EMS personnel, including managers and operational personnel. With the permission of the sub-district managers of eThekweni, the researcher was permitted to visit a base of each of the four sub-districts to conduct the focus group discussions. Purposeful sampling was used to collect the sample of management personnel and random sampling was used to collect the sample of operational staff.

The operational staff members who were present when the researcher visited the bases were asked to participate in the focus group discussions (FGDs). The researcher visited the bases at shift change-over so that staff from both the day shift and night shift could participate. Each FGD was hosted in the

crew-room of each relevant base. The participants were seated around the table in no particular arrangement. The researcher was also seated at the table, in a position where she could observe and engage with all the participants. The researcher took notes, when required, and used a FGD guide throughout the discussion. The voice recorder and video recorder were set up prior to the commencement of the discussion.

The sub-district managers and the communications centre manager for eThekweni were included in the final FGD, which took place in the boardroom at the communication centre (Base 5).

Table 3.1 below shows the number of participants and FGDs that were held.

Table 3.1: Number of participants and FGDs

	Base 1	Base 2	Base 3	Base 4	Base 5
No. of Participants	10	8	8	8	5
No. of FGDs	1	1	1	1	1

3.4.3 Data Collection for Phase One: The focus group discussion

Five FGDs were conducted with EMS personnel in order to identify the factors that needed to be taken into account for the development of the disinfection protocol. Each of the first four groups consisted of between eight and ten EMS operational staff and the fifth group consisted of five EMS management staff. A focus group discussion guide for both operational and management staff was used to facilitate the discussion (See Annexure 6 and 7). The researcher conducted and facilitated the discussions. To ensure accuracy, the discussions were voice-recorded and, when possible, video-recorded with the permission of the participants. Later the focus group discussions were transcribed verbatim.

In an effort to identify factors that needed to be taken into account to develop the disinfection protocol (objective one), during the first four focus group discussions, the operational staff participants were asked to describe how they performed:

Vehicle cleaning

- Vehicle exterior
- Vehicle interior – daily cleaning, cleaning after each patient and deep cleaning.

Self decontamination

- Personal Protective Equipment
- Hand washing

Standard Precautions

- Spillage management
- Waste management
- Linen management

The researcher also asked the participants for suggestions as to how infection control can be improved in the public sector of EMS and how non-compliance can best be prevented. Finally, the researcher asked the participants for any further comments that they would like to express and if there was any other points that they would like to elaborate upon.

The fifth FGD followed a slightly different procedure. As the participants were in positions of management and were responsible for ensuring the implementation of SOPs at the ambulance bases, they were asked to respond to the following:

- Describe the current procedures used for disinfecting the operational ambulances.

- To what extent are these procedures aligned with international policy?
- What factors have hampered implementation of international policy guidelines?
- What do you think should form part of disinfection protocol, specifically in EMS?
- What guidelines can be used in the implementation of the disinfection protocol?

The researcher also asked the participants for suggestions on how non-compliance can best be prevented. Finally, the researcher asked the participants for any further comments they would like to express and if there were any other points that they would like to elaborate upon.

3.4.4 Data Analysis and interpretation for Phase One

The voice recorded data from the focus group discussions was transcribed and then analysed by the researcher, using thematic content analysis (Green and Thorogood, 2004). Data collection and analysis occurred iteratively. As soon as a FGD was concluded, it was transcribed and the analysis commenced. The researcher began by reading through each of the transcripts so as to get a sense of the whole discussion, and to categorise the accounts into a summary, using a process of coding. Themes, categories, subcategories and the relationships between them were identified and recorded in the format of a mind map, see Figure 3.2 below:



Figure 3.2: Mind map of the themes, categories and sub-categories in the first phase

To ensure that the researcher had accurately interpreted the FGD data, member checks were conducted after the initial transcribing of the interviews and its analysis.

Throughout the coding and the analysis of the data, ideas and discussion points were documented and used to assist in later analysis and the development of the conceptual map.

3.5 PHASE TWO: DEVELOPMENT OF THE DISINFECTION PROTOCOL (OBJECTIVE 2)

Based on the information gathered in phase one and a qualitative analysis of internationally accepted guidelines, an ambulance disinfection protocol was developed with the use of the conceptual map described below in Figure 3.3:

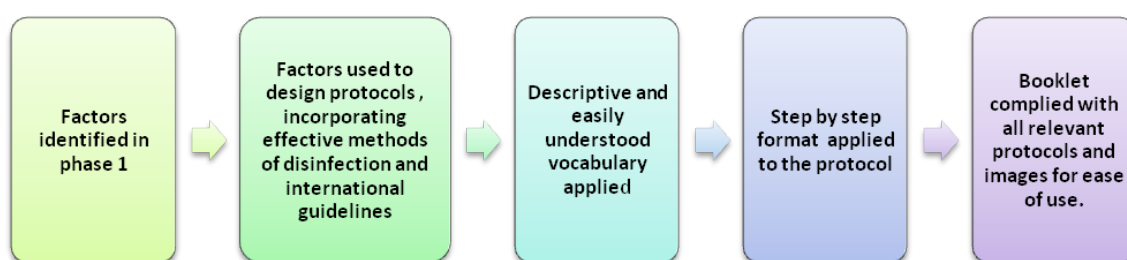


Figure 3.3: Conceptual map for the development of the protocol

3.5.1 Pilot study

The pilot study for the second phase was conducted on of June 2012 as focus group discussion. It took place at Department of Emergency Medical Care and Rescue on the Ritson Campus of Durban University of Technology and fifteen (15) operational ambulance crew members participated. The participants were required to read the letter of information and the disinfection protocol and sign a confidentiality agreement and consent form. The protocol was thus judged and discussed in terms of its readability, simplicity and whether the instructions in the protocol were clear and easily

understood. The participants were also asked in their professional capacity if they thought the protocol could be effectively implemented and to comment on its feasibility.

The pilot study participants were satisfied with the protocol and its ability to be implemented. They also confirmed that the protocol instructions were clear and easy to understand. Although the pilot participants' narrative data was noted, it was excluded from the final analysis of data.

Refer to Chapter 4, heading 4.3 for further discussion with regard to the development of the protocol

3.6 PHASE THREE: IMPLEMENTATION AND EVALUATION OF THE DISINFECTION PROTOCOL (OBJECTIVE 3)

The third and the final phase involved the implementation and evaluation of the disinfection protocol. In the implementation stage, the researcher met with each ambulance crew and the accountable shift supervisor. Each crew was then issued with a ten litre bucket, a mop, three one litre spray bottles, ten packs of paper towels, a five litre atomizer spray bottle, a measuring jug, two litres of cleaning detergent, 500ml of hand soap with dispenser bottle, 500ml of hand gel with dispenser bottle, 500ml of disinfectant and 25 litres of 5% bleach. Each spray bottle/container was labelled to illustrate what it contained, at what concentration and the dilution required. The bucket was also labelled with instructions on how to disinfect the mop after use and the dilution required for the bleach.

Three A4 laminated posters of the protocol were put on display in the patient compartment of the relevant ambulances. Two A3 posters, one on hand hygiene and the other displaying the correct hand washing technique, were put on display in the crew-room at each of the seven bases. Where possible, a laminated A4 poster of the hand washing technique was also put on display at the wash basin in both the male and female toilets at each base. Each ambulance crew and the accountable shift supervisor who were participating

in the study were given an information letter and booklet containing the protocol. Each study participant completed a consent form.

The researcher read the Ambulance Disinfection Protocol Handbook with the study participants and then gave an in depth explanation of each part of the protocol, including the procedures, the schedule and the reasoning behind each procedure of the protocol. The researcher invited the participants to ask questions regarding the protocol and these were answered accordingly. The researcher then gave a practical demonstration of how to dilute the detergents and disinfectants, as stated in the protocol, and how to apply the detergents and disinfectants, as stated in the protocol. The researcher also participated in the cleaning of the vehicles, answering questions if they were raised.

3.6.1 Pilot study

A pilot study was conducted on 26 July 2012. It was conducted to test the questionnaire that would be used for the evaluation of the disinfection protocol. The pilot study took place at Department of Emergency Medical Care and Rescue on the Ritson Campus of Durban University of Technology and fifteen operational ambulance crew members participated.

The participants were required to read the letter of information and the disinfection protocol and to answer the questionnaire. The questionnaires were thus judged and discussed in terms of their readability, simplicity and whether the instructions to the questionnaires were simple and easy to understand. In addition, the pilot study assisted in determining the length of time that it took to complete the questionnaires (average 15-20 minutes). The results revealed that the participants had a clear understanding of the questions. Minimal changes were made on the questionnaires and these did not affect the proposed study. Although the data from the pilot study was noted, it was excluded from the final set of data.

3.6.2 Sampling strategy

The third phase of the study took place in the public sector EMS in the eThekweni District of KZN. The district comprises of four sub-districts, namely North, West, South and Central sub-districts. The data collection took place at the two bases in the North sub-district (Phoenix and KwaMashu), one base in the West sub-district (Marianhill), two bases in the South sub-district (RK Khan and Umlazi) and two bases in the Central sub-district (Central, Wentworth). An ambulance crew from each of the seven ambulance bases, as well as the accountable shift officers (supervisor), were utilized. Purposive sampling was conducted in order to have a varied and well informed mix of participants from the EMS operational staff and management.

Permission to conduct the research was obtained from the KZN Health Department and the EMS under study (See Annexure 2).

3.6.3 Data collection for Phase Three

Participants were requested to use the disinfection protocol in their normal operational duties over a period of four weeks. Every week the researcher visited the participating bases to check and replace stock as required. During the second and fourth weeks, the participants answered a brief evaluation questionnaire regarding the implementation of the disinfection protocol and its use (See Annexure 9). The shift supervisors for each base were also required to complete the questionnaire at the above mentioned intervals. Each question was explained and if a participant had any queries regarding the questions, they were answered accordingly.

The questionnaire contained the following open-ended questions to grade the effectiveness in regard to the participants' perception, opinions and experiences of the ambulance disinfection protocol, in its implementation and use.

- Please comment on the disinfection protocol's ability to be implemented.
- What can be done to improve the implementation of the disinfection protocol?
- What factors hindered the use of the disinfection protocol?
- What will improve the use of the disinfection protocol?
- Please provide final comments and any suggestions for the disinfection protocol

3.6.4 Data analysis and interpretation for Phase Three

The researcher began by reading through all the transcripts so as to get a sense of the overall perception of the protocol, and to categorise the accounts into a summary. The process of coding was then used. Themes, categories, subcategories and the relationships between them were identified and recorded in the format of a mind map as depicted below in Figure 3.4.

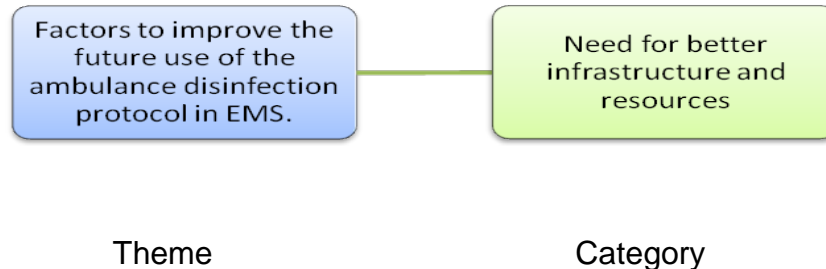


Figure 3.4: Mind map for themes and categories in the third phase

To ensure that the researcher had accurately interpreted the questionnaire data, member checks were conducted after the initial summary of the questionnaire and its analysis.

Throughout the coding and the analysis of the data, ideas and discussion points were documented and used to assist in later analysis and the development of a conceptual framework.

3.7 TRUSTWORTHINESS

As qualitative research has an element of subjectivity, it is open to criticism (Polit and Beck 2010: 174). Therefore, it is important that the study and the findings provide evidence of trustworthiness. Babbie and Mouton, (2001: 276) explain trustworthiness as the extent to which a research study is worth paying attention to, worth taking note of and the extent to which others are convinced that the findings are to be trusted. With the use of Lincoln and Guba's framework, the researcher can address the trustworthiness of the study by establishing credibility, transferability, dependability and conformability (Polit and Beck 2010: 174).

3.7.1 Credibility

Credibility refers to confidence in the truth of data and interpretations of them (Polit and Beck 2010: 175). Credibility of this study was addressed by:

- Use of research methods that are considered to be well established in research;
- Random sampling was conducted with operational staff to prevent possible bias by the researcher in the selection of participants in the FGDs;
- FGDs were held in different districts with similar results emerging after data analysis;
- Triangulation of the results;
- Participants were given anonymity and were informed that they could refuse to participate at any point during the study without explanation. This helped ensure the honesty, frankness and willingness to participate of the participants;
- The researcher often met with her supervisors, colleagues and peers to discuss the study and its progress. This assisted the researcher in

gaining feedback and useful criticism in regard to her research, thus strengthening the discussion and refinement of the research design;

- Member checks were also conducted to ensure the correct interpretation of the data collected.

3.7.2 Transferability

Transferability is the extent to which findings can be transferred to or have applicability in similar settings or groups (Lincoln and Guba 1985: 321). The following measures were put in place to ensure confirmability:

- Inclusion of a detailed description of the study settings and its participants, which allows for the reader to come to a decision as to whether conclusions drawn in this study can be transferred to similar settings.

3.7.3 Dependability

Polit and Beck (2010: 175) define dependability as the stability or reliability of data over time and conditions. The dependability of this study was addressed in ensuring the inclusion of:

- The research design and how it was executed;
- How the data was collected;
- Maintaining an audit trail through safe keeping of raw data of each interview for future reference.

3.7.4 Confirmability

According to Lincoln and Guba (1985: 320-321), confirmability refers to the degree to which the researcher can demonstrate neutrality of the research interpretations. In qualitative research, confirmability focuses on the characteristics of the data gathered in the study and by utilising an audit trail. Therefore, the following measures were put in place to ensure confirmability:

- Availability of the raw data (voice and video recordings and questionnaires) and transcribed data, both of which can be made available on request.
- All analyzed data was scrutinized by the researcher's supervisor and peer reviewed to ensure that the results reflected the voices of the participants and not that of the researcher.

3.8 ETHICAL CONSIDERATIONS

Approval of the study was sought from the Ethics Committee of the Durban University of Technology (Annexure 1) and permission to conduct a study was requested from the Department of Health (Annexure 2). Permission was also obtained from the public sector EMS for the District of eThekweni before data collection proceeded.

3.8.1 Respect

All the participants were fully informed regarding the study and were given information letters that gave further clarification of the study and how the collected data will be used (Annexure 4). The information letter also stated that participation was voluntary and that participants were free to withdraw from the study at any point without any negative consequences. All the participants were required to sign informed consent forms (Annexure 4) and, where applicable, participants were also requested to sign a confidentiality agreement to protect the privacy of all the participants (Henning, 2004: 73-74)

3.8.2 Beneficence

The information letter also stated that all the information gathered would be treated as confidential and that no participants could be identified in the research. All voice recordings, questions and correspondence were kept in a secure archive.

To prevent an accidental breach of confidentiality, each participant was allocated a participation code in substitution for their identity. All identifying documentation was archived on a password accessed computer. No persons other than the researcher herself had access to any identifying documentation (Polit and Beck, 2010: 129).

