KNOWLEDGE AMONG NURSES AND MEDICAL DOCTORS ON ANIMAL BITE MANAGEMENT AND USE OF ANTI-RABIES VACCINES IN THE OMUSATI REGION, NAMIBIA

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BY

STUDENT NAME: WERNER TSHAMWENE AMUTENYA

200522167

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MAIN SUPERVISOR: PROF. HONORE KABWEBWE MITONGA (UNIVERSITY OF NAMIBIA)

CO-SUPERVISOR(S): MR DESDERIUS HAUFIKU (UNIVERSITY OF NAMIBIA)

Abstract

This study investigated the knowledge of registered nurses and medical doctors on animal bites management in the Omusati region, Namibia. This includes knowledge of health care workers regarding wound care, administration of anti-rabies, and administration of Post-Exposure Prophylaxis using a quantitative research method, with a sample of 96 nurses and medical doctors. The research reveals significant knowledge gaps and inconsistencies among registered nurses and medical doctors. The findings show that while most respondents correctly identified immediate washing with soap and water as the appropriate first step after an animal bite, there were misunderstandings about subsequent wound management. Divergent responses were observed regarding the appropriate vaccination site and schedule, with only a minority of healthcare workers identifying the deltoid as the correct site and recognizing the necessity of four doses in the post-exposure regimen. Concerning eligibility criteria for PEP, a lack of consensus was found among registered nurses and medical doctors. Misconceptions about Rabies Immunoglobulin administration sites were also observed, with a significant number incorrectly suggesting the wound site as the injection site. This study emphasizes the need for improved education, clear guidelines, and standardized training among healthcare workers to address these issues and optimize patient care and rabies control efforts. The findings have significant implications for patient outcomes and public health initiatives aimed at controlling and preventing the spread of rabies. Further studies are needed to develop effective educational and training interventions to address these identified gaps and misconceptions.

Keywords: Knowledge, post-exposure prophylaxis, Immunization, animal bite, Rabies, Rabies Immunoglobulin (RIG), Wound Category

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Dedication

I dedicate this study to the Amutenya family, particularly my mom, wife and children, for their words of encouragement. I am also dedicating this to my supervisors, colleagues and fellow students for their inspiration and assistance to complete my study. I thank you all, and may the almighty God continue to protect and guide you always.

Declaration

I, Werner T Amutenya, hereby declare that this study is a true reflection of my own research and that this work or part thereof has not be submitted for a degree in any other institution of high learning.

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Date: April 2024

(Werner T Amutenya)

Abbreviations and acronyms

ARV - Anti Rabies Vaccine

DVS – Directorate of Veterinary Services

RIG – Rabies Immunoglobulin

PEP - Post Exposure Prophylaxis

MoHSS - Ministry of Health and Social Services

MAWF – Ministry Agriculture, Water, and Forestry

SOP – Standard Operating Procedure

UNAM – University of Namibia

VAN – Veterinary Association of Namibia

WHO - World Health Organization

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CHAPTER 1:

ORIENTATION AND THE OVERVIEW OF THE STUDY

1.1 Introduction and background

This chapter aims to inform the reader on the general overview and background of rabies disease globally, in Africa, and in Namibian context, the chapter will also give details on the problem statement, purpose, the significant of the study, and concepts used in the study.

Rabies is present on all continents, with 95 % of the cases occurring in Africa and Asia. It is estimated that, rabies cause 59 000 death annually in over 150 countries. Rabies is one of the neglected tropical diseases that predominantly affects the poor and vulnerable population who live in remote rural locations (1). In Africa, it is estimated 24 476 human deaths per year are attributed to dog-mediated rabies, Rabies continues to be a major public health issue within Namibia and on a global scale (1). The spread occurs through the saliva of an infected creature, with the virus subsequently being lodged in muscle and subcutaneous tissue after a bite (2). If not correctly addressed, rabies has a near 100% fatality rate (3).

As per the Ministry of Agriculture Water and Forestry (MAWF), division of Veterinary Services, unvaccinated and exposed animals, particularly domestic pets such as dogs and cats, pose a significant risk for transmitting rabies to humans (4). Given the intimate relationship many individuals maintain their pets, a severe public health threat emerges, as bites or scratches from these unvaccinated animals could lead to rabies transmission (5). To address issue related to the rabies transmission in human, the Ministry of Agriculture Water and Forestry, in partnership with the Ministry of

Health and Social Services, the Veterinary Association of Namibia (VAN), and other stakeholders, established a National Rabies Control Strategy, offering national guidelines and standard operating procedures for addressing rabies (6).

Registered nurses and medical doctor's knowledge and handling practices concerning potential animal bites significantly affect rabies development and patient outcomes (3). Timely risk assessment of rabies infection, proper wound management, and prophylactic antibiotics selection are critical post-dog-bite interventions (7). Although exact figures on animal bites within Namibia remain unclear, the World Health Organization estimates that dog bites account for 76% to 94% of animal bite injuries. Moreover, despite the high number of animal bites reported at health facilities in Namibia, there is a notable reduction in human rabies-related fatalities w since 2015 from an average case of 26 to 0-2 cases annually. Rabies suspected cases are also reduced with significant number from year 2012 among the reported cases, Kavango region noting the highest rate of suspected and confirmed cases (8). Children aged 5 to 16 years are the most affected, accounting for 83% of all human rabies cases (9).

Rabies is a legally reportable disease in Namibia, under the jurisdiction of the MAWF and the Directorate of Veterinary Services (DVS), which periodically arranges pet vaccination campaigns (10). Mass dog vaccination has demonstrated to be the most effective approach toward the elimination of dog mediated rabies. As dogs are responsible for 99% of human rabies, confirmed human death due to rabies cases in Namibia mainly at the northern communal areas were recorded as follows: 26 cases (2015), 13 cases (2016), 6 cases (2017), 1 case (2018), and 0 case in (2019,2020) (10).

In the Omusati region, hospital records indicate a concerning increase in dog bite incidents, with suspected rabies cases ranging from 258 to 370 between 2011 and

2015. The Regional directors have thus issued a memorandum advising all health districts to adhere to the guidelines on the immunological basis for rabies immunization. As reported by the Namibia country report on human rabies, from 2019-2023, Omusati region recorded 29 animal bites cases in 2022 and 800 cases in 2023 respectively of which only four were suspected and 2 were confirmed. Health worker's knowledge to screen patients presenting animal bite injuries is paramount to clearly identify suspected cases and offer appropriate post-exposure prophylaxis (11).

This study has ascertained the knowledge of registered nurses and medical doctors about immediate action regarding management of animal bites, and vaccination measures and assessed the awareness about management, dressing and suturing of wounds following dog bites among registered nurses and medical doctors in the Omusati region. This study examined the management of patients with animal bites by health workers at four health districts in the Omusati region.

1.2 Problem statement

Despite the annual free vaccination campaigns for dogs and cats in Namibia, an uptick in rabies incidents has been observed, particularly in animals and humans residing in the northern regions, specifically, in the Omusati area (10). In response to this troubling trend, the Ministry of Health and Social Services (MHSS) has adopted the World Health Organization (WHO) guidelines for managing rabies within healthcare facilities (3). An analysis of outpatient registers and rabies suspected cases line list from Outapi District Hospital between January and December 2018 revealed that a significant number of patients exposed or suspected to have been exposed to rabid animals were given anti-rabies vaccines. However, due to insufficient knowledge, these cases were often managed contrary to the guidelines, resulting in a high usage of human rabies vaccines (3).

This mismanagement can lead to shortages of Anti-Rabies Vaccines) in healthcare facilities, as vaccines are sometimes administered even in cases not requiring Post-Exposure Prophylaxis (PEP) (8). Consequently, patients are often turned away due to vaccine shortages, forcing them to seek treatment at private facilities which can charge exorbitant amounts per vaccine.

In consultation with the Ministry of Health and Social Services, the Veterinary Association of Namibia (VAN), and other stakeholders, the Ministry of Agriculture, Water, and Forestry has provided guidelines and standard operating procedures for managing rabies (7).

Adherence to the recommended guidelines on administering rabies vaccines is crucial, including understanding when to administer, when to discontinue, and when to abstain from giving the rabies vaccine (8). However, a knowledge gap among healthcare workers regarding managing animal bites and administering rabies vaccines according to WHO recommendations has led to poor case management and misuse of anti-rabies vaccines. This situation may contribute to vaccine shortages in both public and private health facilities (8).

The following table summarizes the number of rabies vaccines used at four district hospitals in the Omusati region. Several rabies vaccines were ordered and used as Pre-Exposure Prophylaxis (PEP) between 2016 and 2018. These data were obtained from the Oshakati Regional Depot.

Table 1: Quantification of anti-rabies vaccines distribution to district pharmacies, Omusati region

	Outapi	**Oshikuku**	**Okahao**	**Tsandi**	**Total**
2019	692	334	488	240	**1754**
2020	869	386	155	146	**1556**
2021	1014	503	182	178	**1877**
Total	**2575**	**1223**	**825**	**564**	**5187**

Table 2: Quantification of Rabies Immunoglobulin distributed district pharmacies, Omusati region.

	Outapi	**Oshikuku**	**Okahao**	**Tsandi**	**Total**
2019	3	3	13	0	**19**
2020	0	0	10	5	**15**
2021	0	0	10	10	**20**
Total	**3**	**3**	**33**	**15**	**45**

In 2008, 5136 anti-rabies vaccines were given to patients suspected to be bitten or scratched by animals. This indicates that each rabies suspected case is given rabies vaccines of which health care workers were not following the guideline. According to the memorandum issued by the Regional Director in August 2008, all 5136 vaccines were finished, and the community were informed on this matter, and some were advised to seek assistance at private hospitals and pharmacies.

As the researcher is a health care worker, he assumes that several nurses and medical officers at clinics and Out-Patient Departments (OPD) lack knowledge on administering PEP to patients based on the severity of injury sustained. As it is not clear on what leads to the development of rabies among suspected cases, it is also not clear what causes the severe shortage of rabies vaccine in the Omusati region. A survey to assess health care workers health care worker's knowledge on the management of animal bites and administration of PEP conducted in the Omusati region.

1.3 Objectives of the study

Despite the WHO and national guidelines in available in public health sectors to guide health workers on the management of animal bite management and the use of anti-rabies vaccines to improve management of rabies cases at public health facilities, management of animal bites remains one of the greatest challenges in public health facilities. The objectives of the study are to:

a) To assess the knowledge of registered nurses and medical doctors regarding the categorization of animal bite.

b) To evaluate registered nurses and medical doctors on knowledge regarding animal bite management.

c) To determine the knowledge regarding the site, route, and schedule of post-exposure prophylaxis

d) To assess the level of knowledge regarding the use of post-exposure prophylaxis guidelines among registered nurses and medical doctors.

e) To evaluate registered nurses and medical doctor's knowledge of rabies immunoglobulin administration in routine and special situations.

1.4 Significant of the study

Management of animal bites and rabies vaccination plays a significant role in the prevention of rabies development among those exposed to the virus through animal bites or scratches. This study assessed registered nurses and medical doctors as frontline healthcare providers on knowledge of animal bite management and rabies vaccination to reduce the risks of development of human rabies.

Since the MoHSS implemented the WHO guidelines on the management of animal bites and rabies vaccination, no study was done to examine the knowledge of healthcare workers; therefore, as a researcher, it was imperative to conduct a study on health care workers to understand whether they have knowledge or understand the subject matters, and this will enable the MoHSS to identify and develop target interventions. The findings result in recommendations for training registered nurses and medical doctors on rabies management and implementing improved rabies control measures.

1.5 Definition of concepts

Animal bite wound – refers to the wound inflicted by animal suspected of rabies

Anti-rabies Vaccines: This is a vaccine used to prevent rabies.

Confirmed cases: a case that is laboratory confirmed.

District, the intermediate administrative unit serves a population between 10 000 and 300 000.

Exposed: A person who had close contact with a laboratory-confirmed rabid animal.

Frontline healthcare workers, refers to employee of the Ministry of Health and Social Services who provide essential services to the public.

Human Rabies: is a communicable disease affecting human caused by a virus present in the

saliva of rabid animals and cause progressive inflammation of the brain and spinal cord.

Rabies Immunoglobulin - is a medication made up of antibodies against rabies virus. It is used for rabies following exposure.

Registered nurses – A nurse practicing at public health facilities.

Suspected rabies case: a bite or scratch from rabies suspected animal. It can be licking exposure to open wounds, abrasion, or mucous membranes.

Medical doctors- a physician trained and practicing at public health facilities.

Notifiable diseases: there are diseases that are of great public health importance. Notifiable Local, state, and national agencies must be reported when health care workers or laboratories diagnose them.

