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# NATIONAL ACTION PLAN ON RABIES IN PAKISTAN



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## LIST OF ABBREVIATIONS

FAO: Food and Agriculture Organization

USAID: United States Agency of International Development

FGD: Focus Group Discussion

L & DDD: Livestock and Dairy Development Department

P & D: Planning and Development Department of Punjab

NVivo: A software for analyzing qualitative data

SPSS: A software for analyzing quantitative data

HC: Hierarchical Chart

GDP: Gross Domestic Product

PQ: Probing Question

TOR: Terms of Reference

SDGs: Sustainable Development Goals



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## Executive Summary

Rabies is considered one of the major health hazard problems in Pakistan since long. The reports show that the cases of Rabies are increasing gradually and bringing a lot of miseries to people of Pakistan in almost all provinces. There is a dire need to control Rabies through a collective and gradual approach. In this regard, FAO took lead and envisaged a project to prepare the National Action Plan for Rabies at Pakistan level.

This report comprehensively presents the overall scenario of Rabies in Pakistan and various measures taken for controlling it in the form of a brief account of relevant promulgated acts/legislations/policy frameworks, designed and implemented in various provinces of Pakistan. Accordingly, there has been some measures, which were taken in the past but due to lack of coordination these could not reach up to the required compliance and hence results. Hence, the imminent menace of Rabies is gradually increasing in Pakistan. This report describes these ground realities in detail based on collected data from all the relevant stake holders.

The main purpose of this report was to review of all measures taken in the past, observe the recent situation and develop a national action plan on Rabies. For this purpose, a sequential exploratory mixed method study was designed. The data was collected from all the possible stakeholders including veterinary professionals, health professionals, lawyers, officials of district municipalities, officials of NGOs, common communities, and policymakers from all provinces of Pakistan. In the first qualitative stage, 7 Focus Group Discussions (FGDs) and few interviews were conducted with given experts based on snow ball sampling technique. In the second quantitative stage, a total of 300 questionnaires were get filled from respondents. The qualitative data was analyzed through NVivo software by using thematic analysis technique and the results are presented as themes supported with result outputs from NVivo software including word frequency tables, word cloud, word trees and HCs (hierarchical charts). Likewise, the quantitative data were analyzed through SPSS software and results are presented as charts and tables.

It was found that the problem of Rabies and its negative consequences are increasing gradually in almost all provinces of Pakistan. It was found that, in the past, some





measures were taken by various organizations but these were lacking a collaborative approach. Thus, these measures kept on working in silos and resulted in partial but ephemeral success in small pockets in various provinces. Likewise, it was found that the people have been facing a lot of hardships in getting either treatment or preventive facilities from Government facilities. Moreover, it was also found that the previous approach of killing dogs with conventional approaches like chemicals were condemned at all levels and latest humane approaches were recommended to be adopted. The results show that there is a dire need of a national action plan with a collaborative approach to curb the menace of Rabies from Pakistan. After field work, the preliminary draft was made and shared with all the relevant stake holders in a national webinar for getting inputs on prepared draft. After incorporating the feedback/inputs from this webinar, the National action plan on Rabies was finalized which is the part of this report.

There are several components of a national action plan to control any infectious disease. For national action plan to control Rabies in Pakistan, we have proposed important components that include coordination, communication, legal framework, human dog bite case management, pet dog vaccination and registration, stray dog population management, Rabies transmission from other animals, research and diagnosis, improved surveillance, capacity building and stakeholder involvement, It is expected that this designed National Action Plan on Rabies will be approved by the concerned competent authorities and will be adopted at national level. Furthermore, it is expected that this national action plan will help to control Rabies from Pakistan gradually and achieve the goal of “zero by 2030” in Pakistan.



## 1 INTRODUCTION

### 1.1 Rabies and its significance

Rabies is a disease of all vertebrates (humans and animals) caused by a virus belonging to the Lyssavirus genus of the Rhabdoviridae family. It is one of the oldest known zoonotic diseases that spreads through close contact with infected saliva via bites or scratches. Dogs are the source of 99 % of human Rabies deaths in this part of the world. Warm-blooded mammals are natural reservoirs of rabies; these include wolves, wild dogs, domestic dogs, cats, weasels, civets, and foxes.