There were no adverse effects for the participants. On the contrary, the study could be of benefit to the participants as the findings might guide the review of EMS policies and guidelines on infection control and thus possibly improve the participants' working environment. The focus group discussions, the use of the protocol, its implementation and evaluation did not interfere with the participants' normal operational duties during the course of this study.

3.8.3 Justice

All participants had access to the researcher and the research supervisors, either directly, telephonically or by email, to ask questions or to clarify information, instructions and questions throughout the study. Participants were made aware that there would be no prejudice or unfairness if they decided not to participate at any point in the study. They were also made aware that confidentiality would be maintained at all times

3.9 CONCLUSION

This concludes the discussion on the research methodology of the study and the methods of data collection. In the following section the results of the data collection will be discussed with emphasis on the key themes and their significance.

CHAPTER 4

PRESENTATION AND DISCUSSION OF THE FINDINGS

4.1 INTRODUCTION

In this chapter, the findings of the study will be presented and discussed. The discussion will include the three phases of the study. The first phase covers the analysis of the focus group discussions with operational ambulance crew and their immediate management to identify factors that needed to be considered to develop an ambulance specific disinfection protocol. The second phase covers the development of a disinfection protocol based on the information identified in Phase One, together with internationally accepted guidelines. The third phase will include the findings of the questionnaire used to evaluate the effectiveness of the developed protocol after it was implemented at seven ambulance bases in the district of eThekweni.

4.2 THEMES EMERGING FROM THE FOCUS GROUP DISCUSSIONS (PHASE ONE– Objective One)

On analysis of the FGDs, the following three main themes emerged: i) the need for better infrastructure and resources; ii) time required to disinfect; and iii) quality improvement. These are indicated in Figure 4.1 below:

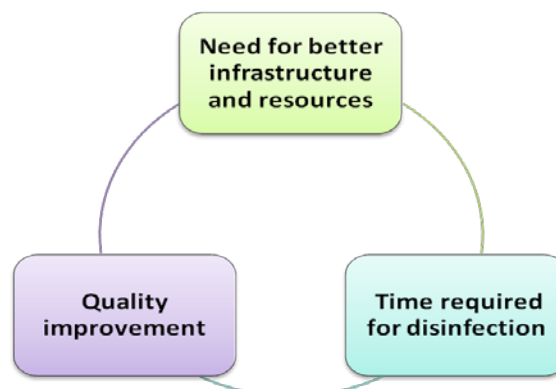


Figure 4.1: Themes emerging from Phase One of the data collection

4.2.1 Need for better infrastructure and resources

This theme emerged as a result of common infrastructural and resource needs. As can be seen from the categories and sub categories listed below (figure 4.2), the lack of extremely basic necessities, such as access to water and waste management, was repeatedly highlighted by the focus group

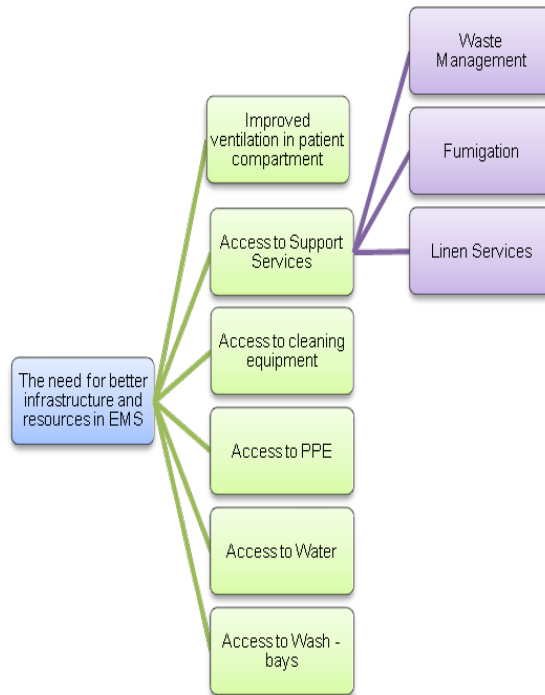


Figure 4.2: Theme 1 – The need for better infrastructure and resources

4.2.1.1 Access to water

The study participants from certain bases felt that they did not have sufficient access to water for cleaning and disinfection. Some stated that they did not have the appropriate equipment, such as hosepipes, to use in rinsing out the ambulances. In extreme cases, participants expressed their concern that they did not have the appropriate tap fittings or water resources for either cleaning the vehicles or for their personal use. Often a single tap would be used for both purposes, which is an obvious concern. An example of such a tap is illustrated in figure 4.3 page 52.

The lack of appropriate tap fittings in healthcare facilities was also identified by the Department of Health. They attributed this to outdated facilities and the limitations in their structural design. The National Infection Prevention and Control Policy instructs all health care facility infection control committees to first identify the facility's structural deficits in meeting the requirements for infection control and prevention measures and then to establish adequate infrastructure to meet infection control and prevention requirements, such as building new hand-washing facilities (Department of Health, 2007: 21, 30). (For further discussion regarding this policy please refer to Chapter 2)

Water is an essential part of cleaning and disinfecting. It is also essential for all employees to have access to water for personal requirements and hygiene.

According to Section 43 of the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993),

...4. Every employer shall, under the circumstances contemplated in Table 4 of Part P of SABS 0400, provide showers for the use of his or her employees, and he or she shall-

(a) provide running hot and cold or premixed hot and cold water for washbasins and showers..."

"...7. Every employer shall-

(a) make available an adequate supply of drinking water for his or her employees at their workplace; and

(b) clearly and conspicuously mark such, taps and pipes that is not fit for human consumption...

The inaccessibility of water taps (for clean and drinking water) and washbasins at certain ambulance bases is an infringement of this act and the regulations set out by the Minister of Labour.

The following excerpts present the study participants' experiences of insufficient access to water for disinfection:

"The water itself, we got no hose pipe to clean up our vehicles" (P1 B2)

"As they mentioned we don't have a wash bay. We normally use a fire hose which is not allowed to be used for cleaning the ESV." (P6 B3)

"There is only one tap, come in here (crew room), using the same tap, come in here. Most of people that is why they are getting sick here and if you are sick here, they just saying "go and stay home". (P3 B3)

"Adding to that, when I have to wash my cup I have to wash it in the same place I have to wash my mop, which is the mop that I'm washing inside the ambo." (P4 B3)



Figure 4.3: The primary water source at an ambulance base in the eThekweni District (Photo taken on July 2012 by Natalee Williams-Claassen)

4.2.1.2 Access to wash bays

The focus group discussions revealed that the need for wash-bays is a major concern for the EMS staff. This factor was also highlighted in a previous research study undertaken in this service. Naguran (2008) recommended the establishment of cleaning facilities for ambulances as the participants in his study commented on the poor wash-bay facilities that are presently available. The KZN Department of Health (2010: 94) acknowledged the inadequacy of wash bay and sluice room facilities in the EMS service under study in the Strategic Plan of the KZN Department of Health 2010-2014. They also attributed the poor maintenance of the ambulances to the lack of these resources.

Although the Strategic Plan of the KZN Department of Health 2010-2014 identified many challenges in the EMS under study, they failed to outline the

department's strategic objectives to improve the availability of wash bays and sluice facilities to emergency service personnel (KZN Department of Health, 2010: 94).

The following excerpts present the study participants' experiences:

"In addition, for washing the vehicles, how can we be saying we are washing the vehicles if we don't have a decent and healthy washing bay. We don't have a washing bay at all. The point is how are going to wash the vehicles. If you are washing the blood and maternity blood in the ambulance into the yard, so really!" (P2 B2)

"As you can see we don't have a wash bay here, we just park the ESV on the parking and then wash it." (P1 B3)

"We got no cloths to wash, no washing bay. Sometime the blood, we are supposed to clean the blood here where we are walking. We are walking the blood in here (crew room), that's why most of the people in EMRS is getting sick because of this infection." (P3 B3)

"Also when we clean the vehicle, when we hose them, whatever debris, like vomitus goes onto the floor, no quarantine or anything limiting these types of germs. It's just been spread throughout the place here." (P5 B3)

4.2.1.3 Access to cleaning equipment and detergents

The participants felt strongly about the lack of cleaning detergent and equipment. The majority of the participants highlighted the inaccessibility of basic cleaning equipment such as hand soap, cleaning detergent and mops.

The participants informed the researcher that minimal "cleaning" occurred as they did not have the resources to clean and disinfect. Those who had access to water would generally just rinse their vehicles if a bio-hazardous

spill had occurred and then proceed to the next case. If they were able to clean their ambulances or wash their hands it was due to them sourcing their own cleaning detergents from hospitals as little or none was provided by the EMS under study. An example of a mop “ready for operational use” is illustrated below on page 57.

The correct practices that should be undertaken in regard to cleaning and disinfecting of ambulances were discussed in Chapter 2, heading 2.4.

The study undertaken by Naguran (2008) also identified the lack of cleaning equipment and materials. He recommended that cleaning equipment, cleaning detergent, disinfectants and hot water be made available to ambulance staff to ensure adequate cleaning and disinfection. The Strategic Plan of the KZN Department of Health 2010-2014 failed to identify this as a challenge and thus their way forward to improve the situation is presently unknown (Department of Health, 2010: 94).

The focus group discussion with junior management highlighted the inadequacies with the provincial tender process in procuring cleaning materials, which explains why these resources are in short supply. They also highlighted the lack of standard operating procedures which exacerbates the situation.

The South African Department of Health (2007: 30) also determined that the lack of these procedures in healthcare facilities is a challenge. They also identified procurement difficulties in regard to the purchasing of cleaning materials. The National Infection Prevention and Control Policy and Strategy stated that the development of validated cleaning standards, in-service training and availability of the relevant cleaning materials is required at all healthcare facilities (Department of Health, 2007: 33).

According to the Occupational Health and Safety Act (Act no. 85 of 1993),
“10. (2) Where reasonably practicable, the employer shall control the exposure of persons to a HBA in the working environment by applying the following measures where appropriate:

(c) *introduce engineering control of exposure, which may include the following:*

(v) *immediate personal/environmental disinfection*

(d) *Introduce appropriate work procedures that employees must follow where the materials are used, processes are carried out, or incidences may occur that could give rise to the exposure of an employee to a HBA, and such procedures shall include written instructions to ensure:*

(ii) *the proper use of and maintenance of process machinery, installations, equipment, tools and local extraction and general ventilation systems;*

(iii) *the regular cleaning of machinery and work areas by vacuum cleaners fitted with the suitable filter that prevents contamination of the environment;” (Republic of South Africa, 1993).*

The lack of available cleaning equipment, detergents and the appropriate standard operating procedures for ambulance disinfection is thus an infringement of this act and regulations set out by the Minister of Labour.

The following excerpts present the participants' experiences in regard to the lack of cleaning detergent and cleaning equipment:

“We mop with basically just plain water and sometimes soap. That’s all we got to utilize and that’s it.” (P1 B1)

“The only time that we can really wash our hands is when we are at hospitals. We use the soaps and whatever to wash our hands there. When we came to base and sometimes we don’t even have washing liquid to wash our hands. The hands dispenser is most of the time empty and to don’t even see soap around. So in that regard unfortunately it is zero” (P2 B1)

“Since I joined the service, I’ve never seen, even once, them doing the spring cleaning and the proper equipment to clean the ESVs, we don’t have” (P5 B2)

“We don’t have the soap to wash our hands, sometimes we didn’t wash our hands, and you remove the gloves and continue with another case.” (P5 B4)

“As when it comes to spill management, I think most of the time the crews would agree with me that people vomit and the blood is there we just the mop with water and mop it cause the reason is there is no disinfectants available to us.” (P4 B4)

“I think since I mentioned it’s all about money, the cheapest stuff. When you buy the cheapest stuff you gonna get the cheap quality so I think that is a problem. If we could guide, if the department could procure the proper disinfectants solutions things would be much better.” (P3 B5)



Figure 4.4: A mop considered ready for use at an ambulance base in the eThekweni District (Photo taken on July 2012 by Natalee Williams-Claassen)

4.2.1.4 Access to Personal Protective Equipment

As discussed in Chapter 2, personal protective equipment (PPE) is essential in the prevention of cross contamination between patients and healthcare providers.

The study participants showed their concern for the lack of PPE being issued to them. They highlighted the fact they often had to source their own PPE from hospitals and clinics, often going to the extreme of “stealing” PPE from these facilities.

According to the Occupational Health and Safety Act (Act no. 85 of 1993),

10. (1) Every employer shall ensure that –

(a) The exposure of persons to Hazardous Biological Agents (HBA) in the working environment is either prevented or, where this is not reasonably practicable, adequately controlled; and

(b) Standard precautions are implemented to reduce the risk of transmission of HBA from recognised and unrecognised sources of infection in a workplace” (Republic of South Africa, 1993)

11. (1) If it is not reasonably practicable to ensure that the exposure of an employee is adequately controlled as contemplated in regulation 10, the employer shall-

(a) In the case of an airborne HBA, provide the employee with suitable respiratory protective equipment and protective clothing; and

(b) In the case of a HBA that can be absorbed through the skin, provide the employee with suitable impermeable personal protective equipment.” (Republic of South Africa, 1993).

They also voiced their concern regarding the sub-standard PPE (masks and gloves) that they were given by the EMS under study and the poor storage of this equipment which often leads to the contamination of the gloves before use.

According to the Occupational Health and Safety Act (Act no. 85 of 1993),

11. (2) Where respiratory protective equipment is provided, the employer shall ensure –

(a) that the relevant equipment is capable of preventing the exposure to the relevant HBA;

(b) that the relevant equipment is correctly and properly used;

(c) that the information, instructions, training and supervision that is necessary with regard to the use of equipment is known to the employees; and

(d) that the equipment is kept in good condition and efficient working order.

11. (3) *An employer shall –*

- (a) *not issue used personal protective equipment to an employee unless it is capable of being decontaminated and sterilized prior to use;*
- (b) *provide separate containers or storage facilities for personal protective equipment and protective clothing when not in use; and*
- (c) *take steps to ensure that all protective equipment and protective clothing not in use are stored in a demarcated area with proper access control.*

The lack of available PPE such as gloves, goggles, facemasks and, where applicable, aprons and the inappropriate storage of PPE is an infringement of this act and regulations set out by the Minister of Labour.

The following excerpts present the participants' experiences in regard to the availability of PPE:

“There are some days when there is actually no stock. Basically there were occasions when we borrowed from the clinic, there were only small gloves available and we had to go get masks, especially the N95 masks. There was definitely nothing here and we had to borrow on numerous occasions.” (P1 B1)

“The gloves that we're given and have to use are mostly large and extra-large. Non-sterile, left in a box in stores, you must pick off 10 pairs at a time to take and go. That's what they say.” (P5 B1)

“We don't have proper equipment to defend ourselves, to protect ourselves.” (P5 B2)

“In case we have a patient that we needs to wear a protection, we have to organize at that time, we don't have. And the masks we got sometimes we don't have.” (P4 B3)

“Sometimes we do have gloves, sometimes they are getting finished so we have to share (what’s left) in order to go to the case…… sometimes you are getting (patients) from King George Hospital, TB hospital MDR and SDR TB and you’ve got no protective (equipment) sometimes you are taking that patient to the isolation room but we’ve been sitting with the patient in the ambulance.” (P3 B3)

“They said we got goggles. I don’t think most of us got goggles. I don’t have.” (P7 B4)

4.2.1.5 Improved ventilation in the patient compartment of the ambulance

The study participants expressed their concern with regard to the inadequate ventilation in the patient compartment of the ambulances. Many of the participants identified that one window for ventilation was inappropriate, especially in the incidence of infectious patients with air-borne diseases. Many of the participants also identified the lack of working air-conditioners and extractor fans. This also has a negative effect on the ventilation and air quality present during transportation of patients.