Vaccination: the process of rendering immunity to the subject, it also called inoculation or immunization.

1.6. Chapter Arrangement

The following is the layout of this thesis, in order:

Chapter 1: Orientation and Overview of the Study

This chapter provides a comprehensive overview and orientation of the study at hand. It introduces the research topic and outlines the background that justifies the necessity of the study. It also clearly states the research problem, questions, and objectives. The researcher highlighted the significance of the study, explaining its expected contribution to the body of knowledge, industry, society, or policy making. It also outlines the scope of the study and any assumptions or limitations that exist at the outset of the research. Lastly, this chapter has provided a roadmap for the subsequent chapters in the thesis or dissertation.

Chapter 2: Literature Review

The second chapter extensively reviews existing literature related to the research topic. The purpose of this chapter is to critically assess and interpret the current body of research that is relevant to the subject of investigation. This includes identifying seminal and recent works, exploring various theories, models or frameworks used, and highlighting the gaps in the existing research the current study aims to fill. The literature review can also provide a historical perspective and discuss the evolution of the research topic over time.

Chapter 3: Methodology: study design, sample, population, data collection and study limitation will be discussed.

Chapter 3 describes in detail the research methodology adopted for the study. This includes the research design (e.g., qualitative, quantitative, mixed methods), the population and sample size, sampling techniques, data collection methods (e.g., surveys, interviews, observations), and data analysis procedures. This chapter also discussed the measures taken to ensure the validity and reliability of the research findings. Ethical considerations pertaining to the research process are also addressed.

Chapter 4: Research Findings: the study results will be covered; Chapter 4 presents the research findings clearly and systematically. The data gathered during the research process is analysed, and the results are discussed in this section. It includes detailed descriptions, supported by tables, charts, or graphs, of the empirical data collected. Because it is a quantitative study, this chapter presents statistical analyses.

Chapter 5: Discussion, Conclusion, Recommendations, and Limitations

The final chapter offers a thorough discussion and interpretation of the research findings in the context of the research questions and objectives, and the literature reviewed. This section draws together the results, offering conclusions about what has been found in light of the research objectives. This chapter also provides recommendations for future research, practice, or policy based on the findings and conclusions. The limitations of the study, reflecting on any weaknesses or constraints encountered during the research process, are also addressed here. Finally, this chapter summarises the entire study, underlining its significance and potential impact.

1.7 Summary

The chapter being summarised has introduced the concept of rabies in the region of study. Background information was provided concerning the rate of rabies cases and the use of rabies vaccines as per sources. The research problem statement, the purpose of the study, study objectives, the significance of the study, the research design and methods and the definition of the concepts were presented. The next chapter, Literature Review, focused on the rabies understanding of rabies at global, country, regional and district levels. The conceptual framework will also be addressed in the next chapter.

CHAPTER 2:

LITERATURE REVIEW

2.1 Introduction

The literature review aims to inform the leader of what is already known regarding the topic under study. Considering that rabies is a public health concern since it is associated with an increased risk of mortality and morbidity. Several studies on rabies have been conducted using various methods. In this chapter, the researcher provided an overview of current knowledge, allowing to identify relevant theories, methods and gaps regarding animal bite management in health care settings.

2.2 Overview of rabies

According to World Health Organization data, Rabies remains a major public health issue in numerous regions globally, with dog bites responsible for over 90% of human cases (8). The WHO's 2013 Country Report estimates that dog-mediated rabies results in approximately 21,476 human fatalities annually in Africa alone (8). Within Namibia, the primary transmission method of rabies is via bites from infected dogs, with a prevalence in the country's northern areas (10). A nationwide analysis confirmed 1,911 rabies cases across all species, with dogs accounting for 34% of these cases. Notably, 93% of all dog-positive cases were concentrated in the northern communal territories (10).

To evaluate the understanding and implementation of strategies developed by the WHO, studies have been conducted to assess the knowledge of healthcare workers regarding the management of animal bites and rabies immunization (8). However, within Namibia, no specific studies have focused solely on dog bite management and post-exposure prophylaxis for rabies. Yet, data collected by the Ministry of Agriculture, Water, and Forestry (MAWF), Ministry of Health and Social Services (MHSS), and Veterinary Association of Namibia (VAN) reveal that hundreds of cases have been reported, with the northern regions being the most affected (11).

A death from Rabies represents a health system failure, a position substantiated by a review in Thailand detailing the deficiencies of Post-Exposure Prophylaxis (PEP) treatment. The study pinpointed delays and non-compliance with the recommended regimen as factors leading directly to the deaths of young children (12). Further research from South Africa and Thailand has spotlighted gaps in health workers' understanding of managing potential Rabies exposures (1). Accordingly, systematic confidential enquiries should be initiated to identify preventable factors contributing to such fatalities.

Global experience, while lacking controlled human trials on Rabies post-exposure prophylaxis utilizing wound treatment, immunoglobulin, and vaccination, unequivocally supports this approach due to ethical concerns (7). A pressing need exists for veterinary and health workers to receive comprehensive training on Rabies risk assessment and appropriate response mechanisms. Furthermore, persistent dialogue between health and veterinary workers involved in managing human cases with potential exposure to the rabies virus is essential for adaptive patient management, guided by data about the source animal (13).

A study from Kolkata, India, on understanding animal bites management and knowledge of rabies Post Exposure Prophylaxis among interns at a government medical college revealed a high actual number of deaths due to rabies, primarily caused by bites from rabid dogs, followed by other animals like cats, cows, monkeys, horses, pigs, and camels (14). The study identified a significant gap in knowledge regarding animal bite injury management and immunization, reinforcing the need for improving knowledge on Rabies classifications and proper vaccination procedures.

Similarly, a study from China reported that 6.3% of the 711 people who died of rabies fell under category one, which theoretically should bear no risk for rabies. This suggests that the understanding of PEP among healthcare staff was insufficient (15). Studies from developing countries like Tanzania and Turkey have indicated a lack of knowledge among physicians regarding zoonotic diseases in general and rabies (12, 16).

Further research in Ghana uncovered that many frontline service providers lacked knowledge about rabies, with only 15.5% knowing the incubation period in dogs and the period required to observe for signs of a rabies infection (17). Additionally, studies in India confirmed that most participants were aware of the importance of proper wound management following an animal bite, further emphasizing the need for improved understanding of wound care and the prevention of rabies (14).

Even though rabies is preventable through modern prophylactic measures, a lack of knowledge continues to pose significant challenges in preventing deaths due to rabies (18). Guidelines from South Africa suggest that those at high risk, such as veterinarians and staff at veterinary practices and welfare organizations, should undergo preventative pre-exposure immunization as a measure of protection (19).

The pre-exposure schedule for rabies vaccination is three doses, given as follows:

Dose 1: as appropriate

Dose 2: 7 days after dose 1

Dose 3: 28 days after dose 1

A booster dose is given every 2-3 years, and such pre-immunized individuals are given only two boosters after an incident of exposure to infection on days 0 and 3. No rabies anti-immunoglobulin is administered. After an exposure, anyone bitten by an animal or who otherwise may have been exposed to rabies should clean the wound and see the doctors immediately. The doctor will determine if the need to be vaccinated.

In Namibia, rabies cases are managed at hospitals by medical doctors, clinics and health centres health care workers are informed to refer patients to district hospitals for rabies vaccine initiation. The pre-exposed prophylaxis schedule given in Namibia is according to the WHO guidelines, and the post-exposure prophylaxis:

Dose 1: Day 0

Dose 2: Day 3

Dose 3: Day 7

Dose 4: Day 14

Dose 5: Day 28

2.3 Animal bite management

Depending on the severity of the contact with the suspected rabid animal, administration of PEP is recommended as follows (see table).

Table 3: Categories of contact and recommended post-exposure prophylaxis (PEP)

Categories of contact with suspect rabid animal	**Post-exposure prophylaxis measures**
Category I *– touching or feeding animals, licks on intact skin*	*Not regarded as exposure- No PEP required*
Category II *– nibbling of uncovered skin, minor scratches, or abrasions without bleeding*	*Immediate vaccination and local treatment of the wound*
Category III *– single or multiple transdermal bites or scratches, licks on broken skin; contamination of mucous membrane with saliva from licks, contacts with bats.*	*Immediate vaccination and administration of rabies immunoglobulin; local treatment of the wound*

All category II and III exposures assessed as carrying a risk of developing rabies require Post post-exposure prophylaxis. This risk is increased if:

- The biting mammal is a known rabies reservoir or vector species.
- The exposure occurs in a geographical area where rabies is still present.
- The animal looks sick or displays abnormal behaviour.
- The animal's saliva contaminated a wound or mucous membrane.
- The animal was unprovoked.
- The animal has not been vaccinated.

The vaccination status of the suspect animal should not be the deciding factor when initiating PEP or not when the animal's vaccination status is questionable. This can be the case if dog vaccination programmes are not being sufficiently regulated or followed out of lack of resources or low priority.

WHO continues to promote human rabies prevention through the elimination of rabies in dogs, dog bite prevention strategies, and more widespread use of the intradermal route for PEP, which reduces volume and, therefore the cost of cell-cultured vaccine by 60% to 80%.

2.4 Integrated case management

If possible, the veterinary services should be alerted, and the biting animal should be identified and quarantined for observation (for healthy dogs and cats). Alternatively, the animal may be euthanized for immediate laboratory examination. Prophylaxis must be continued during the 10-day observation period or while awaiting laboratory results. Treatment may be discontinued if the animal is proven to be rabies-free. If a suspect animal cannot be captured and tested, then an entire course of prophylaxis should be completed.

2.5 Management of animal bite

According to WHO PEP guidelines, first aid for the wound should include:

a) immediate and thorough flushing and washing of the wound for a minimum of 15 minutes with soap and water,
b) Disinfection with detergent, povidone iodine or other substances that kill the rabies virus.

c) Bleeding at any wound site indicates potential severe exposure and must infiltrated with rabies immunoglobin.
d) Other treatment includes administration of antibiotics and tetanus prophylaxis.
e) Administration of Rabies Immunoglobulin (RIG) to wounds classified as category III exposure is of upmost important in wound management.
f) Bite to the head, neck, face, and genitals are category III exposures. RIG should be infiltrated in the depth of the wound and around the wound as much as anatomically feasible.
g) The remaining RIG should be injected at an intramuscular site distant from vaccine inoculation (e.g., into the anterior thigh).

2.6 Awareness of rabies and preventing dog bites

Education on dog behaviour and bite prevention for both children and adults an essential extension of a rabies vaccination programme and can decrease both the incidence of human rabies and the financial burden of treating dog bites. Increasing awareness of rabies prevention and control in communities includes education and information on responsible pet ownership, how to prevent dog bites, and immediate care measures after a bite. Engagement and ownership of the programme at the community level increase the reach and uptake of critical messages.

2.7 Summary

This chapter discusses what other researchers have published about knowledge of health workers' management of rabies. The literature review covers the knowledge, management, and factors associated with the increased number of rabies cases and shortage of anti-rabies vaccine in health facilities.

CHAPTER 3:

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter discussed the design and methodologies that were applied in the study. It further entails and defines the study population, the sample size, the research instrument, sampling methods, the participant inclusion and exclusion criteria, the data collection tools and data analysis methods. This chapter also explained the ethical considerations and participant rights during the study.

3.2 Research design

This research adopts a quantitative, cross-sectional, analytical study design to investigate the level of knowledge about animal bite management and rabies vaccination administration among medical doctors and registered nurses within all four districts of the Omusati region.

A quantitative research approach is employed to collect numerical data, which allows for an objective analysis of the responses received0. This method is advantageous as it offers the ability to generalize findings and test hypotheses derived from the theory. A quantitative research approach also provides a broad overview of a particular research problem (20).

The cross-sectional study design, often employed in healthcare research, is used to gather data at a particular time (21). This approach efficiently provides a 'snapshot' of the phenomena under study, which, in this case, involves the knowledge level of medical practitioners regarding animal bite management and rabies vaccination. A descriptive research design accurately and systematically describes the situation or phenomenon. It provides a comprehensive summary of the issue, presenting an overall picture of the respondents' knowledge concerning managing animal bites and administering rabies vaccines (21).

Participants in this study consist of registered nurses and medical doctors working across all four districts of the Omusati region. The region has been selected as it has seen a rise in rabies cases in recent years. Data was collected through a structured questionnaire evaluating their understanding of managing animal bites and administering rabies vaccinations.

This research improves public health by assessing healthcare professionals' knowledge in effectively managing rabies cases, ensuring the best outcomes for patients, and enhancing rabies prevention efforts in the Omusati region.