Rabies is a neglected tropical disease of poverty, affecting underprivileged communities and especially children less than 15 years of age (30 - 50% of all exposures) (Cleaveland, Kaare et al. 2006). Rabies is almost always fatal once symptoms develop and it has the highest human case-fatality proportion of any infectious disease (Anderson, Jackson et al. 1981; Ruprecht, Hanlon et al. 2002). Rabies is responsible for an estimated 55,000 to 70,000 deaths globally each year (Hampson, Coudeville et al. 2015; World Health Organization, 2018), 60% of these deaths occur in Asia and 36.4% in Africa, mostly in rural areas due to bites from domestic dogs (Hampson, Coudeville et al. 2015).

Rabies is widely distributed across the globe and endemic in most African and Asian countries. An estimated 59,000 people die of rabies each year with about 95% of human deaths occurring in Asia and Africa. In South Asian countries, only Maldives is free from dog mediated rabies mainly due to its geography. Sri Lanka, Bhutan, and Nepal are categorized in medium category based on dog bites, while Pakistan, India and Bangladesh are listed in excessive category (Chowdhury et al. 2015).

Rabies is endemic in Pakistan but unfortunately had been a neglected disease in the past. There is no systematic data available on the burden of the disease in Pakistan however electronic, print and social media continue to present horrifying stories of dog bite cases as well as rabies death in the country. The estimated occurrence of rabies in Karachi has been 9.6 persons per million (Wasay et al. 2008). According to Salahuddin et al. (2011), rabies is responsible for more than 2000-5000 deaths annually in Pakistan. Stray dogs are the leading cause of human rabies in Pakistan. Until recently, the global response to rabies has been fragmented and uncoordinated. In 2015, the world called for action by setting a goal of zero human dog-mediated rabies deaths by 2030, worldwide. In response to this call, the Food and Agriculture Organization (FAO) of the United Nations, the World Organization for Animal Health (OIE) and the World Health Organization (WHO) signed a Tripartite Memorandum of Understanding signed in May, 2018. WHO, FAO, OIE and the Global Alliance for Rabies Control (GARC) then developed the country-centric Global Strategic



Plan “Zero by 30”? This new rabies-focused partnership—known as United Against Rabies—gave a platform to mobilize resources and leverage existing tools and expertise in a coordinated way.

The Stepwise Approach towards Rabies Elimination (SARE) tool was developed through a joint effort of the Food and Agriculture Organization (FAO) of the United Nations and the Global Alliance for Rabies Control (GARC), to provide a standard mechanism for countries to assess their rabies situation and measure progress in eliminating the disease. Pakistan carried out assessment of rabies prevention and control status in 2018 using the SARE tool. The assessment was carried out by the Ministry of National Health Services Regulations and Coordination in collaboration with key relevant stakeholders. The results showed that Pakistan was at the assessment stage, with 1.5/5 score, on their way to Stage 2 of strategic planning for control and elimination. Similar exercise in 2019 also resulted in score of 1.5/5.0.

## 1.2 Scope of the work

Although Pakistan was signatory to “Elimination of dog mediated rabies by 2030”, no coordinated national program for rabies control was developed in the country. Upon a request from the Animal Husbandry Commissioner (Chief Veterinary Officer of Pakistan), Pakistan was included in the list of countries that were supported by a regional TCP project of FAO (TCP/RAS/3708 entitled Strengthening of capacity towards Rabies elimination in Asia). One of the activities under this project is development of action plan for elimination of dog mediated Rabies in Pakistan. A Letter of Agreement (LOA) was signed with University of Veterinary and Animal Sciences, Lahore to develop this action plan. The TOR of the LOA are:

- Prepare a National Action Plan for the control and elimination of dog mediated Rabies in Pakistan. As provinces / administrative units will be implementing partners, the plan should indicate the activities and financial layout for each unit also.
- Share the National Action Plan with different stakeholders and revise the plan as per requirements
- Prepare a detailed costing of the action plan
- Prepare and submit draft and then final report



## 2 REVIEW OF PREVIOUS WORK DONE IN PAKISTAN

Rabies is under-reported in Pakistan and the disease burden is poorly understood. Approximately one million dog-bite cases and 5,000 deaths are reported each year in the country (Kessels et al., 2019). In Pakistan various efforts have been made to control Rabies in different times and different areas. Most of control efforts were based on reactive approach rather than pro-active approach. A brief review of previous work done on Rabies control in Pakistan is summarized in following lines.