In the incidence of air-borne transmitted diseases, as such as tuberculosis (TB), it is essential to reduce the amount of air-borne droplets present in the patient compartment during transportation to prevent cross-infection between patients and healthcare providers. The New York State Department of Health (1992) recommends good ventilation in the patient compartment for purpose of reducing the load of air-borne infectious diseases. This should be done by either opening all the windows in the patient compartment or having a fitted ventilation system set at maximum, in conjunction with the use of disposable face masks for both the patient and the healthcare provider.

According to the Occupational Health and Safety Act (Act no. 85 of 1993),

10. (2) *Where reasonably practicable, the employer shall control the exposure of persons to a HBA in the working environment by applying the following measures:*

(c) *Introduce engineering control measures for the control exposure, which may include the following:*

(ii) *The installation of local extraction ventilation systems to processes, equipment and tools for the control of emissions of air-borne HBA*

The following excerpts present the participants' experiences with regard to the ventilation in the patient compartment of the ambulances:

"That you're sitting in a closed vehicle and that TB is an air-borne virus and it's gonna be all around you." (P2 B1)

"And also we inviting more diseases and also the type of vehicles we are using, they are also causing problems for us because there is no ventilation in the ambulance that you are using. So as a staff we are still in a big problem and you are, all the time, in danger of getting any diseases, any time because there is no ventilation." (P2 B2)

"It is hard to clean the vans, like the new vans. What I know is when you meant to clean you're meant to open all the windows to get a fresh air. So this one (new vehicles) you are wasting your time when cleaning cause you only got one window. One window, only getting air in, not out, which means whatever you're cleaning there still be infection inside cause it can't go out." (P6 B3)

“Most times ma’am there is no air-cons in these units and there is only one window so it’s difficult to work there in the condition.” (P2 B4)

“One of the main comments was the ventilation in the back, one window when they use to have small windows but now they came and all of a sudden vehicles have got just one window.... Very hot and poor ventilation.” (P4 B4)

4.2.1.6 Access to Support Services

a) Linen service

The majority of FGD groups commented on the poor linen facilities available in the EMS under study. The participants described incidences where there was no reusable or disposable linen available for use on the vehicles. Patients were then placed directly on the stretcher or bunk cushions. Often during these cases there would be some form of a biological spill, this Hazardous biological agent would then be absorbed by the torn cushions and used for the next patient. In extreme cases, due to the unavailability of the linen, the participants admitted to “stealing” the required linen from hospital for use on the ambulances.

The following excerpts present the participants’ experiences with regard to the availability of linen:

“The majority of the time you have to swop it at hospital, or steal it from hospital.” (P2 B1)

“Yes I agree because we don’t have any, enough linen saver. Mostly the weekend, we only have one linen saver so we put the patient on the cushion, ... sometime they vomit, urinate, sometimes the cushion has a hole and now the whole day we got like a smell because there is no linen saver.” (P6 B2)

“We don’t have linen. We do take from the hospital. Sometimes they give us, sometime they don’t let us take because they say it belongs to the hospital, we must have our own. So we don’t have in the base at the moment.” (P8 B4)

b) Waste management

There were inconsistency with regard to waste management at all of the ambulance bases that were included in the FGD, the most serious being the incorrect disposal of medical waste due to the incorrect use of colour-coded bags or the failure to use the waste-bags in the removal and disposal of hazardous waste.

Waste management is an essential part of infection control. It ensures the prevention of accidental injury and the prevention of the spread of disease to local communities and healthcare providers with the proper handling of waste (Tietjen, Bossemeyer and McIntosh, 2003: 8-3).

For a detailed description on how waste management should be conducted, please refer to chapter two.

According to the Occupational Health and Safety Act (Act no. 85 of 1993),

“Disposal of HBA

- 17. (1) An employer or self-employed person as contemplated in regulation 2 shall-*
 - (a) lay down written procedures for appropriate decontamination and disinfection,*
 - (b) implement written procedures enabling infectious waste to be handled and disposed of without risk,*
 - (c) ensure that all fixtures and equipment including vehicles, reusable containers and covers that have been in contact with HBA waste*

are disinfected and decontaminated after use in such a way that it does not cause a hazard inside or outside the premises concerned,

The lack of appropriate waste management is an infringement of this act and the regulations set out by the Minister of Labour.

The following excerpts present the participants' experiences with regard to the present waste management:

"We should be using various types of waste facilities, like if we using medical waste we should be carrying our red bags to dispose of all the medical waste. In terms of general waste, we should be carrying white or transferring bags to throw but we can find only one material for disposing the waste management, only red bags for medical waste and we use that medical waste material for general waste material because we dispose almost everything in one bag of which that is contravening the safe management." (P1 B2)

"In regards to our service I don't think anything has been implemented here, apart from the red bags here. We see a lot of hazardous waste lying around the base." (P5 B3)

"It's not always very clean, most of the time you come, I don't know when they come (collection service), it starts accumulating right where you enter, see the bins where you enter? The bins are lying there." (P4 B4)

c) Fumigation

The participants commented on ambulance fumigation. They felt that vector control was needed on all ambulances due to the high levels of cockroach infestations. They commented on lack of fumigation in recent years though the management participants stated that some vehicles had been sent

recently, on an ad hoc basis, for fumigation, though the exact form of fumigation couldn't be specified.

The following excerpts present the participants' experiences with regard to the ambulance fumigation:

*"We have got major issues with the infection. Our vehicles have more cockroaches in them vehicles than basically anywhere else."
(P1 B1)*

*"Coming back to disinfection, the ambulances have not been given fumigations. In the past they use to fumigate our vehicles at the bases... all that was taken away. I don't know, from 2001 I'm here and I've never seen it fumigated once from 2001."
(P4 B4)*

*"...you find that you pick up a lot of cockroaches in the vehicle, the guys are carrying their bags into the vehicles, carrying their lunch, these cockroaches are carrying the germs from there (the ambulance) into their bags and the bags are being taken home with cockroaches now all over the place."
(P4 B5)*

*"It (fumigation) is done by these service providers but the challenge is that we don't know what they are using to fumigate, also I need clarity with occupational health and safety."
(P3 B5)*

4.2.2 Time required for disinfection

This theme arose due to the fact that one of the key issues for not disinfecting ambulances was the lack of time to do it. The reasons are multi-facetted, as explained and depicted (figure 4.5) below:

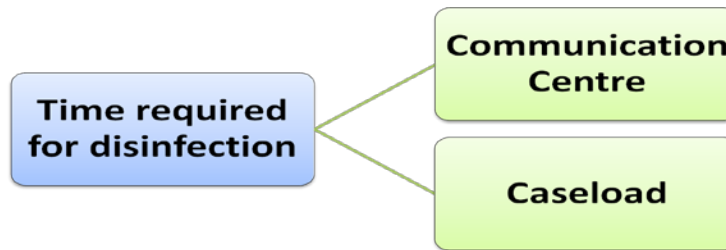


Figure 4.5: Theme 2 – Time required for disinfection and its categories

4.2.2.1 Communication Centre (Control Room)

A major concern for the study participants was the inflexibility of the communication centre staff with regard to the allocating of time for cleaning and disinfection of the ambulances. Many felt that the communication centre staff members were more concerned with completing as many cases as possible and reducing EMS response times versus preventing cross-contamination between patients and staff. The participants comply with the communication staff instructions for fear of reprimand and possible suspension.

The KZN Department of Health (2010: 95) acknowledged the need for the improvement in response times in the EMS service under study in the Strategic Plan of the KZN Department of Health 2010-2014 and identified it as a strategic objective. This could explain why there is such urgency by the communication centre for ambulances to be made immediately available after every case, which would allow for very little time for cleaning and disinfection of ambulances at any given point during the shift. This is also exacerbated by the high caseloads and the inadequate number of operational personnel and ambulances presently available to meet the requirements of the public.

The following excerpts present the participants' experiences with regard to their interaction with communication staff in relation to disinfection:

“They demand that (there are) cases outstanding, we have no choice but to respond to those cases be it a filthy ESV or not, we just make do. Unfortunately our patients are not very literate, I’m sure if everybody was we’d be in a whole lot of nonsense, basically we would.” (P1 B1)

“And it’s harder to clean, sometimes you have a case, like a TB patient and you want to come and disinfect the inside, the control room doesn’t allow us. They will tell us to come; they’re sending us on a case.” (P4 B3)

“Sometimes it’s very hard to clean the interior cause once you completed at hospital they want you to take details, they rush you to take details. If you telling them you want to clean now, they ask what you want to clean now. You have to take the details, all the time.” (P1 B4)

“When you ask the control to give you permission, they give you hard time. You don’t get a chance to wash, so we’re facing a big problem to that point.” (P2 B4)

“If you request to clean the vehicle, they ask what case you had, “ok you had a headache patient, what do you need to clean?” You don’t know what meningitis patient you got, half the time the patients do not tell you the whole history but we are not given the opportunity, we are only given the opportunity when you got a MVA patient and we insist that the patient has vomited....” (P4 B4)

“As they know, we do not have a proper washing bay with the proper facilities. From here to Base X (Ambulance Base) it takes us some time to get there to clean the vehicle and we start to have problems with the crews and Control cause they don’t realize how long it takes to drive from here to there, we have to clean our vehicle. By the time to reach there they already calling us for

cases and we have to rush cause we so scared to say them anything, it's like if you say them anything, you're refusing the case and you'll be suspended..." (P4 B4)

4.2.2.2 Caseload

As discussed earlier, there are presently 37 operational ambulances in the district. Over the month of February 2012, the 37 ambulances travelled a total of 370 118 kilometres and were dispatched to a total of 23 046 patients (cases). Thus on average each ambulance would travel a total of 10 003 kilometres over a four week period, an average of 357 kilometres over a 24 hour period. On average, each ambulance would be dispatched to a total of 623 cases over a four week period, and an average of 22 cases over a 24 hour period (Emergency Medical Rescue Services, eThekweni District, 2012).

By deduction if there is an average of 22 cases per ambulance per a 24 hour period, a case would take an average of 65 minutes. These 65 minutes would include the travel time to the patient pick up point and the locating of the patient, medical management of the patient, transportation to the receiving hospital, administration regarding patient transportation and treatment and patient handover to the receiving facility. These 65 minutes would also include the cleaning and disinfecting of the ambulance and, if required, the ambulance crews' time to refresh and use the restroom.

As stated earlier, the national norm for ambulance to population ratio is one ambulance per population of 10000. According to the Strategic Plan of the KZN Department of Health 2010-2014, there are currently only 219 operational ambulances in the province of KZN, only one ambulance to every 44000 people (four times that of the national norm). A total of 960 ambulances are required to meet the national norms (KZN Department of Health, 2010: 92). Thus due to the low ambulance to population ratio, it can be assumed there would be a very high caseload, which is compounded by the shortages of adequately trained staff and the high poverty index in the

province, further adding to the demand of an already strained EMS system (KZN Department of Health, 2010: 93).

It became evident during the FGD that the majority of the participants felt that there was inadequate time available to clean and disinfect the ambulances due to the high caseloads they had to cope with. In some instances, they are required to transport more than one patient at a time and they expressed their concern regarding this practice, explaining that they often had incidents when infectious patients were being transported with non-infectious patients with no precautions to prevent cross-contamination between these patients.

The following excerpts present the participants' experiences with regard to the availability of time to perform ambulance disinfection due to high patient caseloads:

“With regards to infection control our management requires us to transport patients, many patients, sometimes 3 or 4 at a time, irrespective of the cross infection that is there. We were further told that if there is a case we must try and transport whether it’s a newborn baby, who are much more prone to infection, or it is an elderly person that has TB, who can pass it on to mother who’s pregnant but to date nothing has happened.” (P5 B1)

“Also if we have MDRs cases there is no time that we have left to disinfect the vehicle, the vehicles according to my knowledge must be parked and taken out from status so that vehicle won’t affect another patient and staff but what we are doing now, we are just, without cleaning the vehicle, we are taking MDRs and another patient.” (P2 B2)

“But if there is no time like now, sometimes when we starting the shift we got about 10-20 cases outstanding so we don’t have enough time. We are allowed to check the vehicle, for 15 minutes. In that 15 minutes you need to restock, clean and check the

vehicle. It's impossible, with the cleaning you need to wipe all this thing and the equipment. Sometimes you take a case and later on there's blood stain on the ESV and sometimes on the stretcher.” (P1 B3)

“Because of the caseload that we are having, on a daily basis, it's very hard for them, to have enough time to wash, clean and dry, so that means that everything they do they do very quickly so in that case, there is not enough time for them to make sure that the van is clean.” (P6 B4)

“To add we don't have enough ambulances, so these ambulances are running 24 hours. You find that the day shift was using the very same ambulance; at crew change time there is about 22 cases outstanding, too late to clean the vehicle. They check the vehicle and go.” (P2 B5)

4.2.3 Quality improvement

In order to have an effective infection control and prevention programme, protocols need to be in place, quality control mechanisms must be assured and there must be support for and by the staff. The following is a discussion on the third theme that was identified, as depicted below in Figure 4.6:

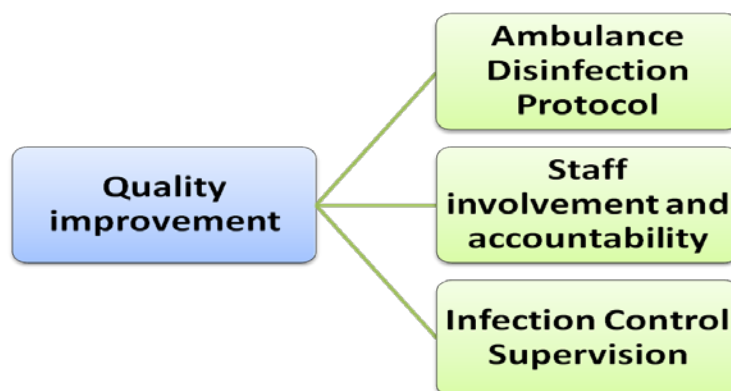


Figure 4.6: Theme 3 – Quality improvement and its categories

4.2.3.1 Ambulance Disinfection Protocol

Many of the study participants expressed the need for an ambulance specific disinfection policy or protocol to be implemented in the EMS under study. They felt that the vehicles were not being cleaned and disinfected correctly because either there was no policy to ensure they are given the opportunity to clean their vehicles or there was no policy to ensure that the EMS personnel clean their vehicles when there is an opportunity.

Chapter 2.4, heading 2.5.2 has further discussion regarding internationally accepted guidelines for infection control in the prehospital environment and the development, implementation and surveillance of a National Infection Control and Prevention Strategy as set out by the South African Department of Health (Department of Health, 2007).