3.2 Quantitative

This research utilized a quantitative research design characterized as a formal, objective, and systematic process. This design facilitates the description of the level of knowledge among healthcare workers regarding animal bite management and allows for the exploration and testing of relationships between variables (22).

The quantitative approach efficiently quantifies data and generalizes results from the sample to the population of interest. Using this approach, we can obtain numerical data from our respondents, which can then be analyzed using statistical methods to draw conclusions or make predictions (22).

In this study, we were particularly interested in investigating the knowledge of healthcare workers - including nurses and medical doctors - concerning the management of animal bites and the proper administration of rabies vaccines. This research has offered insight into the level of awareness and expertise these professionals possess in handling such medical situations.

Additionally, the study assessed the demographic characteristics of these healthcare professionals, such as their age, gender, years of experience, and level of education. This analysis allowed us to examine potential correlations between these demographic variables and the healthcare workers' knowledge on rabies management (22). Such insights could be invaluable in identifying gaps in knowledge or training that may be associated with specific demographic groups.

The research results could contribute to understanding the areas where further education or training may be necessary to improve healthcare workers' competence in managing animal bites and rabies cases. Thus, the research could have significant implications for providing education and training within the health sector, promoting better patient care and improved public health outcomes.

3.3 Cross-sectional

This research employed a cross-sectional study design, a commonly utilized approach in healthcare research that examines the relationship between variables at a specific point in time (23). The study's primary goal is to explore the knowledge base of healthcare workers concerning rabies management and its potential impact on the prevalence of rabies among exposed populations.

Cross-sectional studies provide a snapshot of the variables of interest within a defined population at a single point in time. This method is particularly useful for determining the prevalence of a disease or condition and identifying associated factors (23).

In this case, the healthcare workers' knowledge of rabies management has been the key variable. The level of this knowledge could influence the incidence of rabies within the population, particularly those exposed to potential sources of infection, such as animal bites. Understanding the depth of healthcare workers' understanding of rabies management can help inform the creation of targeted educational interventions or changes in practice to reduce the incidence of rabies (23).

Moreover, this research revealed disparities in the healthcare workforce's knowledge of different demographic groups. Identifying these disparities provided a more nuanced understanding of where educational interventions may be most needed.

While cross-sectional studies, due to their nature, cannot establish causal relationships, they can provide valuable insights into correlations between variables (21). Therefore, the results of this study indicated a potential association between the knowledge of healthcare workers and the prevalence of rabies, although further longitudinal studies would be needed to investigate causality.

3.4 Descriptive study

This study utilized a descriptive research approach, commonly used in health sciences to provide a detailed view of a specific phenomenon. Descriptive studies focus on illustrating the characteristics of a particular group, situation, or event, serving as a foundation for more complex research and aiding in forming hypotheses. In this study, the descriptive approach was instrumental in conducting a thorough analysis of the knowledge levels of healthcare workers regarding rabies management in the Omusati region.

The collected data was organized, summarized, and interpreted using statistical methods to provide meaningful insights. The analysis methods depended on the nature of the data collected, but they also included frequency distributions, measures of central tendency, or measures of variability. These techniques enabled the researcher to gain an in-depth understanding of the current knowledge about rabies management among healthcare workers in the region (21).

This descriptive study has not only highlighted the prevailing level of knowledge but also illuminated the range of understanding concerning rabies management among the healthcare workers in the Omusati region. This granular understanding could identify knowledge gaps that might necessitate targeted educational interventions.

By precisely describing the current situation, the findings from this study contribute significantly to the body of knowledge on rabies management in the region. They also guide the development of strategic initiatives aimed at enhancing the capacity of healthcare workers to manage rabies and, consequently, improve patient outcomes.

3.5 Sample and Sampling process

3.5.1 Sampling procedure

To secure a representative sample, a stratified random sampling method was implemented. This method, known for its high accuracy and representativeness, allows us to divide the population into homogeneous subgroups and then randomly select subjects from each subgroup for inclusion in the study sample.

The total population of medical doctors and registered nurses at OPD in the Omusati region is 226/423. Participants were informed about the study, and their consent was obtained. A questionnaire was given once consent is obtained and where the health providers are less than eight in the facility, all were allowed to participate in the study. In a facility with more than eight providers, eight were selected using a simple random sampling from the total number of providers working in the department.

The following table summarizes the number of medical doctors and registered nurses at each target unit/facility.

Table 4: Sample size

	Outapi	Oshikuku	Okahao	Tsandi	Total
Medical Officers	6	4	3	2	15
Registered Nurse	23	21	31	22	97
Total	29	25	34	24	112/184

3.5.2 Sample Size

The researcher’s purpose influences the researcher's sample size in conducting the research. Using a correct sample size is essential to represent the population accurately. The sample of the respondents is determined from a sampling frame comprising healthcare workers working at OPD/Causality in all 4 hospital districts in the Omusati region. The sample size was calculated using Epi Info 7.0 and a statistical calculator.

Target population – 184 Healthcare workers in the Omusati region

Study population – 112 Nurse and Medical doctors at ODP/ Casualty departments.

Confidence interval - 95%

Margin of Error – 5%

Sample size - 99

<u>Inclusion Criteria</u>

- The study consisted of registered nurses and medical doctors working at OPD who agreed to participate.

<u>Exclusion Criteria</u>

- Nurses and medical doctors were not willing to participate.

3.6 Research instrument

A questionnaire with structured questions on animal bites was distributed to all consenting participants at all four health districts in the Omusati region. The questionnaire is adapted from the similar study used in Kolkata, India (See Annexure 2). The distribution of questionnaires allowed the study to gather specific and structured information from a considerable number of participants, which enhanced the reliability and validity of the findings. These questionnaires consisted of various questions related to different aspects of animal bite management and rabies immunization. These include questions about their understanding of the disease, its transmission, prevention strategies, vaccination schedules, post-exposure prophylaxis, and reporting procedures.

3.7 Data collection method

To compile the necessary data, questionnaires served as our primary data collection tool, these questionnaires, designed to evaluate the level of knowledge related to animal bite management and rabies immunization, were distributed to nurses and medical officers actively engaged in the outpatient departments of four major hospitals in the region: Outapi Hospital, Tsandi Hospital, Okahao Hospital, and Oshikuku Hospital.

Understanding the knowledge gaps among these healthcare providers can be a crucial step towards improving the implementation of rabies management and control strategies. This, in turn, may help to lower the incidence of rabies in the community and ensure appropriate management of animal bites, ultimately improving the overall public health landscape in the Omusati region.

3.8 Data analysis

Data analysis is a systematic process involving applying statistical and logical techniques to describe, summarize, and compare data. In the realm of research, data analysis can be construed as a pivotal method to systematically examine and interpret raw data, to answer the research questions and hypotheses posed at the outset of the study (21). In this study, a descriptive statistical analysis was employed to summarize and interpret data.

In the context of this study, once the data collection phase was complete, the raw responses collected through the questionnaires underwent a rigorous analysis. This process initially involved organizing and categorizing the data according to variables. This encompasses variables such as respondents' demographics, knowledge on rabies transmission, prevention strategies, vaccination schedules, post-exposure prophylaxis, and procedures for reporting rabies cases. These categorized data was then ordered and summarized to ensure they can be presented coherently and comprehensibly.

The data were eventually captured using Statistical Package for Social Sciences (SPSS) -version 27.0 - a widely used software in the field of social sciences for handling large data sets and performing complex data manipulation and analysis (23). Utilizing SPSS allows for a range of statistical tests to be conducted, enabling the researcher to make meaningful inferences from the data.

The findings are reported in the final research report upon completion of the analysis. This includes a detailed discussion of the results and an assortment of tables and graphs to provide a clear visual representation of the data. These graphical illustrations helped compare variables, identify trends, and draw conclusions.

3.9 **Budget**

For this study, funds to cover the following costs were needed; the researcher was able to provide funds for:

1. Transport
2. Printing
3. Meals

3.10 Ethical Consideration

Research ethics provide guidelines for the selection of the study purpose, design methods of measurement, the collection and analysis of data, the interpretation of results and the presentation and publication of results. It is a tool that guides and ensures that the research subjects are respected humanely. During this study, the following ethical issues were considered.

3.9.1 **Anonymity** – Defined as ‘ the degree to which the identity of a message source is unknown and not specified, there is one has less knowledge about the source it becomes harder to specify who the source is among all respondents (30). During the study, all participants were assured the rule of anonymity will be respected. The participants’ names were never linked to any of the information they were given, and all participants were informed and assured of this.

3.9.2 **Confidentiality**: Information obtained from the research study was used for the study purpose only, and information will not be shared or given to the third party without permission (31). No names used during the study, and unique numbers/codes were allocated to participants and attached to the questionnaire.

3.9.3 **Informed consent**, the aim and objectives of the study clearly explained to participants that they are free to participate in the study. I explained to the participant that, during the study, no blood or human tissue sample was to be taken. Nobody was coerced into participating in a research project. Participants had the right to withdraw from the study at any time.

3.9.4 **Harm to the experimental subject and respondent**, the researcher had an ethical obligation to protect participants within all reasonable limits from any form of physical discomfort that may have emerged from the research project. Participants were informed that there would be no physical harm, discomfort, invasion of privacy, or threat of dignity.

3.9.5 **Permission –** the researcher was given Ethical Clearance Certificate to conduct the study by the University of Namibia Research Ethics Committee (UREC). The researcher was granted permission to conduct the study in Omusati region by the Ministry of Health and Social Services. The consent to conduct a study in Omusati region was granted by the Regional Director.

3.9.6 **Right to privacy and voluntarily participation -**Every participant who took part in the study did so voluntarily: it was not forced on anybody. The participants were informed that participation in the study includes the right to withdraw from the study anytime, the right to provide information if they are comfortable and the right to demand clarification of anything concerning the study.

3.11 Dissemination of research findings

The study's findings were documented, and the information is clear to convey clearly and unambiguously to avoid or minimize misappropriation by the subject.

Pending approval from the ethics committee, the researcher ensured that potential ethical dilemmas were considered, and an informed consent was used to acquire permission from all participants and their right to privacy was assured by anonymity in all records made. All information was kept strictly confidential and has not been used for purposes other than this project. The researcher first obtained approval from the University of Namibia (UNAM) ethical committee, MHSS, to enhance conformity to ethical standards. The study findings were disseminated to the Ministry of Health and Social Services at the National Level and the Omusati Regional Health Directorate.

3.11 Summary

In this chapter, the study methodology was discussed. The researcher employed a descriptive quantitative study to meet the study objectives. This chapter also discussed sample sizes, the sampling methods, and ethical issues. The recruitment of participants was explained as the pilot study, the validity and reliability, the anonymity and confidentiality principles. The next chapter presents and discuss the finding of the study.

CHAPTER 4

RESULTS PRESENTATION AND ANALYSIS

4.1 Introduction

This chapter presents the analysis and interpretation of data collected from 96 respondents using a structured questionnaire to assess the knowledge regarding frontline healthcare workers on animal bite management and the use of anti-rabies vaccines at different district hospitals in the Omusati region. The analysis aims to reduce the data into an intelligible and interpretable form so that the relation of the research problem can be studied and tested. Analysis and interpretation of data collected from 96 participants is done based on the objectives and questions of the study using descriptive and inferential statistics.

4.2 Results

A sample of 112 respondent was determined, and questionnaires were distributed to collect information from respondents who are front line health workers in Omusati region to meet the research objectives. Out of the 112 questionnaires that were sent out, only 96 (86%) were completed and returned which deemed to be a reasonable presentation of the population study while 16 (14%) questionnaires were not completed neither returned. Questionnaires were accompanied by a cover letter were shared with respondent indicating the purpose of the study and the research made follow ups with health facilities to ensure that questionnaires are completed and returned.

The table below shows the number of respondents from Omusati region.

Table 5**:** Response rate, Omusati region

	Frequency	**Percentage rate (%)**
Total sample population	112	100%
Usable questionnaire (response rate)	96	86%
Unreturned Questionnaire	16	14%

4.2.1 Demographic characteristics

This section contained demographic information about which was used to interpret the results. The characteristics of the respondents were analysed based on their occupation and the facilities where they are operating from. The results of the demographic characteristics are presented in the form of pie charts for the descriptive statistical analysis.