### 2.1 Legal Framework

In Pakistan, Rabies remained a neglected zoonotic disease both on human and animal side and it was not even a notifiable disease for many years. In 2017, Ministry of National Health Services, Regulations and Coordination (NHS, R&C) declared Rabies as priority zoonotic disease for surveillance and response in Pakistan (Anonymous, 2017). In 2018, considering the importance of global goal of zero rabies by 2030, a policy document was developed to raise understanding among the relevant stakeholders about their role to reduce the incidence of rabies in Pakistan (Rumi et al., 2018). The Punjab Animal Health Act was developed in 2019 to regulate the prevention, control, containment and eradication of scheduled animal diseases. Rabies was included in the list of scheduled disease of animals (PAHA, 2019). Recently, Animal Birth Control (Dogs) Policy 2021 for Punjab province was developed. This policy describes the role and duties of different stakeholders to control the animal birth in humane way as per international practices. Detailed guidelines, operational management and recommendations regarding Dog Population Management (DPM) and Animal Birth Control (ABC) through Capture, Neuter, Vaccinate and Release (CNVR) are described in this policy document. Livestock and Dairy Development Department, Punjab has started implementing these measures in the province. The scope of these recommendations is to deal with stray and feral dogs, which pose serious threats to human health, animal health, welfare problems and have socio-economic, political, and religious impacts. Khyber Pakhtunkhwa Public Health (Surveillance and response) Act, 2020 covers surveillance and control activities of infectious diseases of public health significance. Punjab Animal Welfare Act, 2021 is also under process to ensure that animals intended for use in research facilities or for exhibition purpose or for use as pets are provided humane care and treatment. Dog killing to control Rabies will be banned once animal welfare act is approved and more focus will be on alternative techniques to control stray dog population. These all acts and policies were developed by different provinces and different departments in Pakistan mostly during last five years.

### 2.2 Research Work Undertaken

Several research projects were completed in Pakistan by different institutions working on research and development of Rabies to explore the disease dynamics regarding its transmission and control in Pakistan. A brief review of important research work undertaken in Pakistan during last fifteen years is highlighted below:

For possible eradication of rabies, role of electronic media especially television, radio channels and newspaper advertisement by health care authorities was identified as most important means of mass awareness. It was suggested to have district/divisional level dedicated centers, fully equipped with appropriately trained personnel, vaccines, immunoglobulins, and supportive care needs for rabies (Wasay et al., 2012).



For developing countries low-cost surveillance system is always acceptable in terms of providing better results and sustainability of the system. A Low-Cost Mobile Phone System for prospective surveillance in Pakistan was developed. Using this tool, a total of 6212 dog-bite cases were identified over two years with largest number reported from Karachi (59.7%), followed by Peshawar (13.1%) and Hyderabad (11.4%). Spatial analysis of dog bites was also done to observe the clustering of cases (Zaidi et al., 2013). This model can be applied in Pakistan on national scale or it can be dovetailed with already existing data collection/surveillance systems.

Estimation of Stray-Dog Population is of critical importance and this is baseline information required to initiate Dog population Management and CNVR activities. In Pakistan, for most of the areas, stray dog population is unknown. Even the population of pet dogs is not known because of no existing system of identification and registration of pet dogs. A few systematic studies are available on stray dog population estimation. One study was conducted in Rawalpindi (Shah et al., 2016) and another study was done in Lahore (Khan et al., 2021). In both studies dog population was estimated by OIE recommended methods i.e. direct count method and Hiby's method (Photo capture-Recapture). Stray dog population density was  $38 \pm 6.72$  (km<sup>-2</sup>) in Rawalpindi and  $24 \pm 5$  (km<sup>-2</sup>) in Lahore by direct count method. Using Hiby's method, it was  $55 \pm 9.69$  (km<sup>-2</sup>) in Rawalpindi and  $29 \pm 6$  (km<sup>-2</sup>) in Lahore. In Rawalpindi, human to stray dog ratio was found to be 706:1 by direct count method while 488 by Hiby's. In Lahore, it was 342:1 by direct count method and 254:1 by Hiby's method. Other than these two studies rough estimates of dog population are available but those estimates are not based on strong evidences.