Please refer to Annexure 8 for the developed ambulance specific disinfection protocol.

The following excerpts present the participants' experiences with regard to their need for an ambulance specific disinfection protocol/policy/SOP:

"Those important things I would like to see in the place. It must be stated in black and white because for the crews, no one must say hey we got 3 red codes. It is a policy, we need to stand these vehicles down to protect the staff, and tomorrow we will need them. That is what I would like to see." (P1 B5)

"If we have a policy or a way to implement to avoid the spreading of these diseases I'm sure it can help us. Unfortunately if it's not in black and white you can't implement anything in this department because they say the money too much." (P1 B5)

"I think once we have the SOP it will assist us with it, if you find that the staff are not doing what they are supposed to be doing at the end of the day then you can deal with them according to the

SOP or you can charge them according to the SOP but right at the moment it's a challenge and I also think that in the SOP that it has to be also we have to have a specific person in terms of health risk management.” (P2 B5)

4.2.3.2 Infection Control Supervision

During the FGDs, some of the participants suggested the appointment of an infection control supervisor or safety officer to monitor the upkeep and cleaning of the ambulances. This individual would ensure the appropriate disinfection of the vehicles, monitor the use of cleaning material and monitor infection control and prevention compliance at the ambulance bases. The participants also suggested that there be an infection control supervisor at each base and on each shift to further ensure compliance when a policy/protocol is implemented.

Please refer to Chapter 2, heading 2.5.2 for further discussion with regard to the surveillance of a National Infection Control and Prevention Strategy, as set out by the South African Department of Health (Department of Health, 2007).

The following excerpts present the participants' experiences with regard to their need for an infection control supervisor:

“Yes, most of my colleagues have said, that maybe at least, regarding your question to improve, some years back we requested by the shift manager to nominate one staff, which was gonna be responsible for the infection control, we did so but nothing was done after that we were expecting that maybe the service will send those staff for the course, or something of that sort and take care of the situation but nothing was been done after that.” (P9 B1)

“We can try to implement individual personnel, like some kind of risk officers or safety officers on each shift because you can’t rely on our supervisors or officers as they are too tied up doing their menial tasks. It is an ongoing problem but if we could allocate someone, a permanent person to inspect the ESVs timeously or with continuity, viewing physically of the ESVs and the response vehicles and any other vehicles that we have but it needs be started as law, its compulsory it’s not a negotiable.” (P5 B3)

“If they can have a safety officer and since we got different shifts and have sort of a team leader safety officer so you can look overall because it looks like whenever we say we want to clean it looks like we don’t want to work.” (P1 B3)

“It would be quite simple, if we had the steps and procedure like having the safety officer. Example like having a store man, store man will look after stores and he’ll so make sure that everything is up to date, ensure that and henceforth. But if we have a safety officer, if the crews come and tell the guy “listen here, we need this”, he can make a note e.g. A4 is cleaned and it’s been disinfected, has been given the adequate cleaning material, on a certain date, certain time, and allocated to a certain crew he can make a physical note of that and take for his stats. If not, if you don’t have somebody in charge, is going to be chaos and it’s not going to go anywhere. It will just be down the tube again.” (P5 B3)

“...we feel like as junior managers we need to have somebody who is responsible like a safety officer, you present to your senior manager because it is not in their policy they don’t consider or even bother to think about it and it is important to visit all EMRS bases and check how they are handling their red and black bags.” (P1 B5)

4.2.3.3 Staff involvement and accountability

Many of the study participants felt that disciplinary action and in some cases, prosecution should take place in incidences of negligence with regard to infection control. They felt that their lives and lives of their patients were at risk due to the lack of infection control measures. They suggested that in future, management involve them, or at least gain their input, with regard to the procurement of cleaning materials and the designing of new ambulances. This was also suggested by the junior management staff during their FGD

The following excerpts present the participants' opinions with regard to staff involvement and accountability for infection control in EMS:

“What would improve the compliance? A fine should be imposed on the department, to this institution because the thing is, it’s us that suffer and the patients that suffer and nobody is taking responsibility for the infection control.” (P5 B1)

“.....they should be like using law and enforcement in terms of that if you have been found doing the wrong thing, maybe disposing of the wrong waste in the wrong place you get punished for that because when you are contravening the protocol. I think by so doing you’ll be controlling the infection control.” (P1 B2)

“I think since I mentioned it’s all about money, the cheapest stuff. When you buy the cheapest stuff you gonna get the cheap quality so I think that is a problem. If we could guide, if the dept could procure the proper disinfectants solutions things would be much better.” (P3 B5)

“The challenges is whenever they are procuring the ambulances they don’t involve people that are hands on, people that are hands on are the people that are using those ambulances, at least to get their input.” (P3 B5)

“Regarding the one window, if maybe they do invite people who are hands on with the vehicles at least to tell exactly what they think because you know the staff can tell you something that you never think of or thought of. They are so wise.” (P3 B5)

4.2.4 Revisiting the first objective

The first objective of this study was to identify factors that needed to be considered to develop the ambulance specific disinfection protocol.

After a thematic content analysis of the data from the FGDs, themes, categories and subcategories and the relationships between them were identified and used to develop an ambulance specific disinfection protocol, as described in Chapter 4, heading 4.3. This data also assisted the researcher in making recommendations for the EMS under study, which are included in Chapter 5.

4.3 DEVELOPMENT OF AN AMBULANCE SPECIFIC DISINFECTION PROTOCOL (PHASE TWO)

4.3.1 Revisiting the second objective

The second objective of the study was to develop an ambulance specific disinfection protocol in accordance with internationally accepted guidelines and the information identified in objective one.

The factors that were identified in Phase One included:

Need for better infrastructure and resources, which included,

- Access to Water
- Access to Wash-bays
- Access to Cleaning detergents and equipment
- Access to Personal Protective Equipment
- Improved ventilation in patient compartment

- Access to Support Services, which included,
- Linen Services
- Waste Management
- Fumigation

Time required for disinfection, which included,

- Communication Centre
- Heavy caseloads

Quality improvement, which included

- Ambulance Disinfection Protocol
- Infection Control Supervisor
- Staff involvement and accountability

Through a thorough review of international guidelines for infection control in the prehospital environment and the factors identified in Phase One, the ambulance specific disinfection protocol was developed, as depicted below in Figure 4.7

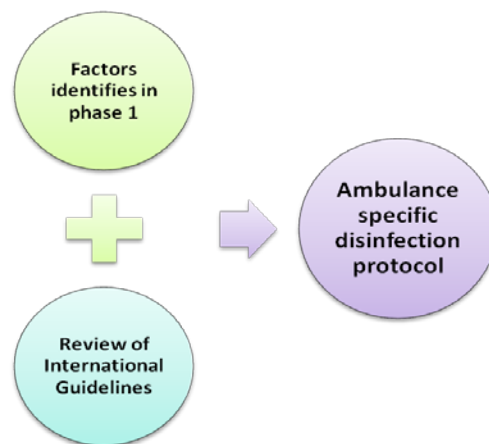


Figure 4.7: Development of the ambulance specific disinfection protocol

The protocol includes hand hygiene, which highlights the preferred hand washing techniques; the cleaning of the vehicle (including the patient compartment, drivers compartment and the equipment) at the start of each shift cycle (deep cleaning), after every patient, and after a bio-hazardous spill; waste management; decontamination of cleaning equipment; as well as instructions for dilution of the cleaning and disinfecting agents.

It is worth noting that all values for the cleaning and disinfecting agents (e.g. times, volumes and concentrations) included in the protocol are product specific and are in line with the manufacturer's instructions.

The International Guidelines that were reviewed and the literature pertaining to each point included in the protocol were discussed in Chapter 2, heading 2.4.

4.3.2 Hand Hygiene

A recent study identified that ambulance staff employed in the EMS under study had poor knowledge of hand hygiene and when it should be applied (Naguran, 2008). Hence a list for all incidences where hand hygiene would be required is included in the developed protocol. See below:

When to wash hands:

- Before patient contact,
- Before aseptic technique,
- After body fluid exposure risk,
- After patient contact
- After contact with patient surroundings.
- At the start and end of shift,
- Before and after PPE use
- Before invasive procedures,
- After cleaning/disinfecting of equipment and vehicle,
- Before leaving the hospital,

- Before and after handling food,
- Before and after smoking,
- After using the restroom or other personal body functions (coughing, sneezing)
- And any time when the paramedic's hands are visibly dirty

If soap and water is not immediately available use alcohol-based hand-rub.

4.3.3 Cleaning of Vehicle

In the development of the protocol, time for disinfection was taken into consideration. Although the cleaning and disinfecting agents used were fast acting, they were non-toxic and non-corrosive. As the lack of resources was also identified as a factor, all detergents, paper towels and cleaning equipment were supplied by the researcher.

Spray bottles with the cleaning agent (1:100), the disinfecting agent (1:100 and 1:50) and water were required to be on vehicles throughout their shift. In incidences where there was limited access to water and/or minimal cleaning and disinfecting was required between patients, the convenience of having the detergents and water on board the vehicles ensured that disinfection could be done without having to return to base and required a minimal amount of time. As the time allowed for cleaning is often minimal, a quick and easy method for cleaning and disinfection is required, as supplied in this protocol

Four specific protocols were developed with regard to cleaning the vehicle. Although very similar, each protocol is used in separate incidences, such as at the start of each shift cycle (deep cleaning, once a week), at the start of each shift (every day), between patients and when a biological spill has occurred. The protocols include disinfection for the driver's compartment, the patient's compartment and personnel disinfection. See below:

4.3.3.1 At the start of each shift cycle (deep cleaning, once a week)

When cleaning the patient compartment

- Don eye protection and gloves
- Remove all equipment, cylinders, bunk cushion and the M17 stretcher from the ambulance
- Remove all stock and jump bags
- Remove all waste as per protocol
- Remove all linen
- Rinse the entire patient compartment with water
- Spray cleaning detergent over all surfaces, wipe down with paper towels and mop thoroughly to remove debris.
- Leave for 5 minutes
- Spray the equipment, the jump bag, cylinders, bunk cushion and the M17 stretcher with cleaning detergent, wipe down with paper towels thoroughly to remove debris.
- Leave for 5 minutes
- Rinse the entire patient compartment with water and wipe dry with new paper towels
- Spray the entire patient compartment with disinfection solution from a distance of 30cm and allow to dry for 5 minutes (1:100)
- Wipe down the equipment, the jump bag, cylinders, bunk cushion and the M17 stretcher with damp paper towels to remove cleaning agent and dry with new paper towels
- Spray the equipment, the jump bag, all sealed stock, cylinders, bunk cushion and the M17 stretcher with disinfection solution from a distance of 30cm and allow to dry for 5 minutes (1:100)
- Dispose of all waste as per protocol
- Decontaminate cleaning equipment as per protocol
- Disinfect your uniform and boots with a light all-over spray of disinfectant (1:100)

- Remove gloves, clean and disinfect hands and up to elbows, dry with paper towel
- Only once dry, re-glove and replace all the equipment , the jump bag, all sealed stock, cylinders, bunk cushion and the M17 stretcher back in the patient compartment
- Remove gloves, disinfect hands with alcohol hand-rub

4.3.3.2 At the start of each shift or after visible soiling has occurred or after every third patient

When cleaning the driver's compartment

- Don eye protection and gloves
- Remove all movable items
- Remove all waste as per protocol
- Spray cleaning detergent over all surfaces (including the steering wheel, gear lever, handbrake, seats, radio microphone, door panels and handles) wipe down with paper towels and mop thoroughly to remove debris
- Leave for 5 minutes
- Wipe down all surfaces with new damp paper towels to remove all cleaning agent. Spray all surfaces with disinfection solution from a distance of 30cm and allow to dry for 5 minutes (1:100)
- Spray all personal issue (e.g. stethoscope) with cleaning detergent, wipe down with new paper towels to remove all debris.
- Leave for 5 minutes and rinse
- Spray with disinfection solution from a distance of 30cm and allow to dry for 5 minutes (1:100)

When cleaning the patients' compartment

- Don eye protection and gloves
- Remove all waste as per protocol

- Remove all linen
- Rinse the patient compartment floor with water
- Spray all exposed surfaces with cleaning detergent, wipe down with new paper towels and mop thoroughly to remove debris.
- Leave for 5 minutes
- Rinse all exposed surfaces or wipe down with new damp paper towels. Air dry or dry with new paper towels
- Spray all exposed surfaces with disinfection solution from a distance of 30cm and allow to dry for 5 minutes (1:100)
- Ensure that all equipment is clean, disinfected and in the correct storage place.
- Replace linen on bunk and M17 stretcher
- Dispose of all waste as per protocol
- Decontaminate cleaning equipment as per protocol
- Disinfect your uniform and boots with a light all-over spray of disinfectant (1:100)
- Remove gloves, clean and disinfect hands and up to elbows, dry with paper towel

4.3.3.3 After every patient with no visible soiling

- Don eye protection and gloves
- Remove all waste as per protocol
- Fog patient compartment with 300ml fine spray of disinfection solution (1:50)
- Leave for a minimum of 5 minutes or allow to dry
- Dispose of all waste as per protocol
- Disinfect your uniform and boots with a light all-over spray of disinfectant (1:100)
- Remove gloves, clean and disinfect hands and up to elbows, dry with paper towel

4.3.3.4 Cleaning of bio-hazardous spill

- Don eye protection, gloves and apron
- Spray the “spill area” with cleaning detergent.
- Cover the spill with paper towels to contain and absorb the spill
- Leave for 5 minutes
- Remove all waste as per protocol
- Remove all linen
- Place all contaminated paper towels and removed matter into red waste bags
- Spray the “spill area” with cleaning detergent and mop with warm water
- Leave for 5 minutes
- Spray all exposed surfaces with disinfection solution from a distance of 30cm and allow to dry for 5 minutes (1:100)
- Ensure that all equipment is clean, disinfected and in the correct storage place.
- Replace linen on bunk and M17 stretcher
- Disinfect your uniform and boots with a light all-over spray of disinfectant (1:100)
- Remove gloves, clean and disinfect hands and up to elbows, dry with paper towel

4.3.4 Waste management

Waste management was also identified as an area that required development in the EMS under study. A step by step framework was utilized in the developed protocol to ensure easy understanding of the protocol and the safety of the participants in the management and removal of waste. See below:

- Don eye protection and gloves;
- Use plastic or galvanized containers with tight fitting lids for contaminated waste;
- Contaminated waste and non-contaminated waste must be disposed of in separate containers;
- Red waste bags must be used to line contaminated waste containers;
- Clear or black waste bags must be used to line non-contaminated waste containers;
- Place all waste in their designated containers;
- Never use hands to compress waste into containers;
- When the waste bags are two thirds full remove bags from the waste container by holding at the top of the waste bags;
- Knot the top of the waste bag;
- Keep the waste bags from touching or brushing your body while lifting and carrying;
- Place the full bags in the designated waste collection area;
- Clean contaminated waste containers each time they are emptied and when the non-contaminated waste container is visibly soiled;
- Rinse waste containers with water;
- Spray with cleaning detergent and leave for 5 minutes;
- Rinse with water and let dry;
- Once dry spray with disinfection solution from a distance of 30cm and allow to dry for 5 minutes (1:100);
- Once dry replace waste bag;
- Disinfect your uniform and boots with a light all-over spray of disinfectant (1:100)
- Remove gloves, clean and disinfect hands and up to elbows, dry with paper towel;

4.3.5 Decontamination of cleaning equipment after every use

As discussed earlier in Chapter 2, heading 2.3, a study was conducted by Nigam and Cutter (2003) to determine the levels of bacterial contamination present in Welsh ambulances and to assess the effectiveness of the disinfection procedures being put into practice in these ambulances.