Occupation

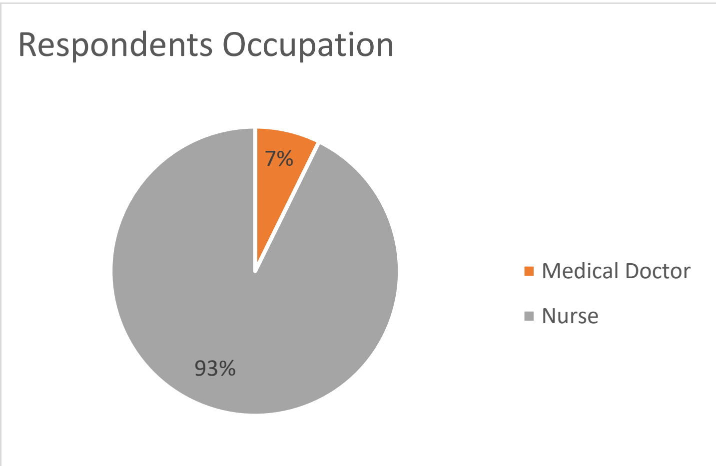

Figure 1: Respondent's occupation.

A total of 96 frontline healthcare workers were interviewed in this study. The following chart shows that 7 % were Doctors and 93% were Nurses.

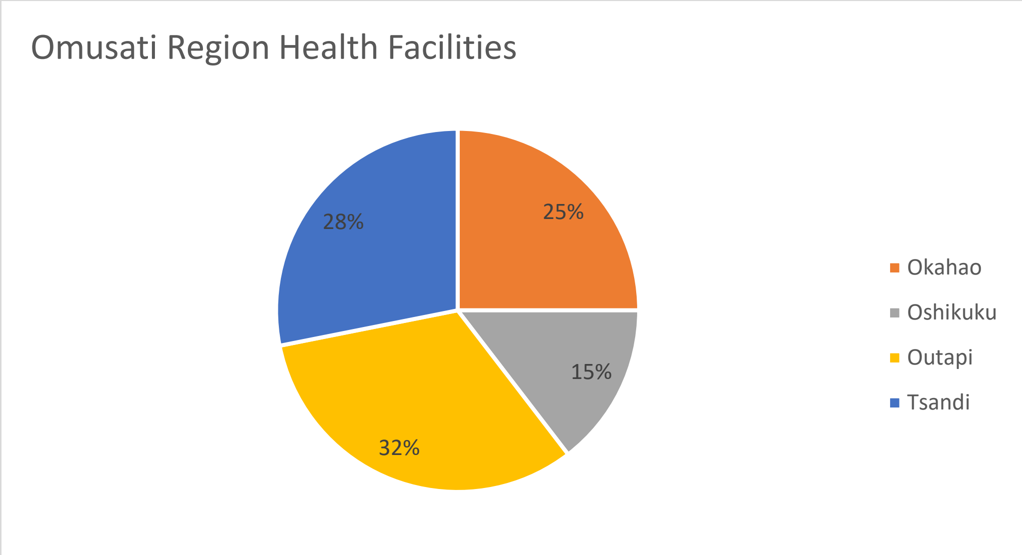

Figure 2 Proportion of frontline health care workers at district hospitals responded/ participated in the study.

Chart 4.2.1.1 shows that out of 96 respondents, 25 % were from Okahao district hospital, 15 % were from Oshikuku district Hospital, 32% were from Outapi district Hospital, and 28% were from Tsandi District Hospital respectively. The proportion of participants from district health facilities, Omusati region.

4.3 To assess the knowledge of registered nurses and medical doctors regarding the categorization of animal bite wounds.

Wounds and scratches cause by animal suspected of rabies are categories into three categories based on the risks of exposure. Categorization of animal bites wound is key to the management of suspected rabies cases to allow health care workers to make informed decisions. The table below shows responses of registered nurses and medical doctor on category I of animal bite wounds.

Table 6: Classification of animal bite wound - Category I

Valid	**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Contamination of mucous membrane	17	17.7	17.9	17.9
Licks on intact skin	37	38.5	38.9	56.8
Abrasion without bleeding	15	15.6	15.8	72.6
Touching of animals	8	8.3	8.4	81.1
Single transdermal bite	18	18.8	18.9	100.0
Total	95	99.0	100.0	

This table refers to the least severe category of animal bite wounds. These include contamination of mucous membranes (17.9% of respondents correctly identified), licks on intact skin (38.9%), abrasions without bleeding (15.8%), touching of animals (8.4%), and single transdermal bite (18.9%). Noticeably, the highest percentage of correct answers falls on 'Licks on intact skin', indicating that this is the most recognized type of CAT I bite among the respondents. However, understanding other types of CAT I bites is somewhat uneven. One responded (%) did not respond to the categorization of animal bite wound. The implications of these results from Table 6 suggest several areas where further education may be needed for frontline healthcare workers in the Omusati region. Firstly, the uneven understanding of different Category I animal bite wounds might result in sub-optimal care for patients. The correct identification of the severity of the bite wound influences the subsequent medical interventions. For instance, if healthcare workers do not accurately recognize abrasions without bleeding (15.8%) or contamination of mucous membranes (17.9%)

as Category I bites, these wounds may not be treated promptly or appropriately, potentially leading to complications or more severe health risks for the patients. Secondly, this data suggests that additional training might be beneficial to ensure a more uniform knowledge across the various types of Category I bite wound. This could involve more detailed training modules about the different types of animal bites, potential complications, and the appropriate medical responses to each. Lastly, the data shows that 'Licks on intact skin' is the most recognized type of Category I bite. This could suggest that either these types of bites are the most common or, therefore, more familiar to healthcare workers or that existing training materials disproportionately focus on these types of bites. Either way, it indicates that additional focus on the less recognized types of bites could be beneficial.

Table 7 presents responses of registered nurses and medical doctor on
category II of animal bite wounds.

Table 7: Classification of animal bite wound - Category II

Valid	**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Contamination of mucous membrane	13	13.5	13.5	13.5
Licks on intact skin	5	3.1	3.1	16.7
Abrasion without bleeding	1	1.0	1.0	17.7
Touching of animals	60	62.5	62.5	80.2
Single transdermal bite	19	19.8	100.0	100.0
Total	96	100.0	100.0	

This category represents a bit more severe animal bite wound. The highest proportion of healthcare workers (62.5%) correctly identified 'Touching of animals' as a CAT II wound, followed by single transdermal bite (19.8%). However, knowledge about the categorization of other types of CAT II bites like licks on intact skin (3.1%) and contamination of mucous membranes (13.5%) is lacking.

The analysis of Table 7, data reveals existing knowledge gaps among healthcare workers in Omusati, Namibia, particularly regarding the identification and categorization of Category II (CAT II) animal bite wounds. This information carries several critical implications.

The potential for wound severity misclassification stands as the most pressing issue. Misidentification of CAT II wounds by healthcare workers can result in the underestimation or overestimation of the wound's severity, leading to inappropriate treatment. More gravely, misclassification can delay the initiation of crucial interventions, such as rabies post-exposure prophylaxis, leading to serious, sometimes fatal, consequences for the patient.

A knowledge gap in categorizing animal bite wounds further highlights the need for targeted training and educational initiatives to improve healthcare workers' understanding of CAT II wounds. It is crucial that healthcare workers possess a comprehensive understanding of all types of animal bite wounds, not merely those most frequently encountered, to ensure the provision of appropriate care to every patient.

In tandem with enhancing training and education, the study's results underscore the importance of reinforcing clinical practice guidelines among healthcare workers. This reinforcement should specifically concentrate on distinguishing between different animal bite categories, understanding each category's unique characteristics, and the corresponding medical response required.

From a public health perspective, the misclassification of wounds could affect the precision of epidemiological data, thus hindering the ability to track the actual incidence and severity of animal bites within the region. This obstacle could frustrate the development of effective prevention and control strategies.

Table 8 presents responses of registered nurses and medical doctor on category III of animal bite wounds.

Table 8: Classification of animal bite wound - Category III

Valid	**Frequency**	**Percent**	**Valid percent**	**Cumulative percent**
Contamination of mucous membrane	50	52.1	52.1	52.1
Licks on intact skin	4	4.2	4.2	56.3
Abrasion without bleeding	12	12.3	12.5	68.8
Touching of animals	1	1.0	1.0	69.8
Single transdermal bite	29	30.2	30.2	100.0
Total	96	100.0	100.0	

Category III represents the most severe type of animal bite wounds. A substantial percentage of respondents (52.1%) correctly categorized 'Contamination of mucous membrane' as CAT III wound. In addition, 30.2% recognized a 'Single transdermal bite' as a severe CAT III bite. This is a positive result as it indicates a high level of understanding for these severe bites. Yet, only a minor portion of the sample recognized 'Licks on intact skin' (4.2%) and 'Touching of animals' (1.0%) as part of this category.

The results outlined in Table 8 provide key insights into the understanding and knowledge of healthcare professionals in the Omusati region of Namibia regarding Category III (CAT III) animal bite wounds, which are recognized as the most severe type. The implications of these results are manifold, covering areas from patient care and training needs to public health concerns.

Firstly, the strengths and weaknesses in the knowledge of healthcare workers become apparent through this data. Most respondents demonstrated a sound understanding of severe CAT III bites, such as 'Contamination of mucous membrane' (52.1% correct recognition) and 'Single transdermal bite' (30.2% correct recognition). This level of knowledge is fundamental, as these types of wounds carry the highest risk and require immediate and suitable care. Despite this, the lower recognition rates for 'Licks on intact skin' (4.2%) and 'Touching of animals' (1.0%) as belonging to the CAT III category reveal areas of deficient knowledge among healthcare workers.

Secondly, implications for patient care become evident. The potential misclassification or failure to identify the severity of CAT III wounds could result in inadequate or delayed treatment, significantly impacting patient outcomes. This is particularly concerning considering the life-threatening nature of diseases such as rabies.

Thirdly, the identified gaps in knowledge imply a necessity for ongoing education and training, especially focusing on the comprehensive identification of CAT III wounds. While 'Licks on intact skin' and 'Touching of animals' may not usually be associated with severe outcomes, they could pose serious risks and require appropriate medical intervention in certain contexts.

Fourthly, the findings highlight the importance of strict adherence to clinical guidelines. It is vital for healthcare workers to understand the full spectrum of CAT III wounds and to follow the recommended procedures for each type. Lastly, from a public health perspective, the potential for wound misclassification could result in inaccurate epidemiological data regarding the incidence and severity of CAT III animal bites. This could hinder public health initiatives aimed at controlling and preventing diseases like rabies.

4.4 To evaluate health care workers knowledge regarding animal bite wound management.

It very important for the health worker to deciding around management of wound caused by animal bites and necessary step should be followed ensuring that correct procedures are don't to prevent possible development of rabies to the exposed victim. The table below shows responses from respondent regarding immediate steps on management of wound caused due to animal bite.

Table 9: Immediate steps on management of animal bite wound

Valid	**Frequency**	**Percent**	**Valid percent**	**Cumulative percent**
Wash immediately with water and soap	63	65.6	55.6	65.6
Wash with water only	18	18.8	18.8	84.4
Clean with anti- septic	15	15.6	15.6	100.0
Total	96	100.0	100.0	

Regarding the immediate step to take after an animal bite, most of the healthcare workers (65.6%) correctly responded that the wound should be washed immediately with water and soap. However, many respondents (18.8%) would wash with water only, and another 15.6% would clean with an antiseptic.

The results from Table 9 present essential implications on the current state of knowledge among healthcare workers in Omusati region, Namibia, concerning immediate steps after an animal bite.

Most healthcare workers (65.6%) demonstrated appropriate knowledge by correctly identifying that washing the wound immediately with water and soap is the first step after an animal bite. This is a crucial step as it helps remove saliva, dirt, and other contaminants, reducing the risk of rabies and other infections.

Nevertheless, a sizable proportion of respondents (18.8%) suggested they would wash the wound with water only. This indicates a critical knowledge gap, as cleaning with water alone may not be as effective in reducing the risk of rabies virus infection.

Furthermore, 15.6% of the respondents chose to clean the wound with an antiseptic as an immediate step. While cleaning with antiseptics is not wrong and can be a subsequent step, washing with water and soap is usually recommended first to remove contaminants mechanically. This suggests a need for guideline clarification or more precise training on immediate wound care after an animal bite.

Management of wound caused by animal suspected to have rabies varies, this depends on the degree of cut or scratches. It very important for the health worker to deciding around category of wound inflicted as it will help the health worker to take necessary action. The table below shows responses from respondents regarding immediate steps on management if wound caused due to animal bite.

Table 10: Animal bite wound management

Valid	Frequency	Percent	Valid percent	Cumulative Percent
Cover the wound only	41	42.7	42.7	42.7
Apply sutures	6	6.3	6.3	49.0
Leave the wound open	39	40.6	40.6	89.6
Don't know	10	10.4	10.4	10.4
Total	96	100.0	100.0	

Regarding managing the wound post-wash, 42.7% suggested to 'Cover the wound only'. A significant percentage (40.6%) would 'Leave the wound open', and 6.3% believed sutures should be applied. This table shows a concerning lack of consensus on this topic, with 10.4% of respondents admitting they do not know the best method of wound management.