Some studies were conducted from time to time describing the number of dog bites during different time periods and from different areas. Dog bite data is available from all the provinces and administrative areas of Pakistan through district health information system (DHIS). This data is arranged on daily, monthly and annual basis and is available for researchers or decision makers as required. Association of dog bites and dog population killed in different towns of Lahore indicated that maximum dog killing and dog bite cases were from same town proving the direct association of dog population and dog bite cases (Saba et al., 2019). In another study, total 85941 dog bite cases were reported during 2004-2013 in Lahore. The dog bite cases were higher in summer (32%) and in highly populated area. 63% bites were from the stray dogs and on lower parts of the body (66%) (Fooks et al., 2014). In a research work, occurrence of rabies and dog bite in Rawalpindi district of Pakistan were studied. Out of 1860 households, 19.13% reported the human victims of dog mediated rabies. Interestingly, 24% people got spiritual treatments from some religious person or according to their faith and believe. Out of remaining respondents, 40% went to hospitals, 25% did both and 11% neither sought spiritual nor hospital treatment (Shah et al., 2016). This practice is applicable in all over Pakistan both for bite cases of humans and animals due to some cultural and social factors prevailing in community.

Beside dog mediated rabies, wild life and particularly bats play important role in transmission of rabies. To study the possibility of transmission of rabies virus from bats to humans, bats were captured from different areas of Pakistan and molecular analysis of the samples showed that rabies virus antigen is not present in Pakistani bat population (Shabbir et al., 2011).

Neutering of dogs is main component of CNVR activity for dog birth control. Mainly two methods are available one is surgical and other is chemical. Results of comparative efficacy of chemical and surgical sterilization in dogs showed no significant difference in both sterilization techniques (Qamar



et al., 2016).

Cross sectional study on use of rabies immune globulins revealed that out of 103 respondents, 97.1% had administered rabies vaccine and 31.1% administered immunoglobulins in past three years of their practice. Although there is awareness about use of RIG, this life saving biological is grossly underused because of poor availability in emergency rooms even though stocked by local dealers (Salahuddin et al., 2014). Rabies deaths in Pakistan occur due to ineffective post-exposure treatment. A study results showed that only 40% patients could receive full course of vaccine while no rabies immunoglobulins (RIG) were administered to any patient. Lack of cold chain to store the vaccines compromised the quality of vaccine (Parviz et al., 2004).

### **2.3 Efforts on Rabies control in dogs**

In Pakistan, first effort to control Rabies using one health approach was done by The Indus Hospital Karachi by an initiative of “Rabies Free Karachi” (RFK). The project began in 2018 in a small town of Ibrahim Hyderi and then expanded to other parts of Karachi. Under the RFK project, dog population management (DPM) was introduced using Capture, Neuter, Vaccinate and Release (CNVR). This activity as performed in collaboration with foreign experts who trained our local professionals to approach, catch, vaccinate, neuter and release the dog. During this activity almost 70% dogs of Ibrahim Hyderi town were vaccinated. Recently, as of 2021, this activity has been extended to other areas in Karachi, like Landhi, Korangi, Defense Housing Authority and areas in the jurisdiction of the Cantonment Board Clifton. So far, around 25,000 dogs have been vaccinated and 2,500 animals have been neutered/spayed. Getting advantage of the successful CNVR activity by THI, Karachi, a small initiative was also taken with the name of Rabies Free Lahore (RFL) during September, 2018, organized by UVAS, Lahore and TIH, Karachi. It was a comprehensive program that included demonstration regarding dog catching in field conditions, vaccination, data uploading to GARC database, neutering demonstration, and use of control pole and dog catching net. Currently, in 2022, The Indus Hospital Karachi is now working on initiative “Rabies Free Pakistan” in collaboration with Getz pharma and city district government of Karachi. In Punjab livestock and dairy development department has adopted no dog killing policy and established a task force for stray dogs. In Punjab trained professionals of livestock department are doing activities relating dog population management. Recently, about 9000 stray dogs are being neutered each month in Punjab.