In several incidences there was an introduction of new bacteria to a site after cleaning. The researchers also found that none of the three regions that participated in the study had implemented a standard cleaning protocol or had dedicated cleaning equipment and materials. This led the researchers to believe that the introduction of the new bacteria at some sites was due to the fact that the equipment being utilised in the decontamination of the vehicles was not being decontaminated after use (Nigam and Cutter, 2003: 479-482).

Decontamination of equipment can be done cheaply and effectively by placing soak-able items (for example, mop and bucket) in 0.5% chlorine solution (bleach) for 10 minutes (Tietjen, Bossemeyer and McIntosh, 2003: 16-9-10). All steps in the recommended procedure are listed below:

- Don eye protection and gloves
- Rinse the mop and bucket with clean water
- Decontaminate mop and bucket by soaking it for 10 minutes in a 0.5% bleach solution
- Wash mop and bucket with cleaning detergent and water daily or when visibly soiled
- Rinse thoroughly with clean water
- Dry completely before next use
- Disinfect your uniform and boots with a light all-over spray of disinfectant (1:100)
- Remove gloves, clean and disinfect hands and up to elbows, dry with paper towel

Refer to Annexure 8 to review the ambulance disinfection protocol booklet that has been developed.

4.4 EVALUATION OF THE NEW AMBULANCE SPECIFIC DISINFECTION PROTOCOL (PHASE THREE)

As described in Chapter 3, once the protocol had been implemented in the selected sites, participants were requested to complete the questionnaires twice, first two weeks after implementation and then again four weeks after implementation.

At the two week mark, a total of 17 (81%) questionnaires were returned for analysis (two participants were not available and two had decided not to participate). At the four week mark a total of 19 (90%) questionnaires were returned for analysis (two had decided not to participate). Of the 19 that returned questionnaires, eight stated that their opinion had not changed since the previous questionnaire and that they had no further comments to make. Thus, a total of 28 questionnaires were utilized in the data analysis of this phase.

The participants provided data on the implementation of the protocol, what hindered the use of the protocol and how best to improve the protocol. They were also given the opportunity to give any final comments or suggestions in regard to the protocol.

On analysis of the questionnaires, two main themes emerged. These were the effectiveness of the ambulance disinfection protocol and factors to improve the future use of the ambulance disinfection protocol in the EMS, as indicated below in Figure 4.8:

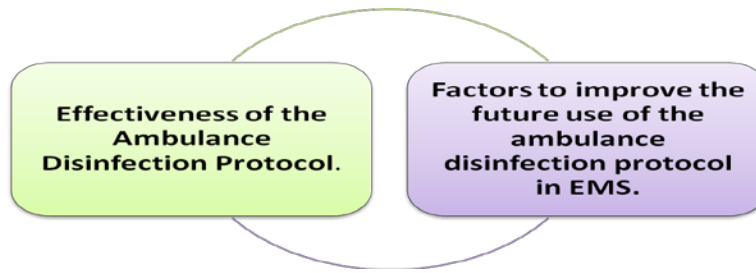


Figure 4.8: Themes emerging from the third phase of the study.

4.4.1 Effectiveness of the Ambulance Disinfection Protocol

The majority of participants stated that the ambulance disinfection protocol was “good” or of a good quality. Many mentioned that they would like the protocol to be implemented throughout EMS as a standard operating procedure or policy and to continue using it. Some of the participants commented on its ease of use and that the step by step instructions were easy to read, follow and understand. Many also felt that it would reduce incidences of cross-contamination between EMS personnel and their patients, that the protocol was good for their health and that they felt it greatly improved their working environment. The participants also mentioned that they felt protected while using the protocol. See Figure 4.9 below:

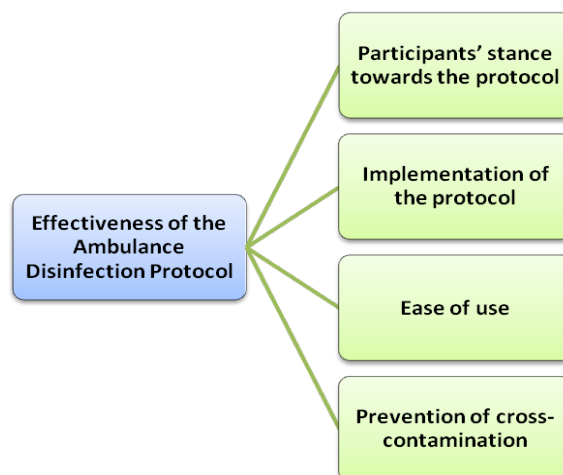


Figure 4.9: Theme 3 – Effectiveness of the Ambulance Disinfection Protocol

4.4.1.1 Participants' stance towards to the protocol

The majority of the participants stated that the ambulance disinfection protocol was "good" or of a good quality. Many of them recommended the use of the protocol and some of them mentioned how time efficient the protocol was when used operationally.

The following excerpts present the participants' stance towards to the protocol:

"Excellent protocol and should be a compulsory protocol." (Q2)

"The crews have recommended this material. They say it is quick to use it, easy to use and dry. It does not take a lot of time as we work on emergency service." (Q12)

"The protocol itself is good there is nothing needs to be changed on it ..." (Q13)

"It is good. I think we should use it. Actually it is perfect. It really helps. We have different people with many diseases. I will like to have it more!" (Q14)

"So far the disinfection protocol is doing so well in our ESV because it even saves time to the staff, they can wipe the vehicle no matter where they are." (Q19)

"The use of the disinfection is excellent to the staff as well as the patient." (Q19)

4.4.1.2 Implementation of the protocol

Many of the participants felt the protocol can and should be implemented in the EMS under study. They also felt that the protocol could be beneficial to both the operational staff and their patients with regard to infection prevention and control.

The following excerpts present the participants' opinions with regard to implementation of the protocol:

"I wish this protocol can be implemented to EMRS and everybody uses it. It's good for patients and for paramedics as well." (Q13)

"It can be implemented with the necessary equipment and once get into the rhythm it becomes very simple and necessary." (Q15)

"This disinfection protocol is good for our health. It must be implemented to all South Africa EMRS because it can reduce infection and to keep our ambulance clean and disinfected. This is a most important. Protocol should be implemented." (Q23)

"I think it is a good tool to be implemented in our service. I like the first two pages showing the picture of the microorganism and it also explains the importance of hygiene, the role of the ambulance personnel. (Q6)

4.4.1.3 Ease of use

Many of the participants expressed that the protocol was easy to read, follow and understand. They followed the step by step instructions and often referred back to the protocol booklet for further instructions if required.

The following excerpts present the participants' opinions with regard to the protocol's ease of use:

"The whole content is easy to read, nothing complicated. I like the arrangement of the content according to the pages which makes it easy to go to the page you are looking." (Q6)

"The protocol is easy and straight forward to use." (Q12)

“The implementation was easy. I didn’t have any problem on it. I didn’t have a problem because I was following the protocol book.”
(Q13)

“The disinfection protocol is good and it is very easy to understand it. It limits the high risk of the infections.” (Q18)

“The protocol is good and easy to read. It shows the high risk of infection and the purpose of preventing it, cleanliness for ESV and the staff as well.” (Q20)

4.4.1.4 The prevention of cross-contamination

Numerous participants stated that they felt protected when using the protocol and that the protocol was good for their health as it could prevent cross-contamination between patients and EMS personnel. Many of the participants also mentioned that the protocol helped ensure a hygienic working environment, which was beneficial to both the EMS personnel and their patients; this is illustrated in figures 4.10 and 4.11 below

The following excerpts present the participants’ experiences with regard to the prevention of cross-contamination between EMS personnel and patients with the use of the protocol:

“Disinfection protocol is good it’s going to help us to protect ourselves from getting diseases from the ESV. For our patients too because we disinfect the ambulance after the case instead of putting patient in the vehicle without cleaning.” (Q7)

“It’s of a good course; it can prevent cross infection and make hygienic working environment for our staff and hygienic environment for patients we are transporting.” (Q9)

“It is an excellent way to prevent cross infection and if implemented it will benefit everyone concerned.” (Q16)

“Disinfection protocol is good for our health and all chemicals that are used are not corrosive on our hands and we can use it on our clothes it doesn’t change the clothes colour and on the skin is not harmful to the linen and bunk is not erosive.” (Q23)

“It’s good and it’s working for me. I feel protected when I’m doing cases that are contagious. Even when I am with (a) patient at the back I (am) not panicking because I know I have to disinfect the back and my uniform.” (Q25)



Figure 4.10. An ambulance patient compartment (of the rear) after the implementation of the developed ambulance specific disinfection protocol at an ambulance base in the eThekweni District (Photo taken on July 2012 by Natalee Williams-Claassen)

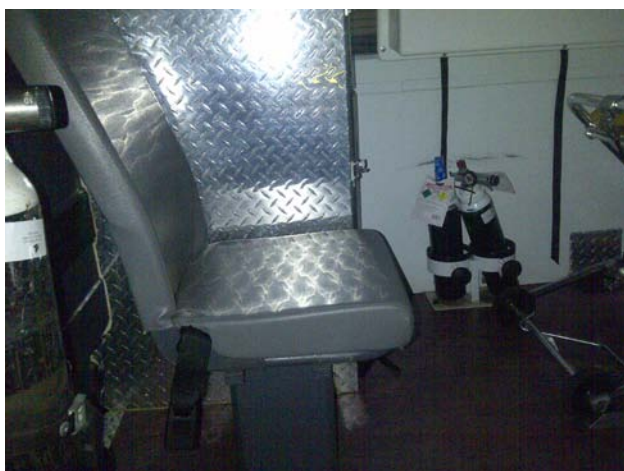


Figure 4.11. An ambulance patient compartment (from the front) after the implementation of the developed ambulance specific disinfection protocol at an ambulance base in the eThekweni District (Photo taken on July 2012 by Natalee Williams-Claassen)

4.4.2 Factors to improve implementation of the protocol

As highlighted by the participants, in order to have an effective infection control and prevention programme, there must be proper education and training to ensure staff “buy-in”. Coupled with this is a need for an effective infrastructure and available resources. This theme and its categories are illustrated below in figure 4.12

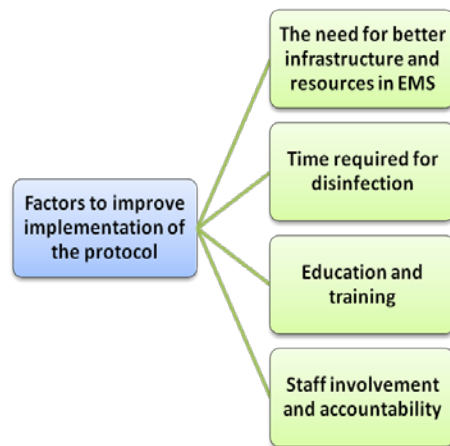


Figure 4.12: Theme 4 - Factors to improve implementation of the protocol and its categories

4.4.2.1 The need for better infrastructure and resources in EMS

The majority of the participants expressed their concern with regard to the facilities and resources that are available to the staff employed by the EMS under study. They felt that for this protocol to be implemented in the future, the relevant resources and facilities, such as cleaning detergents and material for all ambulances, wash bays, sluice facilities and improved ventilation in the vehicles, would need to be provided on a wide scale.

As discussed earlier in Chapter 4, heading 4.2.1, the need for better infrastructure and resources in EMS is a prominent theme emerging for the majority of the participants, in both phases one and three of the study and needs urgent attention from EMS management and the KZN Department of Health

The following excerpts present the participants' thoughts and experiences with regard to better infrastructure and resources for further use of the protocol and what will be required to implement the protocol:

"The cleaning equipment must be provided for all the staff because it will be a waste of time to implement without equipment. Must be proper cleaning facilities (at) all bases. The staffs are driving miles to clean at the end and start of shift." (Q6)

"The service is not providing (us) with proper cleaning equipment. They are buying cheap detergent. The staffs are not well trained, including the communication staff. No sluice at the base." (Q6)

"Poor ventilated vehicles..." (Q17)

"ACs ventilation in ESV is not good as EMRS officials are failing to maintain aircon." (Q18)

4.4.2.2 Time required for disinfection

Many of the participants also commented on the length of time it took to clean a vehicle. They felt they weren't given adequate time by those in the control room to carry out the necessary procedures prescribed by the protocol to ensure that the ambulances were thoroughly clean, specifically at the start of shift and for deep cleaning.

This time restriction can be attributed to the high caseloads being experienced in the district under study, the lack of policy to ensure that the vehicles are cleaned as required and possibly the Communication Centre

staff's need for further training with regards to the length of time required to clean ambulances effectively and how often cleaning is required.

As discussed in Chapter 4, heading 4.2.2, insufficient time allowance for disinfection of the vehicles was a prominent theme that emerged with the majority of the participants, in both Phase One and Phase Three of the study. It therefore needs urgent attention from EMS management and the KZN Department of Health.

As shown in Chapter 4, heading 4.4.1.1, some of the participants stated that the developed protocol was quick to use. They also felt that the developed protocol allowed for the cleaning and disinfecting of the ambulance wherever they were as they carried the cleaning agents and materials with them. Thus, they do not need to return to their ambulance base between patients to clean unless required, such as in the incidence of a bio-hazardous spill. This saved time and allowed for the ambulance to be made available sooner for further cases.

The following excerpts present the participants' thoughts and experiences with regard to time management in the future use of the protocol and what will be required to implement the protocol:

"I suggest that our control room must be informed about the disinfection protocol so that they will not give us hard times when we requesting to mobile base to clean. They don't understand when we want to clean; they always ask us what we want to clean." (Q7)

"Only the implementation of the protocol to all staffs including those who are in the control room and also if the materials will be available at all times it will improve us and also gain more confidence from our patients." (Q8)

“It is an excellent idea with the only problem being time. Every vehicle should be given time to be disinfected. If this can be made possible this will work very well.” (Q10)

“There is no difficult to use your product (protocol), even the ambulance are always clean and look nice. If control they can give us more time to clean.” (Q11)

“(At) the start of the shift, we need more time to do deep cleaning and while we cleaning the cases are piling up.” (Q13)

“Excessive case load (hinders the use of the protocol). A little more time (is required).” (Q15)

4.4.2.3 Education and training

The majority of the participants felt that further education and training in infection control and prevention was required for all staff, including communication centre (control room) staff and management. Many suggested the use of workshops or awareness campaigns, in-service training and booklets and posters to improve their knowledge and understanding with regard to infection control. They emphasized the importance of being made aware of possible cross contamination and infections that can occur while transporting patients.