The findings from Table 10 expose noteworthy implications regarding healthcare workers' understanding of wound management following an animal bite in the Omusati region of Namibia.

First, there seems to be a lack of consensus among healthcare workers on how to manage an animal bite wound after washing. The responses were split, with 42.7% suggesting 'Cover the wound only' and a nearly equal proportion, 40.6%, recommending to 'Leave the wound open'. This indicates a significant divergence in practices, potentially affecting patient outcomes.

The use of sutures in animal bite management is generally not recommended due to the increased risk of infection, yet 6.3% of respondents suggested this as an approach.

Lastly, 10.4% of healthcare workers reported they 'Don't know' the best method of managing an animal bite wound underscores the pressing need for education in this area. The admission of uncertainty can have implications for the quality of care provided to patients and suggests gaps in knowledge that could be addressed through targeted education and training.

4.5 To determine the knowledge regarding the site, route, and schedule of post-exposure prophylaxis.

Table 11 presents a perspective on healthcare workers' understanding of the appropriate site for administering post-exposure rabies vaccination in the Omusati region of Namibia, which has several significant implications.

Table 11: Site of vaccination

Valid	**Frequency**	**Percent**	**Valid percent**	**Cumulative percent**
Gluteal	6	6.3	6.3	6.3
Deltoid	83	86.5	86.5	92.7
Abdomen	2	2.1	2.1	94.8
Thigh	2	2.1	2.1	96.9
Don’t know	3	3.1	3.1	100.0
Total	96	100.0	100.0	

Most healthcare workers (86.5%) correctly identified the deltoid as the appropriate site for vaccination. However, there was some confusion, with 6.3% suggesting the gluteal area, 2.1% the abdomen, 2.1% the thigh, and 3.1% unsure.

Primarily, most healthcare workers have demonstrated a commendable level of knowledge and practice, with 86.5% correctly identifying the deltoid muscle as the correct site for vaccination. This adherence to the recommended guidelines is a positive finding and highlights the proficiency of the healthcare workers in the region.

However, some respondents suggested alternative sites for vaccination, including the gluteal area (6.3%), the abdomen (2.1%), and the thigh (2.1%). These responses are concerning and represent an area of confusion or misinformation that necessitates attention. Misdirection in the vaccination site can reduce vaccine efficacy and potential complications, carrying tangible implications for patient care and rabies prevention.

Further, the data highlights the presence of knowledge gaps among healthcare workers. Specifically, 3.1% of respondents were unsure about the correct site for vaccination. This finding suggests a critical need for targeted training and interventions to address these gaps and improve overall understanding. Additionally, reinforcement of clinical guidelines could assist in ensuring consistent and correct practice across all healthcare workers in the region.

On a broader scale, these findings hold implications for public health. The incorrect administration of rabies vaccines could hinder rabies control efforts at a community level, thereby exacerbating the challenge of preventing and controlling the spread of this potentially fatal disease.

Table 11 presents a perspective on healthcare workers' understanding of the appropriate injection schedules for administering post-exposure rabies vaccination in the Omusati region of Namibia, which has several significant implications.

Table 12: Injection schedule

Valid 1	**Frequency**	**Percent**	**Valid percent**	**Cumulative percent**
4 doses	41	42.7	42.7	42.7
8 doses	10	10.4	10.4	53.1
10 doses	2	2.1	2.1	55.2
14 doses	8	8.3	8.3	63.5
Don’t know	35	36.5	36.5	100.0
Total	96	100.0	100.0	

This table shows a considerable spread of responses regarding the correct injection schedule. Only 42.7% correctly answered that 4 doses are needed. It's concerning that 36.5% of healthcare workers admitted they do not know the correct schedule.

The findings in Table 12 underscore the critical need for healthcare workers in the Omusati region of Namibia to comprehensively understand the post-exposure vaccination schedule for rabies. The implications of these findings are significant and necessitate immediate attention.

Firstly, a considerable knowledge gap is evident, with just 42.7% of healthcare workers correctly identifying that four doses of the vaccine are required in the post-exposure regimen. This shortage of knowledge presents a compelling case for further education and training programs, as it is essential for healthcare workers to be thoroughly acquainted with the correct vaccination schedule to ensure optimal patient care.

Secondly, this lack of knowledge poses a tangible risk to patient care. Misinformation regarding the vaccination schedule can lead to inappropriate treatment for patients exposed to rabies, placing them in grave danger. The failure to administer the correct number of vaccine doses can severely compromise the treatment's efficacy, resulting in fatal consequences given the nature of rabies.

Moreover, 36.5% of healthcare workers confessed their lack of knowledge concerning the correct vaccination schedule is particularly alarming. This level of uncertainty among healthcare professionals could profoundly impact patient care. It also emphasizes the pressing need for ongoing education and training initiatives to bridge this gap.

Lastly, the broader public health implications cannot be overlooked. An incorrect vaccination schedule not only affects individual patients but can also hinder public health initiatives aimed at controlling and preventing the spread of rabies in the community. Such an oversight could potentially escalate the incidence of rabies, thereby posing a significant risk to public health.

4.6 To assess level of knowledge regarding the use of post exposure prophylaxis guideline among medical doctors and registered nurses.

Table 13 presents a perspective on healthcare workers' understanding of the patients who are eligible for Post Exposure Prophylaxis of rabies vaccination in the Omusati region of Namibia, which has several significant implications.

Table 13: Eligible for PEP

Valid	**Frequency**	**Percent**	**Valid percent**	**Cumulative percent**
CAT I	4	4.2	4.2	4.2
CAT I and II	14	14.6	14.6	18.8
CAT II	2	2.1	2.1	20.8
CAT II and III	36	37.5	37.5	58.3
CAT III	5	5.2	5.2	63.5
All categories	21	21.9	21.9	85.4
Don't know	14	14.6	14.6	100.0
Total	96	100.0	100.0	

The distribution of knowledge about eligibility for post-exposure prophylaxis (PEP) shows that 37.5% correctly identified that both CAT II and III are eligible. A noteworthy 21.9% incorrectly suggested all categories are eligible for PEP, and 14.6% did not know.

The results presented in Table 13 shed light on the knowledge of healthcare workers in the Omusati region of Namibia regarding the eligibility criteria for Post Exposure Prophylaxis (PEP), and the implications of these findings are of significant concern.

Firstly, a lack of consensus among healthcare workers regarding the eligibility for PEP is evident from the data. While 37.5% correctly identified that Category II and III animal bite wounds are eligible for PEP, a noteworthy proportion (21.9%) incorrectly believed that all categories, including Category I, are eligible. This discrepancy highlights the need for more explicit guidelines and improved education to ensure a common understanding among healthcare workers regarding PEP eligibility.

The incorrect belief that all categories of animal bite wounds are eligible for PEP raises concerns about potential inappropriate treatment. Administering PEP unnecessarily to Category I bites or failing to provide it for Category II or III bites can result in unnecessary medication and insufficient protection for patients at risk of rabies. This carries significant implications for patient care and underscores the importance of accurate knowledge in guiding appropriate interventions.

The finding that 14.6% of healthcare workers admitted to not knowing the eligibility criteria for PEP indicates the existence of knowledge gaps in this area. Ongoing education and training programs are crucial to addressing these knowledge gaps and ensuring that healthcare workers are well-informed about the eligibility criteria for PEP.

Education and clear guidelines cannot be overstated in enhancing healthcare workers' understanding of PEP eligibility criteria. Reinforcing the guidelines and providing consistent, accurate information can mitigate misunderstandings and improve the overall quality of care for individuals who have experienced animal bites. Continuous education and training initiatives are vital to ensuring that healthcare workers stay updated with the latest guidelines and best practices.

Accurate knowledge of PEP eligibility criteria is crucial not only for patient care and public health initiatives aimed at preventing and controlling rabies. Inaccurate understanding among healthcare workers can hinder the effectiveness of these initiatives, potentially leading to increased transmission and a higher incidence of rabies cases in the community. Thus, improving healthcare workers' knowledge in this area is of utmost importance for successful public health interventions.

The cross-tabulation presents the distribution of knowledge regarding the administration site for Rabies Immunoglobulin (RIG) across two healthcare professions: Medical Doctors and Nurses.

Table 14**:** Cross-Tabulation

Profession/Knowledge	CAT I	CAT I and II	CAT II	CAT II and III	CAT III	All categories	Don't know	Total
Medical Doctor	0	2	0	5	1	3	1	7
Nurse	4	12	2	31	4	18	13	89
Total	4	14	2	36	5	21	14	96

The table shows that out of 7 medical doctors, none believed that only Category I is the correct site, 2 believed that both Category I and II are the correct sites, 5 correctly identified that both Category II and III are the appropriate sites, 1 believed only Category III is the correct site, 3 incorrectly believed that all categories are the correct sites, 1 did not know the correct site.

The data also shows that out of 49 nurses, 2 believed only Category I is the correct site, 6 believed that both Category I and II are the correct sites, 20 correctly identified that both Category II and III are the appropriate sites, 2 believed only Category III is the correct site, 10 incorrectly believed that all categories are the correct sites and 8 did not know the correct site.

The data underscores the need for targeted education and training to address misconceptions and knowledge gaps regarding the correct administration site for RIG. While a significant portion of both Medical Doctors and Nurses displayed accurate knowledge, there remains a concerning number who either harbour misconceptions or admit to knowledge gaps. Continuous training and updates on medical protocols and procedures are essential to ensure that healthcare workers are equipped with accurate and up-to-date information.

The table below present the statistical analysis to test the association between the two professions in the Omusati region.

Table 15. Chi-Square test of independence

Source	Chi-square Value	Df	p-value
Pearsons Chi-square	15.23	24	0.872

The p-value of 0.872 is greater than the typical alpha level of 0.05. This indicates that there isn't a statistically significant association between the two profession of healthcare workers and their knowledge about PEP eligibility in this hypothetical dataset. In other words, the profession does not seem to play a significant role in determining the level of knowledge about PEP eligibility among healthcare workers in the Omusati region of Namibia.

4.7 The knowledge of registered nurses and medical doctors on rabies immunoglobulin administration in routine and emergency scenarios.

Table 16 presents response of the administration of Rabies Immunoglobulin (RIG) among registered nurse and medical doctors in the Omusati region of Namibia, and the implications of these findings call for immediate attention and intervention.

Table 16: Response on administration site(s) of rabies immunoglobulin

Valid	Frequency	Percent	Valid percent	Cumulative percent
Wound site	39	40.6	40.6	40.6
Deltiod	44	45.8	45.8	86.5
Gluteal	6	6.3	6.3	92.7
Para-umbilical	1	1.0	1.0	93.8
Don’t know	6	6.3	6.3	100.0
Total	96	100.0	100.0	

For the administration of Rabies Immunoglobulin, 45.8% correctly identified the deltoid as the injection site. However, 40.6% incorrectly suggested the wound site. A small portion thought it should be administered in the gluteal area (6.3%), and para-umbilical area (1%), and 6.3% did not know.

The results presented in Table 16 shed light on the administration of Rabies Immunoglobulin (RIG) among healthcare workers in the Omusati region of Namibia, and the implications of these findings call for immediate attention and intervention.

Firstly, the data reveals a concerning level of confusion among healthcare workers regarding the correct injection site for Rabies Immunoglobulin. While 45.8% correctly identified the deltoid as the appropriate injection site, a significant proportion (40.6%) incorrectly suggested administering the injection at the wound site. This highlights an apparent misunderstanding of the recommended administration procedure. Such confusion can lead to inadequate treatment, jeopardizing the effectiveness of the immunoglobulin and compromising the patient's health. It is crucial to address this confusion to ensure the proper delivery of Rabies Immunoglobulin and optimize patient outcomes.

The misconception regarding the injection site emphasizes the need for targeted education and training among healthcare workers. The finding that 6.3% of healthcare workers believed the gluteal or para-umbilical area to be the correct injection site further underscores the necessity for accurate and up-to-date information. Education and training programs should focus on providing healthcare workers with clear guidelines and protocols regarding the appropriate injection site for Rabies Immunoglobulin. Equipping healthcare workers with the correct knowledge can enhance their ability to administer the treatment accurately and effectively.

Clear guidelines and protocols play a vital role in preventing confusion and ensuring uniformity in practice. The observed confusion regarding the injection site highlights the importance of providing explicit instructions to healthcare workers. Clear guidelines should be developed and disseminated to ensure healthcare workers know the correct Rabies Immunoglobulin injection site. By establishing clear protocols, we can minimize errors and improve the quality of care provided to patients.