### **2.4 Non-Government Organizations (NGOs) Efforts on Rabies Control**

Justice for Kiki (JFK) Animal Rescue and Shelter is a registered nonprofit organization founded by a dog owner in memory of her pet dog Kiki who was rescued from the streets but was shot dead by a culling squad in 2020. JFK is involved in CNVR activities, has special facilities for disabled animals and works to create awareness about the humane treatment of all animals (JFK, 2020).

Another animal rescue organization that is working to improve the morbid conditions of Rawalpindi's



pet market at Gordon College Chowk is Anila Umair's Critters Ark Welfare Organization. Anila has been working with animals for 17 years and began using social media nine years ago to highlight her efforts of rescuing, treating, sheltering, and finding forever homes for animals (CAW, 2004). Save the Strays is another NGO. It is based in Islamabad and is among very few trustworthy and transparent local donation-based animal rescue and shelter services working independently for more than 15 years. Another organization with comparatively a large setup and networking is "Benji Project for Animal Welfare and Rescue". The Benji Project is supporting struggling shelters and rescuers in Islamabad, Karachi, Lahore, Peshawar, Charsadda, Abbottabad, and Wah. The Benji Project is making history by deploying Pakistan's first national fleet of animal rescue vehicles and opening Pakistan's very first facility dedicated to trap, neuter, vaccinate and release programs (TNVR), and have begun collaborating with concerned citizens and officials at all levels of government to implement TNVR programs (Benji, 2005).

### **2.5 Efforts on Rabies control in Humans**

NIH (National Institute of Health) team along with other stakeholders developed National recommendations for rabies surveillance in Pakistan in 2018. NIH has developed detailed work-plan based on SARE score using RACI (Responsible, Accountable, Consulted, Informed) mechanism to identify the detailed activities and relevant responsible institutions. In 2018, following the National One Health Strategic Framework and SARE scoring the NIH team developed Integrated Bite Case Management (IBCM) guidelines for investigation of suspected rabies cases that serves as a standard decision matrix for field staff to conduct dog bite case investigations.

A small project was conducted recently in Islamabad by the Field Epidemiology and Disease Surveillance Division (FEDSD) of the (NIH) to evaluate real time surveillance of dog bite cases using mobile based application to track and trace the cases in collaboration with the World Veterinary Services (WVS). A total of 2,661 dog bite cases were reported from selected healthcare facilities using the WVS mobile application during 2020. About 70% of these victims were male and from the rural/ peripheral areas of Islamabad. In 2021, National Institute of Health (NIH) has included the Integrated Disease Surveillance and Response (IDSR) system for continuous surveillance and response.

A workshop on enhancing progress towards rabies elimination 'Zero by 30' in the SAARC region was conducted during 26-28 June 2019 at Kathmandu, Nepal. SARE scoring for Pakistan was done on the basis of self-assessment of seven core components of activities mainly the legislation, information, dog population management, laboratory diagnosis, data collection and analysis, prevention and control and the cross-cutting issues. Considering the accomplished and pending activities SARE score for Pakistan was defined as 1.5. Small scale rabies control programs are in place and Pakistan is working towards developing national rabies control program



## 3 RESEARCH DESIGN AND METHODOLOGY

In order to evaluate the current status of in-country preparedness, response and mitigation strategies against rabies a comprehensive study at national level was needed. FAO Pakistan took an initiative to identify the relevant stakeholders, their role and responsibilities for prevention and control of rabies. This study is designed with aim to develop a national level strategic planning for rabies control.

For the preparation of National Action Plan for Rabies in Pakistan, the following steps were undertaken:

1. Detailed online and telephonic meetings were held with Dr. Muhammad Afzal (FAO Responsible Officer) and Ms. Quart ul Ain (Epidemiologist) of FAO office to discuss the main scope of the project.
2. In house consultation with university experts was done to identify all the possible approaches and challenges to control rabies in Pakistan. All the seven components of SARE scoring were deliberated.
3. Consultation with experts from Livestock and Dairy Development Department Punjab was done to explore the different aspects of rabies control program, particularly relating to administrative, financial and legislative issues.
4. Desk review of previous work done on rabies in Pakistan
5. Interviews of different stakeholders
6. Write up of draft National Action plan
7. Presentation of draft national action plan against rabies in zoom consultation meeting
8. Final National Action plan submitted