The following excerpts present the participants’ thoughts and experiences with regard to education and training in the further use of the protocol and what will be required to implement the protocol:

“There should be a campaign awareness to teach the staff about disinfecting the ambulances after every patient and the importance of disinfecting the uniform after cleaning the ambulance.” (Q1)

“To add on page 14, waste management – I think our staff are lacking there, they need to be educated thoroughly about handling of waste. It must be done practically like cleaning of ESV.” (Q6)

“To engage staff into workshops about being hygienic and creating a working hygienic environment.” (Q9)

“All the staff has shown so much interest in this issue and they are willing to participate if training is to be provided or conducted as more often they are (exposed) to most hazardous situations. Regarding infection from ill and injured patients and this sometimes even affect the family members e.g. cross infection – chicken pox, small pox etc.” (Q22)

“Health workers need to be made aware that there are contagious diseases in the vehicle which can cause infection so with proper education people will be aware of the dangers that they are exposing themselves and patients too.” (Q26)

“Proper education and exposure to the dangers of unhygienic vehicles and equipment, continuous swab test to check amount of bacteria in the vehicle.” (Q26)

4.4.2.4 Staff involvement and accountability

A few of the participants felt that motivating factors were required to ensure the use of the protocol. Some suggested an award system for good practice. Others felt that the operational staff should take responsibility for infection control whether it be, personal responsibility and accountability or being part of an infection control committee for the EMS under study. One of the participants also suggested the use of a supervisor to ensure the proper use of the protocol.

The National Infection Control and Prevention Strategy, as set out by the South African Department of Health (Department of Health, 2007: 14), also

suggested that the incentives and rewards systems that are already in place in the public sector be expanded to include infection prevention and control procedures. They also suggested that all good practices in infection control in the public sector should be shared nationally.

For further discussion with regard to staff accountability and the use of an infection control supervisor, please refer back to Chapter 4, heading 4.2.3.3

The following excerpts present the participants' thoughts and experiences in regard to staff involvement and accountability in the further use of the protocol and what will be required to ensure effective implementation of the protocol:

"I think everyone should be involved especially the management must also visit our ESVs. The staff should be motivated, every 6 months for example, we can have some competitions, winning trophies for the best ambulance cleaners; I think that will motivate the staff." (Q6)

"...Supervisor must act to check vehicle is clean and stand down one vehicle to base for clean when the time is quiet on the road...." (Q20)

"...there must be someone who is responsible for disinfection protocol. Awards can be given to those who keep their ambulances clean." (Q23)

"If the crews are not working hand and hand (it) is very (difficult) because it hard clean alone, to take the responsibility for the equipment and solutions. The crews need to be taught to be responsible for cleaning the ESV." (Q25)

"It is a good idea to disinfect the vehicle and equipment on continuous basis; however everybody should participate in ensuring the disinfection of vehicles." (Q26)

4.4.3 Revisiting the third objective

The third objective of the study was to implement and evaluate the effectiveness of the new disinfection protocol.

After the implementation of the protocol, a thematic content analysis of the data collected from the open-ended questionnaires was done. Themes, categories and subcategories and the relationships between them were identified and were used to demonstrate the effectiveness of the protocol. This data also assisted the researcher in identifying the required information to make recommendations for the EMS under study, which is included in Chapter 5.

CHAPTER 5

CONCLUSION, RECOMMENDATIONS AND LIMITATIONS OF THE STUDY

5.1 INTRODUCTION

From this study it can be concluded that an ambulance specific disinfection protocol is urgently required in the public sector emergency medical services in the eThekweni District of KZN. It can also be concluded that for an

ambulance specific disinfection protocol to be implemented in the EMS under study and for it to be effective, further infrastructure, resources, education and training and a quality improvement plan are also urgently required.

This study has developed an ambulance specific disinfection protocol that can be used and implemented in the EMS in order to reduce the risk of communicable disease transmission between patients and the operational ambulance staff.

Many themes were identified throughout the study, which have highlighted the present difficulties that are being experienced in the public sector EMS of the eThekweni District. This has allowed for the development of an ambulance specific disinfection protocol and the development of recommendations for the EMS under study. These recommendations intend to assist the EMS in improving its present situation with regard to infection control and prevention and thus will hopefully be of benefit to the staff of EMS and the patients in their care.

5.2 STRENGTHS OF THE STUDY

A crucial strength of the study is that no similar studies have been undertaken in the prehospital environment and it has highlighted the factors that needed to be considered to develop an ambulance specific disinfection protocol. The development of this protocol is also a key strength of the study. Another key strength was the buy-in from the participants, who developed a sense of ownership as they aided in the development of the protocol. This also assisted in ensuring compliance with the developed protocol and could possibly facilitate future compliance if the protocol is implemented permanently in the EMS under study. The factors and themes identified throughout the study also allowed for the formulation of recommendations to help improve the EMS under study.

5.3 LIMITATIONS OF THE STUDY

A limitation to the study was the lack of infrastructure, such as wash bays and access to water, at many of the ambulance bases included in the study. This might have affected the implementation of the protocol as the participants had to travel to other bases to have access to adequate water resources and a wash bay to clean the ambulances. Although the researcher provided an alternative to hose pipes in the form of stray-bottles for use between patients and the wiping down of equipment, a wash bay and adequate water resources are still required for deep cleaning, daily cleaning and in the incidence of a bio-hazardous spill. Of all the ambulance bases that took part in the study, Wentworth Ambulance Base was the only base with a purpose made wash bay (See figure 3.1 for the locations for the ambulance bases in the District of eThekweni).

5.4 RECOMMENDATIONS

5.4.1 Recommendations regarding quality improvement

As discussed earlier in Chapter 4, heading 4.2.3, in order to have an effective infection control and prevention programme, protocols need to be in place, quality control mechanisms must be assured and there must be support for and by the staff.

The researcher recommends that in order to pave the way ahead with regard to quality improvement the following is required:

- All EMS staff require training and education in relation to infection control and prevention (As discussed in Chapter 2, headings 2.5.1 and 2.5.2 and Chapter 4, heading 4.4.2.3)
- Development and implementation of a protocol and policy document for infection control specifically for the EMS (Such as the ambulance specific disinfection protocol developed in this study) (As discussed in

Chapter 2, heading 2.5.1, Chapter 3, heading 3.4.3 and Chapter 4, heading 4.3).

- The appointment of Infection Control Supervisors at all ambulance bases to monitor infection control and prevention measures and ensure compliance with infection control protocols and policies (As discussed in Chapter 2, heading 2.5.2 and Chapter 4, heading 4.2.3.2)
- Incentives for staff and reward systems that are already in place in the Department of Health should be expanded to include issues of infection control and prevention procedures. (As discussed in Chapter 4, heading 4.4.4.2)
- Operational staff should also be included in discussions with regard to infection control policies and procedures in EMS and be involved in development of these policies and procedures by appointing operational staff as representatives on committees that deal with issues of infection control in EMS.

5.4.2 Recommendations regarding improvement of infrastructure and resources

As discussed earlier in Chapter 2, heading 2.5.1, and Chapter 4, headings 4.2.1 and 4.4.2.1, there is a definite need for the improvement of infrastructure and resources in the EMS.

The National Infection Prevention and Control Policy instructs all healthcare facility infection control committees to first identify the facilities' structural deficits in meeting the requirements for infection control and prevention measures and then establish adequate infrastructure to meet infection control and prevention requirements, such as building new hand-washing facilities (Department of Health, 2007: 21, 30). (For further discussion regarding this policy please refer to Chapter 2)

Various such deficits were identified in this study. Most of the ambulance bases lacked wash bays and most experienced poor access to water resources and poor availability of personal protective equipment, cleaning materials and support services. Ambulance crews also expressed the need for improved ventilation in most of the ambulances.

The researcher therefore recommends that all the structural deficits that have been identified at the EMS bases under study, such as washing bays and access to water, need to be established and material deficits, such as personal protective equipment, cleaning material and support services, need to be made available, so that the ambulance specific disinfection protocol can be implemented effectively.

5.4.3 Recommendations regarding time restrictions

As discussed in Chapter 4, headings 4.2.2 and 4.4.2.2, one of the key reasons for ambulances not being cleaned and disinfected effectively is the lack of time to do it.

This time restriction can be attributed to the high caseloads being experienced in the district under study, the lack of policy to ensure that the vehicles are cleaned as required and the Communication Centre staff's need for further training with regard to the length of time required to clean ambulances effectively and how often cleaning is required.

To ensure the necessary standard of cleanliness within the EMS ambulances, the researcher therefore makes the following recommendations:

- The deployment of more ambulances as there is a definite shortage of ambulances in KZN (As discussed in Chapter 3, heading 3.3.1)
- The employment of more staff for the deployment of new ambulances (As discussed in Chapter 3, heading 3.3.1)

- Communication Centre staff need further training in infection control, specifically with regard to the length of time required to clean ambulances effectively and how often cleaning is required.

5.5 CLOSING STATEMENT

As discussed in Chapter 1, there is presently no national policy on infection control that is specifically designed for use in the prehospital environment in South Africa (Mahomed, Jinabhai, Taylor and Yancey, 2007: 498). An active infection prevention and control strategy is essential to reduce the levels of HCAI and improve the EMS working environment for both EMS staff and their patients

For the implementation of the ambulance disinfection protocol to be fully successful, the necessary infrastructure and resources need to be made available. A surveillance programme and/or system of infection control supervision need to be implemented in conjunction with the protocol. This would facilitate compliance and ensure quality assurance in infection prevention and control in the EMS under study.

There is a great paucity of research in this area and in the EMS as a whole, not only in the South African context, but internationally as well. Further research and awareness needs to be generated in the Emergency Medical Care field with regard to infection control.

REFERENCES

- Alves, D.W. and Bissell, R.A. 2008. Bacterial Pathogens in Ambulances: Results of unannounced sample collection. *Prehospital Emergency Care*, **12**(2): 218-224
- Babbie E. and Mouton, J. 2001. *The practice of social research*. Cape Town: Oxford University Press
- Department of Health, Republic of South Africa. 2007. *The National Infection Prevention and Control Policy and Strategy*. Pretoria: Government Printer
- Department of Health, Republic of South Africa. 2010. *Strategic Plan of the KZN Department of Health 2010-2014*. Pretoria: Government Printer
- Emergency Medical Rescue Services. 2012. *February 2012 Report*. Durban: Emergency Medical Rescue Services
- Galtelli, M., Deschamp, C. and Rogers, J. 2006. An assessment of the prevalence of pathogenic microorganisms in the rotor wing air ambulance: one program's findings. *Air Medical Journal*, **25**(2): 81-84
- Geographic Information Systems Unit. 2010. Kwa-Zulu Natal Health District – eThekwini District EMRS Bases. Pietermaritzburg: Kwa-Zulu Natal Department of Health
- Henning, E., van Rensburg, W. and Smit, B. 2004. *Finding your way in qualitative research*. ed. Pretoria: Van Schaik Publishers
- Hoffman, P., Bradley, C. and Ayliffe, G.A.J. 2004. *Disinfection in Healthcare*. ed. London: Wiley-Blackwall.
- Lee, J.B., Levy, M. and Walker, A. 2006. Use of a forensic technique to identify blood contamination of emergency department and ambulance trauma equipment. *Emergency Medicine Journal*, **23**(1): 73-75
- Lincon, V.S. and Guba, E.G. 1985. *Naturalistic Enquiry*. California: Sage

Mahomed, O., Jinabhai, C.C., Taylor, M. and Yancey, A. 2007. The preparedness of emergency medical services against occupationally acquired communicable diseases in the prehospital environment in South Africa. *Emergency Medicine Journal*, **24**: 497-500.

Mayhall, C. (ed). 1996. *Hospital Epidemiology and Infection Control*. Baltimore: Williams and Wilkins.

Merlin, M.A., Matthew, L.W., Proyer, P.W., Rynn, K., Marques-Baptista, A., Perritt, R., Stanescu, C.G. and Fallon, T. 2009. Prevalence of Methicillin-Resistant *Staphylococcus aureus* on the stethoscopes of Emergency Medical Services Providers. *Prehospital Emergency Care*, **13**: 71-74.

Naguran, S. 2008. An assessment of ambulance infection control in an emergency medical service in the Ilembe District of KwaZulu-Natal. M.Tech, Durban University of Technology.

Nigam, Y. and Cutter, J. 2003. A preliminary investigation into bacterial contamination of Welsh emergency ambulances. *Emergency Medicine Journal*, **20**: 479-482.

Ontario Ministry of Health and Long - Term Care - Emergency Health Services Branch, 2007. *Infection Prevention and Control – Best practices manual for land ambulance paramedics*. Ontario: Emergency Health Services Branch

Polit, D.F. and Beck, C.T. 2010. *Essentials of nursing research – Appraising evidence for nursing practice*. ed. Philadelphia: Wolters Kluwer/Lippincott Williams and Wilkins.

Raka, L. 2009. Lowbury Lecture 2008: infection control and limited resources, searching for the best solutions. *The Journal of Hospital Infection*, **72(4)**: 292-298.

Republic of South Africa. 2004. National Health Act No. 61 of 2003. Pretoria: Government Printer

Republic of South African. 1993. Occupational Health and Safety Act No. 85 of 1993. Pretoria: Government Printer.

Roline, C. E., Crumpecker, C. and Dunn, T.M. 2007. Can methicillian-resistant staphylococcus aureus be found in an ambulance fleet? *Prehospital Emergency Care*, 11(2): 241-244.

Siegel, J.D., Rhineheart, E., Jackson, M. and Chiarello, I. and the Healthcare Infection Control Practices Advisory Committee. 2007. *Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings 2007* (online). Available: <://www.cdc.gov/ncidod/dhqp/pdf/isolation2007>. (Accessed 21 January 2012).

South Western Ambulance Service NHS Trust. 2007. *Guidance and Procedure for Infection Prevention and Control: Managing Healthcare Associated Infection and Control of Serious Communicable Diseases*. United Kingdom: South Western Ambulance Service

Tietjen, L., Bossemeyer, D. and McIntosh, N. 2003. *Infection Prevention: Guidelines for Healthcare Facilities with Limited Resources*. Baltimore: JHPIEGO.

Waterman, H., Tillen, D., Dickson, R. and de Koning, K. 2001. Action research: a systematic review and guidance for assessment. *Health Technology Assessment [online]*, 5(23). Available at <://www.hta.ac.uk/execsumm/summ523>. [Accessed 13 July 2010].

Welsh Healthcare Associated infection Programme. 2010. *Infection Prevention Model Policy/Procedure 6: Management of blood and body fluid spillages*. United Kingdom: Welsh Assembly Government

World Health Organisation. 2012. Clean hands protect against infection (image). Available at ://www.who.int/gpsc/clean_hands_protection/en/

Yin, RK. 2003. *Case study research: design and methods*. (ed). Thousand Oaks: Sage

Yin, RK. 2009. *Case study research: design and methods*. 4th (ed).
Thousand Oaks: Sage



ETHICS CLEARANCE CERTIFICATE

Student Name	N S Williams-Claassen	Student No	20200418
Ethics Reference Number	FHSEC 030110	Date of FRC Approval	23 AUGUST 2010
Qualification	M Tech : EMC		
Research Title	Development of a disinfection-protocol for the public Sector Emergency Medical Services in the eThekweni District of Kwa zulu Natal.		