The presence of knowledge gaps among healthcare workers, as indicated by the 6.3% who admitted not knowing the correct injection site, is a significant concern. These knowledge gaps can compromise patient care and require targeted efforts to enhance healthcare workers' understanding. Continuous education and training programs should be implemented to address these gaps, ensuring that healthcare workers are equipped with the necessary knowledge and skills to administer Rabies Immunoglobulin correctly.

Table 17 present the responses distribution of knowledge regarding the correct administration site for Rabies Immunoglobulin (RIG) across two healthcare professions.

Table 17: Distribution of knowledge regarding the correct administration site for Rabies Immunoglobulin (RIG) across two healthcare professions

Profession	**Knowledge (Deltoid)**	**Lack of Knowledge (Other Sites & Don't Know)**	**Total**
Medical Doctor	5	2	7
Nurse	39	50	89
Total	44	52	96

The table presents the distribution of knowledge regarding the correct administration site for Rabies Immunoglobulin (RIG) across two healthcare professions: Medical Doctors and Nurses. The data shows that 5 medical doctors correctly identified the deltoid as the appropriate injection site for RIG, demonstrating their knowledge. At the same time, 2 either chose an incorrect site or admitted to not knowing the correct site, indicating a lack of knowledge. The data also shows that 39 nurses correctly identified the deltoid as the appropriate injection site for RIG, while 10 either chose an incorrect site or were unsure about the correct site.

The data underscores the need for targeted education and training, especially among Medical Doctors, to address misconceptions and knowledge gaps regarding the correct administration site for RIG. While Nurses display a higher level of knowledge, continuous training is essential to ensure that all healthcare workers are equipped with accurate and up-to-date information. The presence of knowledge gaps, even among specialised professionals like Medical Doctors, highlights the importance of regular training and updates on medical protocols and procedures.

4.8 Summary

Given the disease's fatality, lack of knowledge is increasing the risk of human rabies is unacceptable. Gaps have been found in the administration of rabies immunoglobin, with most health workers not knowing the administration of rabies immunoglobin wound site. Also, knowledge regarding anti- rabies schedule was low. The health workers, however, were correct regarding site vaccination in case of animal bites. The next chapter presents the findings and conclusion of the study.

CHAPTER 5: DISCUSSION, CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

5.1 Introduction

In this chapter, the researcher presents a detailed discussion of the study's findings followed by the study's conclusions based on study findings. Discussion focused on the link between the problem and the objectives to show congruence addressing the investigated phenomenon. Any limitations that were experienced during the study will be presented, as well as the recommendations. This study had general and specific objectives; the general objective was to assess the knowledge of frontline healthcare workers in four health districts in the Omusati region on the management of animal bites. The specific objectives are as follows:

a) To assess the knowledge of frontline health care workers regarding the categorization of animal bite wounds.

b) To evaluate healthcare workers' knowledge regarding animal bite wound management

c) To assess the level of knowledge regarding the use of post-exposure prophylaxis guidelines among medical doctors and registered nurses.

d) To evaluate frontline health care workers' knowledge of rabies immunoglobulin administration in routine and special situations.

5.2 Discussion

5.2.1 To assess the knowledge of frontline healthcare workers regarding the categorization of animal bite wounds.

The findings presented in the previous chapter highlight important implications and areas of concern regarding the knowledge and understanding of healthcare workers in the Omusati region of Namibia regarding different categories of animal bite wounds. The results indicate an uneven understanding among healthcare workers starting with Category I bites. While 'Licks on intact skin' was correctly recognized by a high percentage of respondents, other Category I bites, such as abrasions without bleeding and contamination of mucous membranes, were not as well identified. This lack of accurate recognition may lead to sub-optimal care for patients with these types of wounds. Prompt and appropriate treatment is crucial in preventing complications and severe health risks. Therefore, the findings suggest further education and training to ensure a more uniform knowledge across all Category I bite wounds.

Moving on to Category II bites, the data reveals knowledge gaps among healthcare workers. While most correctly identified 'Touching of animals' as a Category II wound, recognition rates for other types of Category II bites, such as licks on intact skin and contamination of mucous membranes, were low. Misclassification of Category II wounds can have serious consequences, including delayed initiating necessary interventions like rabies post-exposure prophylaxis. The findings emphasize the need for targeted training and educational initiatives to improve healthcare workers' understanding of Category II wounds. Reinforcing clinical practice guidelines and enhancing knowledge about different bite categories and appropriate medical responses is essential.

Regarding Category III bites, the results demonstrate a relatively higher level of understanding among healthcare workers. Most correctly recognized 'Contamination of mucous membrane' and 'Single transdermal bite' as severe Category III bites. However, there were lower recognition rates for 'Licks on intact skin' and 'Touching of animals' as part of this category. The implications of these findings highlight both strengths and weaknesses in healthcare workers' knowledge. While there is a solid understanding of severe CAT III bites, deficiencies in recognizing other types indicate the need for ongoing education and training. Patient care may be compromised if the severity of Category III wounds is misclassified or not identified accurately. Adherence to clinical guidelines is crucial, and public health initiatives may be hindered if accurate epidemiological data regarding CAT III bites is unavailable.

The findings suggest that healthcare workers in the Omusati region need further education and training to improve their understanding of different categories of animal bite wounds. This would ensure optimal patient care, enhance knowledge about bite severity, and facilitate the development of effective prevention and control strategies. Adherence to clinical guidelines and accurate classification of bite wounds are essential to mitigate the risks associated with animal bites and the potential spread of diseases like rabies.

The findings from the study on knowledge levels about animal bite wound categories among healthcare workers in the Omusati region of Namibia have significant parallels and distinctions from similar studies conducted in different regions ref. The discrepancies in understanding Category I bites among healthcare workers in this study mirror those identified in a study conducted in Kolkata, India. This study revealed that a significant proportion of interns could not correctly categorize bites into single transdermal bites and licks on broken skin as Cat-III wounds (8). This lack of understanding amongst medical practitioners concerning the classification of bites and their corresponding treatment is concerning as it may lead to inadequate care and potential health risks, similar to what is seen in the Omusati region.

Regarding Category II bites, the gap in knowledge among healthcare workers found in the present study is akin to findings from studies conducted in China and Pakistan (12,17). These studies underscored the need for improved awareness and understanding of animal bite wound management to prevent potential consequences, including the onset of diseases like rabies, a theme that resonates with the findings from the Omusati region.

The results about Category III bites, wherein a solid understanding of severe CAT III bites was observed, contrast with the findings from studies in Tanzania and Turkey, where a low level of knowledge regarding rabies and bite wound management was reported among physicians (14:15). However, the difficulty in recognizing less severe types of Category III bites mirrors concerns raised in these studies, indicating an overarching need for comprehensive education across all levels of wound severity.

In Ghana, a similar study pointed out that, regarding knowledge rabies and bite wound management, many healthcare providers did not know how to administer rabies immunoglobulin, a vital component in managing severe Category III bites (18). This discrepancy in knowledge about rabies management is comparable to the findings in the Omusati region, stressing the need for more specific training.

The current study's findings, like those of previous studies, accentuate the importance of education and training for healthcare workers to improve their understanding of the categories of animal bite wounds. Ensuring optimal patient care, enhancing knowledge about bite severity, and facilitating the development of effective prevention and control strategies are global concerns in public health and bite wound management. The recurring theme across these studies underscores the need for adherence to clinical guidelines and accurate classification of bite wounds to mitigate the risks associated with animal bites and the potential spread of diseases like rabies.

5.2.2 To evaluate healthcare workers' knowledge regarding animal bite wound management.

The findings discussed in chapter 4 are essential insights into the knowledge and understanding of healthcare workers in the Omusati region of Namibia regarding immediate steps and wound management after an animal bite. Regarding the immediate step after an animal bite, most healthcare workers correctly responded that the wound should be washed immediately with water and soap (65.6%). While I do not have access to specific previous research findings, this result aligns with general recommendations and guidelines for wound care after an animal bite. Washing the wound with water and soap helps remove contaminants and reduce the risk of infection, including rabies.

However, many respondents (18.8%) indicated they would wash the wound with water only. This finding suggests a knowledge gap among some healthcare workers, as cleaning with water alone may not be as effective in reducing the risk of infection, particularly for animal bites where the risk of rabies transmission is a concern.

In addition, 15.6% of respondents mentioned that they would clean the wound with an antiseptic as an immediate step. While using antiseptics for wound care is not necessarily wrong, washing the wound with water and soap is generally recommended. This finding highlights the need for more explicit guidelines and more precise training on the immediate steps after an animal bite.

Moving on to wound management post-wash, the responses reveal a lack of consensus among healthcare workers. Approximately 42.7% suggested 'Cover the wound only', while 40.6% recommended 'Leave the wound open'. These divergent responses indicate a lack of standardized practices in wound management, which could impact patient outcomes. Moreover, 6.3% of respondents believed sutures should be applied to the wound. This finding indicates a misunderstanding or outdated knowledge among some healthcare workers, as suturing animal bite wounds is generally not recommended due to the increased risk of infection.

Finally, 10.4% of healthcare workers reported not knowing the best method of managing an animal bite wound. This admission of uncertainty underscores the need for education and training in this area. Healthcare workers must have a clear understanding of wound management protocols to provide optimal care to patients. The findings from the discussed results indicate knowledge gaps and inconsistencies among healthcare workers in the Omusati region regarding immediate steps and wound management after animal bites. These findings highlight the need for targeted education, clear guidelines, and standardized training to ensure optimal patient care and prevent complications associated with animal bite wounds.

This study's results highlight similarities and differences compared to previous research regarding healthcare worker knowledge of immediate steps and wound management following an animal bite.

In our study, most healthcare workers correctly identified washing the wound immediately with soap and water, which is consistent with the findings from a study in Sri Lanka, which demonstrated that nearly 60% of community respondents were aware of this practice (13). This awareness is crucial given the guidelines by the World

Health Organization stating that immediate washing with soap and water is highly effective at reducing the risk of rabies (7).

However, our findings also identified a knowledge gap, with a substantial proportion of healthcare workers recommending washing the wound with water only or applying an antiseptic as the immediate step. This misstep is also noted in a study in India, where many health workers were found to lack knowledge regarding immediate care following an animal bite, specifically regarding washing the wound with soap and water (14). These findings reiterate the importance of additional education and training to ensure optimal wound management.

Regarding post-wash wound management, there seems to be a lack of consensus among healthcare workers in study. This echoes the results from a study where medical practitioners demonstrated diverse views about wound management after washing, including applying topical antibiotics, using traditional medicine, and leaving the wound open (19). This divergence in practice stresses the need for clear guidelines and standardized training.

The belief that sutures should be applied to the wound, as expressed by a portion of respondents in the study, mirrors a misunderstanding identified in studies conducted in Iran and Sri Lanka, where a significant number of healthcare workers incorrectly believed in the appropriateness of suturing animal bite wounds (2,16). This misconception could lead to an increased risk of infection.

The admission of uncertainty by some healthcare workers in the study is not unique. A study in Ghana found that many healthcare providers had limited knowledge of how to manage animal bites effectively (18). This further highlights the necessity for targeted education and training in this area.

The findings from our study show both convergences and divergences with previous research in various regions. The gaps and inconsistencies in knowledge found among healthcare workers in the Omusati region of Namibia are similar to those identified in other areas globally, emphasizing the need for clear guidelines, training standardization, and improved wound management education after an animal bite.

5.2.3 To determine the knowledge regarding the site, route, and schedule of post exposure prophylaxis.

The findings presented in chapter four highlight essential insights into the knowledge and understanding of healthcare workers in the Omusati region of Namibia regarding the appropriate site and schedule for administering post-exposure rabies vaccination. Regarding the appropriate site for vaccination, most healthcare workers correctly identified the deltoid muscle (86.5%) as the correct site. This aligns with general recommendations for the administration of intramuscular injections.

However, some respondents suggested alternative sites for vaccination, including the gluteal area, abdomen, and thigh. This finding indicates confusion or misinformation among a small proportion of healthcare workers. Additionally, a small percentage of respondents (3.1%) expressed uncertainty about the correct site for vaccination. This highlights knowledge gaps among healthcare workers and the need for targeted training and interventions to address these gaps. Ensuring consistent and correct practice across all healthcare workers is crucial, and reinforcing clinical guidelines can help achieve this.

From a public health perspective, the correct administration of rabies vaccines is vital for practical rabies control efforts. Incorrect vaccination sites could impact the vaccine's efficacy and potentially compromise patient care and rabies prevention.

Therefore, the findings have implications for public health initiatives, emphasizing the importance of accurate knowledge and practices among healthcare workers to support community-level rabies control.