### 3.1 Research Methodology

A mixed-method study was designed to achieve the broader spectrum of results derived from the data collected by qualitative and quantitative approaches. The empirical data was collected from all stakeholders including veterinary professionals, medical doctors, pharmacists, vaccine producing officials, researchers, academicians, common people, officials of NGOs, officials of local municipalities, opinion leaders, policy makers and lawyers etc. from various provinces of Pakistan. It was a sequential exploratory mixed method design for which qualitative stage was conducted first and based on qualitative results, the quantitative stage was conducted later on<sup>1</sup>.

#### 3.1.1 Area and Stake holder`s Study

For collecting qualitative and quantitative data from different areas of Pakistan field activity was started from early October to December 2021. A total of 7 focus group discussions (FGDs) and 25 interviews were conducted for the qualitative phase of the study from all provinces of Pakistan. Afterward, a total of 300 questionnaire survey responses were collected as per given research design.

<sup>1</sup>Creswell, J. (2009). Research design: Qualitative, quantitative, and mixed methods approaches. Thousand Oaks, SAGE Publication Ltd.





Figure 3 1: Provinces of Pakistan

### 3.2 Statistical analysis

For the qualitative study, an interview guide was designed for Focus group discussions and interviews. A total of 7 Focus Group Discussions (n=7) were conducted for various cities including Bhimber, AJK, Lahore, Bahawalpur, DI Khan, Karachi, Peshawar and Quetta. Likewise, a total of 25 interviews (n=25) were conducted from different cities of Pakistan. The qualitative data were transcribed and analyzed by using NVivo 12 software to extract themes by using a thematic analysis approach<sup>2</sup>. The extracted themes were used to develop the questionnaire for the quantitative phase of the study. The details of the sample are given. The results were presented in the form of software generated images including word clouds, hierarchical charts and combined hierarchical charts. In order to analyze quantitative data, content analysis was performed. For quantitative content analysis data were organized for replicable examination of signs of communication and were assigned numeric values according to valid measurement rules, and the analysis of associations connecting those values using statistical significance.

For the quantitative study, a questionnaire survey was conducted from various cities of Pakistan. The quantitative data was collected (n=300) from all kinds of stakeholders including veterinary professionals, medical doctors, pharmacists, vaccine producing officials, researchers, academicians, common people, officials of NGOs, officials of local municipalities, opinion leaders, policy makers and lawyers etc. Thus, the questionnaires instrument (Appendix 5) was designed, pretested, screened and then used for data collection from respective respondents. In these instruments, some of the questions were similar and rest were depending on their level of involvement with this issue of Rabies. A google survey form was designed to collect data to save resources and ensure participation of maximum respondents from varied locations. The quantitative data were analyzed by using SPSS 25. The percentages/frequency distribution against options of all questions were worked out and reported under results. The results of descriptive statistics were explained in the form of pie charts.

<sup>2</sup>Creswell, J. W. and V. L. P. Clark (2007). Designing and conducting mixed methods research, Wiley Online Library.



## 4 RESULTS OF QUALITATIVE AND QUANTITATIVE STUDY

### Results of Qualitative Study

The qualitative phase of this study is comprised of two methods: Interviews and Focus Group Discussions (FGDs). A total of 25 interviews and 7 Focus Group Discussions (FGDs) were conducted with all the relevant stakeholders including veterinary professionals, medical doctors, pharmacists, vaccine producing officials, researchers, academicians, common people, officials of NGOs, officials of local municipalities, opinion leaders, policy makers and lawyers etc. from various provinces of Pakistan. The respondents were approached through a snowball sampling approach. The data was analyzed using NVIVO software.

### Results of FGDs and Interviews

A total of 25 interviews and 11 focus group discussions were conducted from relevant stakeholders. A proper way of taking an appointment was adopted and the permission was sought to record their interview. Only a few respondents did not allow to record their voice. However, in such cases, the field notes were taken. The recorded voice was later on transcribed into English and these transcripts were used in data analysis through NVivo 13 software. The data were analyzed using a thematic analysis approach. After adopting the coding process on transcribed material, major themes and subthemes were extracted to get a clear understanding of the data which are summarized in below Table 4-1.