In terms of the ethical considerations for the conduct of research in the Faculty of Health Sciences, Durban University of Technology, this proposal meets with institutional requirements and confirms the following ethical obligations:

1. The researcher has read and understood the research ethics policy and procedures as endorsed by the Durban University of Technology, has sufficiently answered all questions pertaining to ethics in the DUT 186 and agrees to comply with them.
2. The researcher will report any serious adverse events pertaining to the research to the Faculty of Health Sciences Research Ethics Committee.
3. The researcher will submit any major additions or changes to the research proposal after approval has been granted to the Faculty of Health Sciences Research Committee for consideration.
4. The researcher, with the supervisor and co-researchers will take full responsibility in ensuring that the protocol is adhered to.
5. **The following section must be completed if the research involves human participants:**

	YES	NO	N/A
❖ Provision has been made to obtain informed consent of the participants	✓		
❖ Potential psychological and physical risks have been considered and minimised	✓		
❖ Provision has been made to avoid undue intrusion with regard to participants and community	✓		
❖ Rights of participants will be safe-guarded in relation to:	✓		
- Measures for the protection of anonymity and the maintenance of Confidentiality.	✓		
- Access to research information and findings.	✓		
- Termination of involvement without compromise	✓		
- Misleading promises regarding benefits of the research	✓		

SIGNATURE OF STUDENT/RESEARCHER

30/08/2010
DATE

SIGNATURE OF SUPERVISOR/S

30/08/10
DATE

SIGNATURE OF HEAD OF DEPARTMENT

30/8/2010
DATE

SIGNATURE OF CHAIRPERSON OF RESEARCH ETHICS COMMITTEE

29/2010
DATE



HEALTH
KwaZulu-Natal

Health Research & Knowledge Management sub-component
10 – 103 Natalia Building, 330 Langalibalele Street
Private Bag x9051
Pietermaritzburg
3200
Tel.: 033 – 3953189
Fax.: 033 – 394 3782
Email.: hrkm@kznhealth.gov.za
www.kznhealth.gov.za

Reference : HRKM170/10
Enquiries : Mrs G Khumalo
Telephone : 033 – 3953189

26 October 2010

Dear Mrs J N Williams-Claassen

Subject: Approval of a Research Proposal


1. The research proposal titled '**Development of a disinfection protocol for the public sector Emergency Medical Services in the eThekweni District of KwaZulu-Natal**' was reviewed by the KwaZulu-Natal Department of Health.

The proposal is hereby **approved** for research to be undertaken at **eThekweni District Emergency Services**.

2. You are requested to take note of the following:
 - a. Make the necessary arrangement with the identified facility before commencing with your research project.
 - b. Provide an interim progress report and final report (electronic and hard copies) when your research is complete.
3. Your final report must be posted to **HEALTH RESEARCH AND KNOWLEDGE MANAGEMENT, 10-102, PRIVATE BAG X9051, PIETERMARITZBURG, 3200** and e-mail an electronic copy to hrkm@kznhealth.gov.za

For any additional information please contact Mrs G Khumalo on 033-3953189.

Yours Sincerely


Mrs E Snyman

Interim Chairperson, Health Research Committee

KwaZulu-Natal Department of Health

Date: 01/11/2010

uMnyango Wezempilo . Departement van Gesondheid

Fighting Disease, Fighting Poverty, Giving Hope

Annexure 3: Letter of Information and Consent

Title of the Research Study:

Development of a disinfection protocol for the public sector Emergency Medical Services in the eThekweni District of KwaZulu-Natal

Principle Investigator/s: Natalee J. Williams-Claassen

Co-Investigator/s: Dr. MN Sibiyi and Mr S. Naguran

Brief Introduction and Purpose of the Study:

Ambulance personnel play a vital role in the treatment of critically ill or injured patients as they are often the first point of contact with patients. Very little is known about the Emergency Medical Services (EMS) role in the prevention and transmission of healthcare acquired infection (HCAI). By the very nature of their work, ambulance personnel are at increased risk of exposure to infection. In terms of the National Health Act 61 of 2003 and the Occupational Health and Safety Act 85 of 1993, healthcare providers are to be protected from these varying hazards with the implementation of policies and guidelines. Presently there is no national policy on communicable diseases and infection control that is specifically designed for use in the pre-hospital environment in South Africa thus the purpose of this study is to develop an EMS specific disinfection protocol and to evaluate its effectiveness in EMS in the eThekweni District of KwaZulu-Natal.

Outline of the Procedures:

The study population will be made up of both operational staff and management from the public sector Emergency Medical Services (EMS) in the eThekweni District of Kwa-Zulu Natal. The first four focus groups will consist of 10-12 operational staff each. The fifth focus group will consist of 10 EMS management staff. The focus group discussions will be conducted to identify factors that need to be taken into account to develop an ambulance specific disinfection protocol.

Based on the information gathered in phase one and the qualitative analysis of internationally accepted guidelines, an ambulance disinfection protocol will be developed.

During the third phase of the study an ambulance crew from each of the 7 ambulance bases in the eThekweni District will be purposively chosen in order to have a varied and well informed mix of participants from EMS operational staff.

During this phase, over a period of four weeks, participants will use the protocol in their normal operational duties. During this time they will evaluate the protocol by answering a brief open-end questionnaire at the second week and at the fourth week

Risks or Discomforts to the Subject:

There are no adverse effects for the participants

Benefits:

To the participants - Findings will guide the review of EMS policies and guidelines on Infection Control and thus possibly improving the participants working environment

To the researcher- M Tech qualification, two publications on completion and a conference presentation

Reason/s why the Subject May Be Withdrawn from the Study:

Possible non-compliance but there will be no adverse consequences for the participants involved.

Remuneration:

No forms of remuneration will be given.

Costs of the Study:

The study will be conducted at no cost to the participants

Confidentiality:

No names of the participants will be linked to any focus group. All participants of the focus group will be requested to sign a confidentiality agreement, with the main purpose of protecting the participants' privacy

Research-related Injury:

There no adverse effects anticipated and the participants partake in the study at their own risk.

Persons to Contact in the Event of Any Problems or Queries:

N.J. Williams-Claassen, Tel: 031 373 5203, Email: [@dut.ac](mailto: @dut.ac).

Dr MN Sibiyi, Tel: 031 373 2032, Fax: 031 373 2039, Email: [@dut.ac](mailto: @dut.ac).

Statement of Agreement to Participate in the Research Study:

(I,.....subject's full name....., ID number....., have read this document in its entirety and understand its contents. Where I have had any questions or queries, these have been explained to me byto my satisfaction. Furthermore, I fully understand that I may withdraw from this study at any stage without any adverse consequences and my future health care will not be compromised. I, therefore, voluntarily agree to participate in this study.

Subject's name (print)

Subject's signature:..... Date:.....

Researcher's name (print) signature:

Researcher's signature:.....Date:.....

Witness name (print) signature:

Witness signature:Date:.....

Annexure 4: Letter to the Department of Health

Miss S. Shezi
KZN Health eThekweni District
83 Jan Smuts Highway
Mayville
Durban
4000
P/Bag X54318

Dear Madam

Re: Permission to conduct research

I wish to conduct a research project in order to complete a Masters degree in Emergency Medical Care through the Department of Emergency Medical Care and Rescue, Durban University of Technology.

Title of research: Development of a disinfection protocol for the public sector Emergency Medical Services in the eThekweni District of KwaZulu-Natal

Name of research student: Mrs. N.J. Williams-Claassen

Contact No: 031 3735203

Name of supervisor: Dr. M.N. Sibiyi

Name of Co-Supervisor: Mr. S. Naguran

Ambulance personnel play a vital role in the treatment of critically ill or injured patients as they are often the first point of contact with patients. Very little is known about the Emergency Medical Services (EMS) role in the prevention and transmission of healthcare acquired infection (HCAI). By the very nature of their work, ambulance personnel are at increased risk of exposure to infection. In terms of the National Health Act 61 of 2003 and the Occupational Health and Safety Act 85 of 1993, healthcare providers are to be protected from these varying hazards with the implementation of policies and guidelines.

Presently there is no national policy on communicable diseases and infection control that is specifically designed for use in the pre-hospital environment in South Africa and thus the purpose of this study is to develop an EMS specific disinfection protocol and to evaluate its effectiveness in EMS in the eThekweni District of KwaZulu-Natal.

The study population will be made up of both operational staff and managers from the public sector Emergency Medical Services in the eThekweni District of KwaZulu-Natal. The focus group 1 and 2 will consist of 10-12 EMS operational staff each. The focus group 3 will consist of 10-12 EMS management staff. Focus group discussions will be conducted to identify the factors needed to develop a disinfection guideline and thereafter, the information gathered will be used to develop a disinfection protocol. The last stage will entail the implementation and evaluation of the disinfection guideline.

Tape recorded data from the focus group discussions will be transcribed, and then analysed by the researcher using thematic content analysis (Green & Thorogood, 2004). The researcher will begin by reading through all the transcripts so as to get a sense of the whole, and to categorise the accounts into a summary. Themes, codes and relationships between them will be identified and recorded in the format of a mind map. The information gathered and the qualitative analysis of internationally accepted guidelines will be used to develop a disinfection guideline.

The disinfection guideline will be implemented on an ambulance in each of the 7 ambulance bases in the district over a four week period. In the evaluation of the disinfection guideline, the ambulance crew, as well as each base manager, will be required to answer a brief open-ended questionnaire at two weeks and at four weeks. These questionnaires will be evaluated with the use of thematical analysis. Please take note that the study will not impact negatively on the normal operational duties of the service.

All data will be coded and handled confidentially to ensure anonymity. The name of the ambulance service, the bases in the district, the ambulances and staff will not be identified. Participation in the study is voluntary and participants will be required to complete a consent form.

The researcher will be responsible for all data collection. This study hopes to contribute to reducing healthcare associated infection for patients, ambulance staff and their families. A report containing the findings of the study will be forwarded to you. You are free to use the findings to implement policy. A copy of the research proposal is attached.

Do not hesitate to contact me if you require any information regarding my research study.

Thank You

Natalee Jean Williams-Claassen
Research Student

Annexure 5: Letter to EMRS

eThekwini District Manager: EMRS
Private Bag X01
Dalbridge
4000

Dear Sir/Madam

Re: Permission to conduct research

I wish to conduct a research project in order to complete a Masters degree in Emergency Medical Care through the Department of Emergency Medical Care and Rescue, Durban University of Technology.

Title of research: Development of a disinfection protocol for the public sector Emergency Medical Services in the eThekwini District of KwaZulu-Natal

Name of research student: Mrs. N.J. Williams-Claassen

Contact No: 031 3735203

Name of supervisor: Dr. M.N. Sibiya

Name of Co-Supervisor: Mr. S. Naguran

Ambulance personnel play a vital role in the treatment of critically ill or injured patients as they are often the first point of contact with patients. Very little is known about the Emergency Medical Services (EMS) role in the prevention and transmission of healthcare acquired infection (HCAI). By the very nature of their work, ambulance personnel are at increased risk of exposure to infection. In terms of the National Health Act 61 of 2003 and the Occupational Health and Safety Act 85 of 1993, healthcare providers are to be protected from these varying hazards with the implementation of policies and guidelines.

Presently there is no national policy on communicable diseases and infection control that is specifically designed for use in the pre-hospital environment in South Africa

and thus the purpose of this study is to develop an EMS specific disinfection protocol and to evaluate its effectiveness in EMS in the eThekweni District of KwaZulu-Natal.

The study population will be made up of both operational staff and managers from the public sector Emergency Medical Services in the eThekweni District of KwaZulu-Natal. The focus group 1 and 2 will consist of 10-12 EMS operational staff each. The focus group 3 will consist of 10-12 EMS management staff. Focus group discussions will be conducted to identify the factors needed to develop a disinfection guideline and thereafter, the information gathered will be used to develop a disinfection protocol. The last stage will entail the implementation and evaluation of the disinfection guideline.

Tape recorded data from the focus group discussions will be transcribed, and then analysed by the researcher using thematic content analysis (Green & Thorogood, 2004). The researcher will begin by reading through all the transcripts so as to get a sense of the whole, and to categorise the accounts into a summary. Themes, codes and relationships between them will be identified and recorded in the format of a mind map. The information gathered and the qualitative analysis of internationally accepted guidelines will be used to develop a disinfection guideline.

The disinfection guideline will be implemented on an ambulance in each of the 7 ambulance bases in the district over a four week period. In the evaluation of the disinfection guideline, the ambulance crew, as well as each base manager, will be required to answer a brief open-ended questionnaire at two weeks and the fourth week. These questionnaires will be evaluated with the use of thematical analysis. Please take note that the study will not impact negatively on the normal operational duties of the service.

All data will be coded and handled confidentially to ensure anonymity. The name of the ambulance service, the bases in the district, the ambulances and staff will not be identified. Participation in the study is voluntary and participants will be required to complete a consent form.

The researcher will be responsible for all data collection. This study hopes to contribute to reducing healthcare associated infection for patients, ambulance staff

and their families. A report containing the findings of the study will be forwarded to you. You are free to use the findings to implement policy. A copy of the research proposal is attached.

Do not hesitate to contact me if you require any information regarding my research study.

Thank You

Natalee Jean Williams-Claassen
Research Student

Annexure 6: Focus Group Discussion Guide (FGD) for the development of an Ambulance Disinfection Protocol: Operational Staff

The purpose of this guide is to generate dialogue, ideas and opinions on the subject and to identify the factors needed to develop an ambulance specific disinfection protocol.

1. Introduction

- The researcher will welcome the participants and introduce herself.
- Introduce any observers.
- Explain the purpose of the study and the purpose of the FGD.
- Explain the presence and purpose of the tape recorder and obtain permission from the participants for its use.
- Address the issue of confidentiality.

2. Discussion Guide

The researcher will use the following framework to guide the discussion,

- Vehicle cleaning
 - Vehicle exterior
 - Vehicle interior – daily cleaning, cleaning after each patient and deep cleaning.
- Self decontamination
 - Personal Protective Equipment
 - Hand washing
- Standard Precautions
 - Spillage management
 - Waste management
 - Linen management

The researcher will also ask the participants for suggestions as to how infection control can be improved in the public sector of EMS and how non-compliance can best be prevented.

Finally the researcher will ask the participants for any further comments they would like to express and if there is any other point that they would like to elaborate upon.

3. Closing

- Closing remarks.
- The researcher will express her appreciation and thanks for participants' participation.
- The researcher will thank any observers and assistants.

Annexure 7: Focus Group Discussion Guide (FGD) for the development of an Ambulance Disinfection Protocol- Management Staff

The purpose of this guide is to generate dialogue, ideas and opinions on the subject and to identify the factors need to be taken into account to develop an EMS specific disinfection protocol.

1. Introduction

- The researcher will welcome the participants and introduce herself.
- Introduce any observers.
- Explain the purpose of the study and the purpose of the FGD.
- Explain the presence and purpose of the tape recorder and obtain permission from the participants for its use.
- Address the issue of confidentiality.

2. Discussion Guide

The researcher will use the following questions to guide the discussion,

- Describe the current procedures used for disinfection on the operational ambulances.
- To what extent are these procedures aligned with international policy?
- What factors have hampered implementation of international policy guidelines?
- What do you think should form part of disinfection protocol, specifically in EMS?
- What guidelines can be used in the implementation of the disinfection protocol?