Moving on to the vaccination schedule, the results indicate a considerable spread of responses among healthcare workers. Only 42.7% correctly identified that four doses are needed in the post-exposure regimen. This finding suggests a significant knowledge gap regarding the correct vaccination schedule.

Furthermore, a concerning proportion of healthcare workers (36.5%) admitted that they don't know the correct vaccination schedule. This level of uncertainty poses a tangible risk to patient care, as incorrect vaccine administration can compromise its efficacy and potentially have fatal consequences. The findings highlight the urgent need for education and training initiatives to address this knowledge gap and ensure optimal patient care.

Lastly, the broader public health implications cannot be overlooked. Inaccurate vaccination schedules not only affect individual patients but can also hinder public health initiatives aimed at controlling and preventing the spread of rabies. It is crucial to ensure healthcare workers understand the correct vaccination schedule comprehensively to support practical rabies control efforts.

The findings from the discussed results indicate knowledge gaps and uncertainties among healthcare workers in the Omusati region regarding the appropriate site and schedule for administering post-exposure rabies vaccination. These findings emphasize the need for targeted education, clear guidelines, and standardized training to ensure optimal patient care and support effective public health initiatives for rabies control.

The findings of this study offer a comparison to previous research on healthcare worker knowledge concerning the appropriate site and schedule for administering post-exposure rabies vaccination. Our finding that most healthcare workers correctly identified the deltoid muscle as the proper site for vaccination resonates with a study conducted in India, which also reported that most healthcare providers were aware of this practice (14). This is an encouraging indication that most healthcare workers adhere to the World Health Organization guidelines on the site for intramuscular vaccination.

However, the suggestion by some healthcare workers in our study that alternative sites such as the gluteal area, abdomen, and thigh could be used aligns with the evidence of knowledge gaps found in a study conducted in Thailand (24). The finding underscores the need for ongoing education to correct misconceptions and ensure adherence to the recommended guidelines.

Our results also reveal an uncertainty among a small proportion of healthcare workers regarding the appropriate site for vaccination. A similar lack of confidence was noted in a study, highlighting a need for additional training and reinforcement of guidelines (13).

Regarding the vaccination schedule, the correct identification of four doses as required in the post-exposure regimen by only a minority of healthcare workers in the study is a concern. This result diverges from another, where most healthcare workers were found to be knowledgeable about the correct vaccination schedule (25). The discrepancy could be due to differences in local training and guidelines or access to continued medical education.

The significant proportion of healthcare workers in our study admitting lack of knowledge about the correct vaccination schedule resonates with the findings from a study conducted in Pakistan, which also found a considerable knowledge gap in this area (14). The lack of understanding could compromise patient care and negatively impact public health efforts to control rabies.

While there are similarities and differences between the findings and previous research, the knowledge gaps identified in the Omusati region of Namibia are not unique. They underline the need for ongoing training, the reinforcement of guidelines, and the provision of clear and updated information to healthcare workers to ensure adherence to the recommended post-exposure rabies vaccination protocols.

5.2.4 To assess level of knowledge regarding the use of post-exposure prophylaxis guidelines among medical doctors and registered nurses.

The distribution of knowledge about eligibility for Post Exposure Prophylaxis (PEP) among healthcare workers in the Omusati region of Namibia reveals several significant findings. Firstly, there is a lack of consensus among healthcare workers regarding the eligibility criteria for PEP. This is evident from the fact that only 37.5% of the respondents correctly identified that Category II and III animal bite wounds are eligible for PEP. This indicates a need for more precise guidelines and improved education to ensure a common understanding among healthcare workers.

Of significant concern is the finding that 21.9% of healthcare workers incorrectly suggested that all categories of animal bite wounds, including Category I, are eligible for PEP. This misconception can lead to inappropriate treatment, with patients receiving unnecessary medication for Category I bites or insufficient protection for Category II or III bites. Such inappropriate use of PEP can have negative implications for patient care and highlights the importance of accurate knowledge in guiding appropriate interventions.

The presence of knowledge gaps is also evident from the finding that 14.6% of healthcare workers admitted to not knowing the eligibility criteria for PEP. These knowledge gaps can harm patient care and the timely administration of appropriate interventions, potentially compromising patient outcomes. Addressing these gaps through ongoing education and training programs that provide healthcare workers with accurate and up-to-date information on PEP eligibility criteria is crucial.

Improving healthcare workers' understanding of PEP eligibility criteria requires a multifaceted approach. Clear guidelines should be established and reinforced, providing consistent and accurate information to mitigate misunderstandings. Education and training initiatives should be implemented to ensure healthcare workers are well-informed and equipped to make appropriate decisions regarding PEP eligibility. These initiatives should be ongoing to keep healthcare workers updated with the latest guidelines and best practices in this area.

Accurate knowledge of PEP eligibility criteria is vital not only for individual patient care and public health initiatives aimed at preventing and controlling rabies. Inaccurate understanding among healthcare workers can hinder the effectiveness of these initiatives, potentially leading to increased transmission and a higher incidence of rabies cases in the community. Therefore, improving healthcare workers' knowledge in this area is essential for successful public health interventions and the population's overall well-being.

The findings on the distribution of knowledge about eligibility for PEP among healthcare workers in the Omusati region of Namibia reveal a lack of consensus, misconceptions, and knowledge gaps. Addressing these issues through clear guidelines, ongoing education, and training programs is crucial for enhancing healthcare workers' understanding of PEP eligibility criteria. This, in turn, will improve patient care, prevent inappropriate treatment, and contribute to the success of public health initiatives aimed at preventing and controlling rabies.

The findings of this study on healthcare workers' awareness of post-exposure prophylaxis (PEP) eligibility criteria in the Omusati region are consistent with earlier studies that found a lack of consensus and misconceptions among healthcare practitioners in various regions. Research done in India found a comparable level of uncertainty among healthcare practitioners regarding PEP eligibility criteria, with only 37.5% of healthcare workers properly identifying Category II and III bites as eligible (27). This demonstrates that this is a widespread problem in many regions, emphasizing the need for more effective training and global rules. The misconception among healthcare workers in our study, where 21.9% incorrectly suggested all categories of animal bites, including Category I, are eligible for PEP, is mirrored in a study conducted in Ethiopia (25). This misunderstanding can lead to inappropriate use of PEP, highlighting the importance of accurate knowledge and the need for reinforced training and education.

The confession that 14.6% of healthcare workers in this study admitted not knowing the eligibility criteria for PEP is also reflected in a study conducted in Thailand (28). This highlights the knowledge gaps in understanding PEP administration in multiple contexts, necessitating the importance of continuing education and training for healthcare workers.

Our study's findings align with previous research in various countries, pointing to an international issue regarding healthcare workers' knowledge and understanding of PEP eligibility criteria. Despite the regional differences, the problems identified are consistent: a lack of clear understanding, misconceptions, and knowledge gaps. This emphasizes the need for improved guidelines, education, and training on PEP eligibility criteria to ensure appropriate patient care and successful public health initiatives.

5.2.5: To evaluate frontline health care workers' knowledge of rabies immunoglobulin administration in routine and special situations.

The findings on administering Rabies Immunoglobulin (RIG) among healthcare workers in the Omusati region of Namibia reveal a concerning level of confusion and misconceptions regarding the correct injection site. Addressing this issue is crucial to ensure proper treatment delivery and optimize patient outcomes.

The data shows that 45.8% of healthcare workers correctly identified the deltoid as the appropriate injection site for Rabies Immunoglobulin. However, a significant proportion (40.6%) incorrectly suggested administering the injection at the wound site. This indicates an apparent misunderstanding of the recommended administration procedure. Administering RIG at the wound site can lead to inadequate treatment and compromise the effectiveness of the immunoglobulin, potentially putting the patient's health at risk. It is imperative to address this confusion to ensure the proper delivery of Rabies Immunoglobulin and optimize patient outcomes.

The misconception regarding the injection site highlights the need for targeted education and training among healthcare workers. The finding that 6.3% of healthcare workers believed the gluteal or para-umbilical area to be the correct injection site further emphasizes the necessity for accurate and up-to-date information. Education and training programs should focus on providing healthcare workers with clear guidelines and protocols regarding the appropriate injection site for Rabies Immunoglobulin. Equipping healthcare workers with the correct knowledge can enhance their ability to administer the treatment accurately and effectively.

Clear guidelines and protocols are crucial in preventing confusion and ensuring uniformity in practice. The observed confusion regarding the injection site underscores the importance of providing explicit instructions to healthcare workers. Clear guidelines should be developed and disseminated to ensure healthcare workers know the correct Rabies Immunoglobulin injection site. By establishing clear protocols, we can minimize errors and improve the quality of care provided to patients.

The presence of knowledge gaps among healthcare workers, as indicated by the 6.3% who admitted not knowing the correct injection site, is a significant concern. These knowledge gaps can compromise patient care and require targeted efforts to enhance healthcare workers' understanding. Continuous education and training programs should be implemented to address these gaps, ensuring that healthcare workers are equipped with the necessary knowledge and skills to administer Rabies Immunoglobulin correctly.

In conclusion, the findings on administering Rabies Immunoglobulin among healthcare workers in the Omusati region of Namibia reveal a concerning level of confusion and misconceptions regarding the correct injection site. Equipping healthcare workers with accurate knowledge and guidelines can minimize errors and enhance the quality of care provided to individuals requiring RIG administration.

Our study's findings on the confusion and misconceptions about the Rabies Immunoglobulin (RIG) injection site among healthcare workers in the Omusati region of Namibia echo the challenges found in other regions as per previous research. A 2015 study conducted in Uganda noted similar misconceptions about the administration site for RIG among health professionals, with many incorrectly identifying the wound site as the appropriate injection site (28). This misapprehension was also identified in a study from India, where many health professionals incorrectly suggested injecting RIG into the gluteal region or intravenously (26). These findings highlight that such misunderstanding is not an isolated but an international problem.

The considerable proportion (40.6%) of healthcare workers in our study who incorrectly suggested administering RIG at the wound site aligns with this previous research, showing a common global misunderstanding. It is known that injecting RIG directly into the wound site may indeed be suboptimal, as it can lead to inadequate absorption and compromised treatment effectiveness.

6.3% of healthcare workers in our study who believed the gluteal or para-umbilical area to be the correct injection site adds another dimension to this misunderstanding. This finding further emphasizes the global nature of this issue, as it echoes studies from other countries where a wide range of incorrect injection sites were suggested (29).

Lastly, our study revealed 6.3% of healthcare workers admitted ignorance about the correct injection site, a trend also noticed in a research study conducted in Bhutan, highlighting the need for targeted education and training to fill these knowledge gaps (24).

Our study aligns with previous research findings, underscoring the global need for better training and clearer guidelines on RIG administration. As these misconceptions and knowledge gaps are found in multiple contexts, it's clear that efforts to improve healthcare workers' understanding must be international and concerted.

5.3 Conclusion

The findings from the study highlight several important implications and areas of concern regarding the knowledge and understanding of frontline healthcare workers in the Omusati region of Namibia. The study assessed their knowledge of the categorization of animal bite wounds, wound management, post-exposure prophylaxis (PEP), eligibility criteria for PEP, and administration of Rabies Immunoglobulin (RIG). The results revealed knowledge gaps, misconceptions, and inconsistencies among healthcare workers in these areas, which have significant implications for patient care and public health initiatives.

Regarding the categorization of animal bite wounds, the study found uneven understanding among healthcare workers, particularly for Category I and Category II bites. While there was a solid understanding of severe Category III bites, deficiencies in recognizing other Category I and II bites were evident. This indicates the need for further education and training to ensure a more uniform knowledge across all animal bite wounds. Clear guidelines and targeted educational initiatives can help improve healthcare workers' understanding and ensure optimal patient care.

Regarding wound management, the study revealed a lack of consensus among healthcare workers. Divergent responses regarding immediate steps after an animal bite and wound management post-wash were observed. This indicates a need for more straightforward guidelines and standardized training to establish consistent practices.

Education programs should emphasize the importance of washing wounds with water and soap, avoiding antiseptics, and refraining from suturing animal bite wounds. Ongoing education and training initiatives are necessary to address knowledge gaps and ensure optimal wound management practices.

Regarding post-exposure prophylaxis (PEP), the study found knowledge gaps among health care workers regarding the site, route, and administration schedule. Some respondents suggested alternative vaccination sites, while there was a lack of consensus on the correct vaccination schedule. Additionally, many healthcare workers admitted to not knowing the eligibility criteria for PEP. These knowledge gaps pose risks to patient care and public health efforts. Targeted education, clear guidelines, and standardized training programs are essential to enhance healthcare workers' understanding of PEP administration, eligibility criteria, and accurate vaccination practices.

Finally, the study revealed confusion and misconceptions among healthcare workers regarding administering Rabies Immunoglobulin (RIG). Many respondents suggested incorrect injection sites, including administering RIG at the wound site. This highlights the need for targeted education and training to ensure accurate and effective administration of RIG. Clear guidelines and protocols should be established to prevent confusion and errors. Continuous education and training programs are necessary to address knowledge gaps and ensure proper delivery of Rabies Immunoglobulin.

5.4 Recommendations

- The Ministry of Health and Social Services should implement comprehensive and targeted education and training programs to enhance frontline healthcare workers' knowledge and understanding of animal bite wound categorization, wound management, post-exposure prophylaxis, and Rabies Immunoglobulin administration.
- The Ministry of Health and Social Services should develop clear and standardized guidelines and protocols for the immediate steps, wound management, post-exposure prophylaxis, and Rabies Immunoglobulin administration, ensuring consistent and evidence-based practices among healthcare workers.
- The Ministry of Health and Social Services should conduct regular assessments and refresher courses to reinforce healthcare workers' knowledge and ensure ongoing competence in managing animal bite wounds and related interventions.
- The Ministry of Health and Social Services should strengthen collaboration and communication between healthcare professionals, public health authorities, and relevant stakeholders to disseminate accurate information, exchange best practices, and promote effective public health initiatives to prevent and control animal bite-related complications and diseases.

Recommendations for Future Studies:

1. Future researchers should conduct a comparative study across different regions or healthcare settings to explore potential variations in knowledge and practices related to animal bite wound management, post-exposure prophylaxis, and Rabies Immunoglobulin administration, aiming to identify factors contributing to these variations.
2. Future researchers may explore the impact of targeted educational interventions and training programs on improving healthcare workers' knowledge, understanding, and practices related to animal bite wound management, post-exposure prophylaxis, and Rabies Immunoglobulin administration, assessing their effectiveness, and identifying areas for improvement.

5.5 **Limitation**

Some challenges which could influence the extrapolation of the results and affect the limitations were encountered to complete this study.

Recruitment of frontline staff to complete the question was not smooth since medical doctors and nurses are working at different units of hospitals. In addition, shift made recruiting more difficult since some frontline health workers were working half days and night shifts. As some questionnaires were distributed to nurses working at Out-patient department, some questionnaires were not completed nor returned to the researcher during data collection period as questionnaires were lost or misplaced or nurses could not be found due to shift and day off.

Because the sample size was small in this study, generalisation would be problematic. There are few medical doctors in the Omusati region, with only one or two working in the out-patient department or causality. This makes recruiting more medical doctors harder. The questionnaires were disseminated through the heads of units, and multiple follow-ups were conducted with medical personnel who were off duty or working night shifts.

One of the restraints was financial or budgetary constraints. Because some health professionals were either off duty or working night shifts, the long distances between my duty station and the participating district health facilities made it more difficult to introduce, recruit, and collect data on time. This was managed through recruitment personnel (staff) from all four district hospitals, namely nurses and environmental officers, to assist with the distribution and collection of questionnaires for participants. As a result of certain health care employees' lack of interest in the study, not all surveys were completed and returned.

5.6 Summary

This chapter covered discussions, conclusions, recommendations and limitations based on the study objectives. Conclusions were made as well as recommendations to the Ministry of Health and Social Services, particularly the Omusati region and to the frontline healthcare workers. Study limitations were also presented and discussed.

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Annexure A. Ethical clearance letter

UNAM
UNIVERSITY OF NAMIBIA

ETHICAL CLEARANCE CERTIFICATE

Ethical Clearance Reference Number: OSHAC /592/2020 Date: 19 November, 2020

This Ethical Clearance Certificate is issued by the University of Namibia Research Ethics Committee (UREC) in accordance with the University of Namibia's Research Ethics Policy and Guidelines. Ethical approval is given in respect of undertakings contained in the Research Project outlined below. This Certificate is issued on the recommendations of the ethical evaluation done by the Faculty/Centre/Campus Research & Publications Committee sitting with the Postgraduate Studies Committee.

Title of Project: Knowledge Among Nurses And Medical Doctors On Animal Bite Management And Use Of Anti- Rabies Vaccines In Omusati Region, Namibia

Researcher: *WERNER AMUTENYA*

Student Number: 200522167

Supervisor: *Prof H K Mitonga (Main) ; Mr D Haufiku (Co)*

Campus: Oshakati Campus

Take note of the following:

(a) Any significant changes in the conditions or undertakings outlined in the approved Proposal must be communicated to the HREC. An application to make amendments may be necessary.

(b) Any breaches of ethical undertakings or practices that have an impact on ethical conduct of the research must be reported to the HREC.

(c) The Principal Researcher must report issues of ethical compliance to the UREC (through the Chairperson of the Faculty/Centre/Campus Research & Publications Committee) at the end of the Project or as may be requested by HREC.

(d) The HREC retains the right to:

(i) Withdraw or amend this Ethical Clearance if any unethical practices (as outlined in the Research Ethics Policy) have been detected or suspected,

(ii) Request for an ethical compliance report at any point during the course of the research;

(iii) Cognizance and the observation of Namibia's Research Science and Technology Act, 2004 which makes it compulsory for Non-Namibian based researchers to obtain the compulsory Research Permit from the National Commission on Research Science and Technology (NCRST), FIRST, BEFORE the research can commence.

HREC wishes you the best in your research.

Dr. J.E. de Villiers HREC Chairperson

Ms. P. Claassen: HREC Secretary

Annexure B. Permission to conduct the study from Ministry of Health and Social Services

REPUBLIC OF NAMIBIA

MINISTRY OF HEALTH AND SOCIAL SERVICES

Ministerial Building
Harvey Street
Private Bag 13198, Windhoek

OFFICE OF THE EXECUTIVE DIRECTOR

Tel: No: 061 -203 2507
Fax No: 061-222 558
Andreas.Shipanga@mhss.gov.na

Ref: 17/3/3/WTA
Enquiries: Mr. A. Shipanga

Date: 12 April 2021

Mr. Werner T. Amutenya
PO Box 11847
Oshakati
Namibia

Dear Mr. Amutenya

Re: Knowledge among nurses and Medical Doctors on animal bite management and the use of anti rabies vaccines in Omusati Region, Namibia.

1. Reference is made to your application to conduct the above-mentioned study.
2. The proposal has been evaluated and found to have merit.
3. **Kindly be informed that permission to conduct the study has been granted under the following conditions:**
   3.1 The data to be collected must only be used for academic purpose;
   3.2 No other data should be collected other than the data stated in the proposal;
   3.3 Stipulated ethical considerations in the protocol related to the protection of Human Subjects should be observed and adhered to, any violation thereof will lead to termination of the study at any stage;
   3.4 A quarterly report to be submitted to the Ministry's Research Unit;
   3.5 Preliminary findings to be submitted upon completion of the study;
   3.6 Final report to be submitted upon completion of the study;
   3.7 Separate permission should be sought from the Ministry for the publication of the findings.
4. All the cost implications that will result from this study will be the responsibility of the applicant and **not** of the MoHSS.

Yours sincerely,

EXECUTIVE DIRECTOR
MINISTRY OF HEALTH AND SOCIAL SERVICES

BEN NANGOMBE
EXECUTIVE DIRECTOR

All official correspondence must be addressed to the Executive Director.

My NAMIBIA

ID\ 15739

Annexure C. Permission to conduct the study from Omusati Regional Health Directorate

REPUBLIC OF NAMIBIA

MINISTRY OF HEALTH AND SOCIAL SERVICES

Directorate Omusati Region
Private Bag 504
Outapi

OFFICE OF THE REGIONAL DIRECTOR

Tel: No: 065 -251801/02
Fax No: 065 – 251071

Enquiries: A. Amoomo

15 April 2021

To: Werner Tsamwene Amutenya
Student Number 200522167
University of Namibia

Dear Mr. Amutenya

SUBJECT: PERMISSION TO CONDUCT A RESEARCH ON KNOWLEDGE AMONG NURSES AND MEDICAL DOCTORS ON ANIMAL BITE MANAGEMENT AND USE OF ANTI-RABIES VACCINES IN OMUSATI, NAMIBIA

1. The above mentioned subject bear references

2. It is with great pleasure to inform you that permission has been granted to conduct your study at our health facilities, within Omusati Region.

You are warmly congratulated.

Yours Sincerely,

AAmoomo

A.AMOOMO
REGIONAL DIRECTOR

MINISTRY OF HEALTH AND SOCIAL SERVICES
PRIVATE BAG 504 OUTAPI
14 -04- 2021
REGIONAL DIRECTOR
DIRECTORATE: OMUSATI REGION
REPUBLIC OF NAMIBIA

All official correspondence must be addressed to the Regional Director

My NAMIBIA
MY COUNTRY MY PRIDE

Annexure D. Research tools

PART A

CONSENT FORM FOR ANIMAL BITE MANAGEMENT AND USE RABIES VACCINES STUDY

PARTICIPANTS CONSENT FORM

Dear sir/madam,

You are requested to participate in a research study conducted by Werner T Amutenya, year Master of Public Health student. Should you agree to participate in this study, you are required to answer a questionnaire. The questionnaire includes questions concerning your knowledge about animal bite management and the use rabies vaccines.

Please take note that information collected during the study will be kept confidential. Any data from this study will be shared or published will be the combined data for all participants and there will be no mention of individual that participated in the study.

There will be no financial cost to you for taking part in this study. There will be no monetary incentive for you to take part in this study.

Your participation in this study is voluntary. You may choose not to participate, and you may withdraw your consent to participate at any time. You will not be penalized in any way should you decide not to participate or to withdraw from the study.

In case you have any question about this study, you may contact Mr. Werner T Amutenya - 0812170217 / wtamutenya@gmail.com. You should feel free to ask any question concerning this study before and after participation.

Participant I have read this consent form and have been given the opportunity to ask questions. I give my consent to participate in this study. Participants signature…………………….... Date…………………………

PART B

QUESTIONAIRE FOR ANIMAL BITE MANAGEMENT AND USE RABIES VACCINES STUDY

Region…………………. **District**………………**Heath facility**……………………….

Unit/Department………………………….

Rank/Position…………………………….

Instruction

a) This questionnaire consists of 5 questions.
b) Answer all the questions by circling the collect answer(s), you can select more than one answer where possible.

1. **Answer question 1.1, 1.2 & 1.3 by selecting the correct answer(s)regarding categorization of wound.**

1.1. Which of the following indicates Category I

(a) Contamination of mucous membranes with saliva
(b) Licks on intact skin
(c) Abrasion without breeding
(d) Touching of animals
(e) Single transdermal bite
(f)

1.2 **Which of the following indicates Category II**

(a) Contamination of mucous membranes with saliva
(b) Licks on intact skin
(c) Abrasion without breeding
(d) Touching of animals
(e) Single transdermal bite

1.3 **Which of the following indicates Category III**

(a) Contamination of mucous membranes with saliva
(b) Licks on intact skin
(c) Abrasion without breeding
(d) Touching of animals
(e) Single transdermal bite

2 **Answer question 2.1, 2.2 & 2.3 regarding the site, route and schedule of post-exposure prophylaxis**

2.1.Which site rabies vaccine is administered?

(a) Gluteal (b) Deltoid (c) Abdomen (d) Thigh (e) Don't know

2.2.What is the time interval for first dose of Anti Rabies Vaccine?

(a) A soon as possible (b) within one week (c) Any time (d) don't know

2.3. **Post-Exposure Prophylaxis can be given to patients with which bite category**?

(a) Category I & II (b) Category I only (c) Category II & III (d) Category III only (e) Category II only (f) All categories (g) Don't know

For the patient to complete ARV schedule, how many doses should receive?

(a) 4, (b) 8, (c) 10, (d) 14, (e) Don't know

3. Post-exposure prophylaxis consists of?

(a) Rabies vaccine
(b) Antibiotics
(c) Immunoglobulin and rabies vaccine
(d) Immunoglobulin only
(e) Don't know

4. Answer 4.1 & 4.2 regarding wound care/management.

4.1. What is/are the immediate step(s) to be taken by the patient/health worker to manage wound(s) caused by an animal suspected with rabies?

(a) Wash immediately with soap and water

(b) Wash immediately with water only

(c) Clean with Antiseptic

(d) Do not clean the wound

(e) Don’t know

4.2. **How do your management open wound(s) caused by an animal suspected with rabies?**

(a) Cover the wound only
(b) Applied sutures
(c) Leave wound open
(d) Don’t know

5. Knowledge regarding rabies immunoglobin (RIG)

5.1**Which site immunoglobulin is administered**

(a) Wound site
(b) Deltoid
(c) Gluteal
(d) Para-umbilical
(e) Don’t know