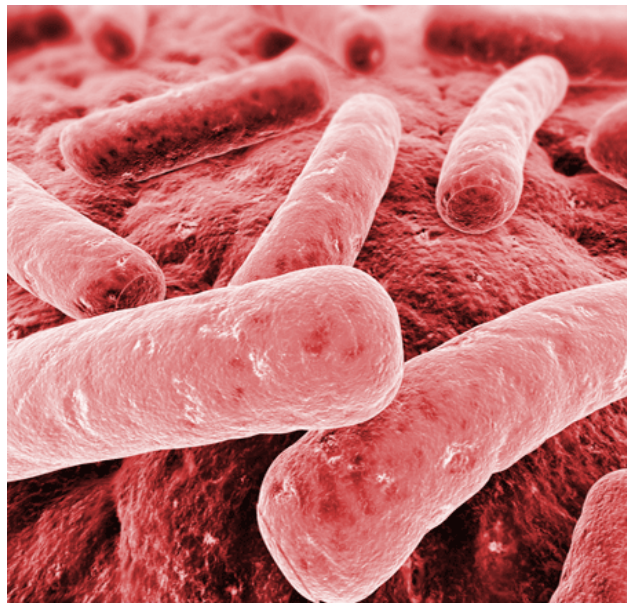
The researcher will also ask the participants for suggestions on how non-compliance can best be prevented.

Finally the researcher will ask the participants for any further comments they would like to express and if there is any other point that they would like to elaborate upon.

3. Closing

- Closing remarks.
- The researcher will express her appreciation and thanks for participants' participation.
- The researcher will thank any observers and assistants.

AMBULANCE DISINFECTION PROTOCOL



Title of Dissertation:

*Development of a disinfection protocol for the public sector Emergency
Medical Services in the eThekweni District of KwaZulu-Natal*

*By Natalee Williams-Claassen
Durban University of Technology*

Date: June 2012

Overview of Study

Ambulance personnel play a vital role in the treatment of critically ill or injured patients, as they are often the first point of contact with patients. Very little is known about the Emergency Medical Services (EMS) role in the prevention and transmission of healthcare acquired infection (HCAI). By the very nature of their work, ambulance personnel are at increased risk of exposure to infection.

In terms of the National Health Act 61 of 2003 (Republic of South Africa, 2004) and the Occupational Health and Safety Act 85 of 1993 (Republic of South Africa, 1993), healthcare providers are to be protected from these varying hazards with the implementation of policies and guidelines. Presently there is no National or Provincial Policy on Infection Control specifically for the Pre-hospital environment in South Africa (Mahomed, et al. 2007: 497-500).

A recent study conducted in the province of KZN showed that there is a high prevalence of microorganism contamination on the ambulances that were tested as well as poor staff knowledge and practice on infection control. The study has highlighted the need for the development and implementation of an ambulance disinfection protocol in EMS (Naguran. 2008)

The purpose of this study is to develop an EMS specific disinfection protocol and evaluate its efficacy in the public sector EMS in the eThekweni District of KZN, in order to reduce the risk of communicable disease transmission among ambulance staff and patients during the delivery of public health services to the community.

Over a period of 4-6 weeks, participants will use the disinfection protocol in their normal operational duties. During this time they will answer a brief evaluation questionnaire at two weeks and at the fourth week regarding the implementation of the disinfection protocol. The Base supervisors for each base are also required to complete the questionnaire at the above mentioned intervals.




Table of Contents

Hand Hygiene

- | | | |
|----|-------------------------|---|
| 1. | When to wash your hands | 4 |
| 2. | Hand Washing Technique | 5 |

Cleaning and Disinfecting of the Ambulance

- | | | |
|----|---|----|
| 1. | At the Start of each shift cycle | 6 |
| 2. | At the Start of each shift | 8 |
| 3. | After visible soiling has occurred | 8 |
| 4. | After every third patient | 8 |
| 5. | Cleaning of Bio-Hazardous Spill | 10 |
| 6. | After every patient with no visible soiling | 12 |
| 7. | Waste Management | 14 |

Instructions for Dilution of Solutions

- | | | |
|----|--|----|
| 1. | Dilution of Disinfectant Solution (1:100) | 16 |
| 2. | Dilution of Disinfectant Solution (1:50) | 17 |
| 3. | Dilution of Cleaning Solution (1:100) | 18 |
| 4. | Dilution of Bleach for Decontamination of cleaning equipment | 19 |


- | | | |
|--|------------|----|
| | References | 20 |
|--|------------|----|

Hand Hygiene

When to wash your hands:

1. Before patient contact,
2. Before aseptic technique,
3. After body fluid exposure risk,
4. After patient contact
5. After contact with patient surroundings.
6. At the start and end of shift,
7. Before and after PPE use
8. Before invasive procedures,
9. After cleaning/disinfecting of equipment and vehicle,
10. Before leaving the hospital,
11. Before and after handling food,
12. Before and after smoking,
13. After using the restroom or other personal body functions (coughing, sneezing)
14. And any time when the paramedic's hands are visibly dirty

If soap and water is not immediately available use alcohol-based hand rub



Hand Washing Technique





(World Health Organisation, 2012)

Cleaning and Disinfecting of the Ambulance

At the Start of each shift cycle

Patient compartment

- Don eye protection and gloves
 - Remove all equipment, cylinders, bunk cushion and the M17 stretcher from the ambulance
 - Remove all stock and jump bags
 - Remove all waste as per protocol
 - Remove all linen as per protocol
 - Rinse the entire patient compartment with water
 - Spray cleaning detergent over all surfaces, wipe down with paper towels and mop thoroughly to remove debris.
 - Leave for 5 minutes
 - Spray the equipment, the jump bag, cylinders, bunk cushion and the M17 stretcher with cleaning detergent, wipe down with paper towels thoroughly to remove debris.
 - Leave for 5 minutes
 - Rinse the entire patient compartment with water , allow to dry or wipe dry with new paper towels
 - Spray the entire patient compartment with disinfection solution from a distance of 30cm and allow to dry for 5 minutes (1:100)
- 

- Wipe down the equipment , the jump bag, cylinders, bunk cushion and the M17 stretcher with damp paper towels to remove cleaning agent and dry with new paper towels
 - Spray the equipment , the jump bag, all sealed stock, cylinders, bunk cushion and the M17 stretcher with disinfection solution from a distance of 30cm and allow to dry for 5 minutes (1:100)
 - Dispose of all waste as per protocol
 - Decontaminate cleaning equipment as per protocol
 - Disinfect your uniform and boots with a light all-over spray of disinfectant (1:100)
 - Remove gloves, clean and disinfect hands and up to elbows, dry with paper towel
 - Only once the equipment is dry, re-glove and replace all the equipment , the jump bag, all sealed stock, cylinders, bunk cushion and the M17 stretcher back in the patient compartment
 - Remove gloves, disinfect hands with alcohol hand-rub
- 


Cleaning and Disinfecting of the Ambulance

At the Start of each shift or


After visible soiling has occurred or

After every third patient

Driver's compartment


- Don eye protection and gloves
 - Remove all movable items
 - Remove all waste as per protocol
 - Spray cleaning detergent over all surfaces (including the steering wheel, gear lever, handbrake, seats, radio microphone, door panels and handles) wipe down with paper towels and mop thoroughly to remove debris
 - Leave for 5 minutes
 - Wipe down all surfaces with new damp paper towels to remove all cleaning agent. Spray all surfaces with disinfection solution from a distance of 30cm and allow to dry for 5 minutes (1:100)
 - Spray all personal issue (e.g. stethoscope) with cleaning detergent, wipe down with new paper towels to remove all cleaning agent.
 - Leave for 5 minutes and rinse
 - Spray with disinfection solution from a distance of 30cm and allow to dry for 5 minutes (1:100)
- 


Patients' compartment

- Don eye protection and gloves
 - Remove all waste as per protocol
 - Remove all linen as per protocol
 - Rinse the patient compartment floor with water
 - Spray all exposed surfaces with cleaning detergent, wipe down with new paper towels and mop thoroughly to remove debris.
 - Leave for 5 minutes
 - Rinse all exposed surfaces or wipe down with new damp paper towels. Air dry or dry with new paper towels
 - Spray all exposed surfaces with disinfection solution from a distance of 30cm and allow to dry for 5 minutes (1:100)
 - Ensure that all equipment is clean, disinfected and in the correct storage place.
 - Replace linen on bunk and M17 stretcher
 - Dispose of all waste as per protocol
 - Decontaminate cleaning equipment as per protocol
 - Disinfect your uniform and boots with a light all-over spray of disinfectant (1:100)
- 

Cleaning and Disinfecting of the Ambulance


Cleaning of Bio-hazardous spill

- Don eye protection, gloves and apron
 - Spray the “spill area” with cleaning detergent.
 - Cover the spill with paper towels to contain and absorb the spill
 - Leave for 5 minutes
 - Remove all waste as per protocol
 - Remove all linen
 - Place all contaminated paper towels and removed matter into red waste bags
 - Spray the “spill area” with cleaning detergent and mop with warm water
 - Leave for 5 minutes
 - Spray all exposed surfaces with cleaning detergent, wipe down with new paper towels to remove debris.
 - Leave for 5 minutes
 - Rinse all exposed surfaces with water or wipe down with new damp paper towels. Air dry or dry with new paper towels
 - Spray all exposed surfaces with disinfection solution from a distance of 30cm and allow to dry for 5 minutes (1:100)
 - Ensure that all equipment is clean, disinfected and in the correct storage place.
- 


- Replace linen on bunk and M17 stretcher
 - Dispose of all waste as per protocol
 - Decontaminate cleaning equipment as per protocol
 - Disinfect your uniform and boots with a light all-over spray of disinfectant (1:100)
 - Remove gloves, clean and disinfect hands and up to elbows, dry with paper towel
- 

Cleaning and Disinfecting of the Ambulance

After every patient with no visible soiling


- Don eye protection and gloves
 - Remove all waste as per protocol
 - Fog patient compartment with 300ml fine spray of disinfection solution (1:50)
 - Leave for a minimum of 5 minutes or allow to dry
 - Dispose of all waste as per protocol
 - Disinfect your uniform and boots with a light all-over spray of disinfectant (1:100)
 - Remove gloves, clean and disinfect hands and up to elbows, dry with paper towel
- 


Decontamination of cleaning equipment after every use

- Don eye protection and gloves
 - Rinse the mop and bucket with clean water
 - Decontaminate mop and bucket by soaking it for 10 minutes in a 0.5% bleach solution
 - Wash mop and bucket with cleaning detergent and water daily or when visibly soiled
 - Rinse thoroughly with clean water
 - Dry completely before next use
 - Disinfect your uniform and boots with a light all-over spray of disinfectant (1:100)
 - Remove gloves, clean and disinfect hands and up to elbows, dry with paper towel
- 

Cleaning and Disinfecting of the Ambulance

Waste management


- Don eye protection and gloves
 - Use plastic or galvanized containers with tight fitting lids for contaminated waste
 - Contaminated waste and non-contaminated waste must be disposed of in separate containers
 - Red waste bags must be used to line contaminated waste containers
 - Clear or black waste bags must be used to line non-contaminated waste containers
 - Place all waste in their designated containers
 - Never use hands to compress waste into containers
 - When the waste bags are two thirds full remove bags from the waste container by holding at the top of the waste bags
 - Knot the top of the waste bag
 - Keep the waste bags from touching or brushing your body while lifting and carrying.
 - Place the full bags in the designated waste collection area
 - Clean contaminated waste containers each time they are emptied and when the non-contaminated waste container is visibly soiled
 - Rinse waste containers with water
- 

- Spray with cleaning detergent and leave for 5 minutes
 - Rinse with water and let dry
 - Once dry spray with disinfection solution from a distance of 30cm and allow to dry for 5 minutes (1:100)
 - Once dry replace waste bag
 - Disinfect your uniform and boots with a light all-over spray of disinfectant (1:100)
 - Remove gloves, clean and disinfect hands and up to elbows, dry with paper towel
- 


Instructions for Dilution of Solutions

Dilution of Disinfectant Solution

At 1:100 concentration

- Draw up 10ml concentrated disinfection solution
 - Fill spray bottle with 1000ml water
 - Add the 10ml of solution to the spray bottle
 - Replace the nozzle and mix
 - Spray desired surfaces from a distance of 30cm
 - Allow to dry for a minimum of 5 minutes before touching sprayed surfaces
- 

At 1:50 concentration

- Draw up 60ml concentrated disinfection solution
 - Fill pressurised spray bottle with 3000ml water
 - Add the 60ml of solution to the spray bottle
 - Replace the nozzle and mix
 - Fog patient compartment with 300ml fine spray of disinfection solution
 - Allow to dry for a minimum of 5 minutes before touching sprayed surfaces
- 

Instructions for Dilution of Solutions


Dilution of Cleaning Solution

At 1:100 concentration

- Draw up 10ml concentrated cleaning solution
 - Fill spray bottle with 1000ml water
 - Add the 10ml of solution to the spray bottle
 - Replace the nozzle and mix
 - Spray desired surfaces
 - Wipe down with paper towels or mop
 - Leave for a minimum of 5 minutes
 - Rinse with water
 - Allow to dry or dry with new paper towels
 - Apply Disinfectant as per protocol
- 

Dilution of Bleach for Decontamination of cleaning equipment

At 0.5% bleach solution

- Measure 500ml of Bleach 5%
 - Fill bucket to 5 litres (1/2 of 10 litre bucket)
 - Add 500ml to bucket and mix
 - Decontaminate mop and bucket by soaking it for 10 minutes in a 0.5% bleach solution
 - Clean equipment as per protocol
- 

References

Mahomed, O., Jinabhal, C.C., Taylor, M. and Yancey, A. 2007. The preparedness of emergency medical services against occupationally acquired communicable diseases in the prehospital environment in South Africa. *Emergency Medicine Journal*, **24**: 497-500.

Naguran, S. 2008. An assessment of ambulance infection control in an emergency medical service in the Ilembe District of KwaZulu-Natal. M.Tech, Durban University of Technology.

Republic of South Africa. 2004. National Health Act No. 61 of 2003. Pretoria: Government Printer

Republic of South African. 1993. Occupational Health and Safety Act No. 85 of 1993. Pretoria: Government Printer.

World Health Organisation. 2012. Clean hands protect against infection (image). Available at http://www.who.int/gpsc/clean_hands_protection/en/

Researcher and Author Mrs Natalee Williams-Claassen

Durban University of Technology
Department of Emergency Medical Care
and Rescue

Tel: 031 373 5336
Fax: 031 373 5201
Email: nataleew@dut.ac.za

Annexure 9: Questionnaire on the implementation and evaluation of an EMS specific disinfection protocol.

Questionnaire no.____

Instructions: Please answer all of questions below with a short explanation.

1. Please comment on the disinfection protocol's ability to be implemented.

2. What can be done to improve the implementation of the disinfection protocol?

3. What factors hindered the use of the disinfection protocol?

4. What will improve the use on the disinfection protocol?

5. Please provide final comments and suggests for disinfection protocol.

Thank you for your participation in this study.

Please take note that all answers will be keep confidential.