Table 4 1: Major themes, sub-themes, and nodes emerged from the qualitative stage

S. No	Themes	Sub themes	Nodes	
1	Incidence of rabies/Dogs	Increasing	Cases of rabies are increasing day by day in metropolitan cities	
			In rural and urban areas there are lot of cases regarding dog bites	
			Mostly in remote areas there a lot of cases	
		Alarming increases	We have seen a lot of cases in animals. These cases are extensively increasing day by day.	
			There are lots of cases	
			Number of dogs increasing at district level as well and public is suffering from these dogs	
			Almost every one of us have seen rabies	
			Rabies is a major problem and also increasing extensively.	
	There are lots of cases regarding dog bites in our country.			
2	Govt. measures taken	Inadequate Measures	Heard that govt. has started to kill the dogs	
a)	Level		Only heard, but not seen	
			Nothing has performed functional	
			No attention at all	Govt, don't care about this
				Not proper attention by Govt.
Govt.never think about it				
b)	Result/Measures		Total failure	No interest seen by Govt.
				If some initiative taken, not properly executed
				Not successful at all
				Not functional after some time
			Dependent on other departments	



3	Awareness about Rabies	Low Awareness	There is lack of awareness.
	a) Level		No awareness at all among public Lack of awareness among society Not enough knowledge even being in health officials People have lack of awareness There is scarcity of awareness among people.
b)	Requirement of campaigns	Extensively needed	Some of us maybe have information regarding rabies There should be some seminar for awaring people Campaigns should be at mass level. Govt.Should organize some programs Campaigns should launch at district level There should be seminars in colleges and universities as well
			Moderate Awareness
4	Awareness about Vaccination	Low Awareness	People know that this is a dangerous disease but no bother vaccine There is lack of awareness about vaccination People don't know about the vaccine even after dog bite they go to others instead of vaccine. Don't take interest in vaccination as they don't know about it. People don't have information about vaccine.
	a) Level		Moderate Awareness In some areas some of the people is having a little bit information
5	Vaccine Availability	Not Available	Once I did a project in that I was having facility Not available by Govt. Never seen anywhere Vaccination is not available until you will not use reference Scarcity of vaccine
			Livestock Department Livestock dept. Should take lead This dept should play the role Only livestock dept can do this With the help of other departments livestock dept can control this This is the only responsibility of livestock department
7	Approach required	Collaborative at National level	There should be a national level program It should be at mass level by collaboration of other departments. There should a national level program for all of the provinces There should be a program implemented in all over the Pakistan
			On collaborative level Only one department has started to kill the dogs With the collaboration of some departments With the collaboration of some foreign institute, it was started
8	Past Initiatives	On individual level	I have won a project from foreign agency and started to work on it Some of my colleagues has started individually Without any support we have started Lots of activities have been organized individually



9	Suggested Approach	CNVR	I think it is the best way
			This is the best way to overcome this disease
			Best approach to deal with
			Instead of killing I think CNVR is the best
			Unethical to kill so we should go to CNVR
9	Required Sources	Financial Resources	Financial resources also play an important role
			If we will have finances, we can manage all thing efficiently and effectively
			Finances plays crucial role in this disease
		Will of Govt.	There is a dire need of govt. interest
			Govt. attention is must necessarily
			If govt. will start taking interest, we can control
			Govt. interest is much necessary to overcome this disease
		Awareness among society	There is a need for creating awareness among society
			People should well aware about it
Awareness among public at mass level is required			
10	Expectations of public/society	Humane dealing	I think we should treat humanely
			This disease should treat in humane manner
			We should treat with ethically
11	Diagnosis	Not properly diagnosed	We are unable to diagnose either it is rabies or not
			There are no diagnostic facilities.
			Unable to diagnose the confirm case of rabies
			We have not enough sources to diagnose this disease.

From the qualitative data analysis, a total of 11 themes, 22 sub-themes, and 82 nodes were extracted which are explained in detail in subscript.



**Combined Hierarchical Chart**

Figure below shows combined hierarchal chart of all themes extracted from the interviews and focus group discussions. These themes are explained below;

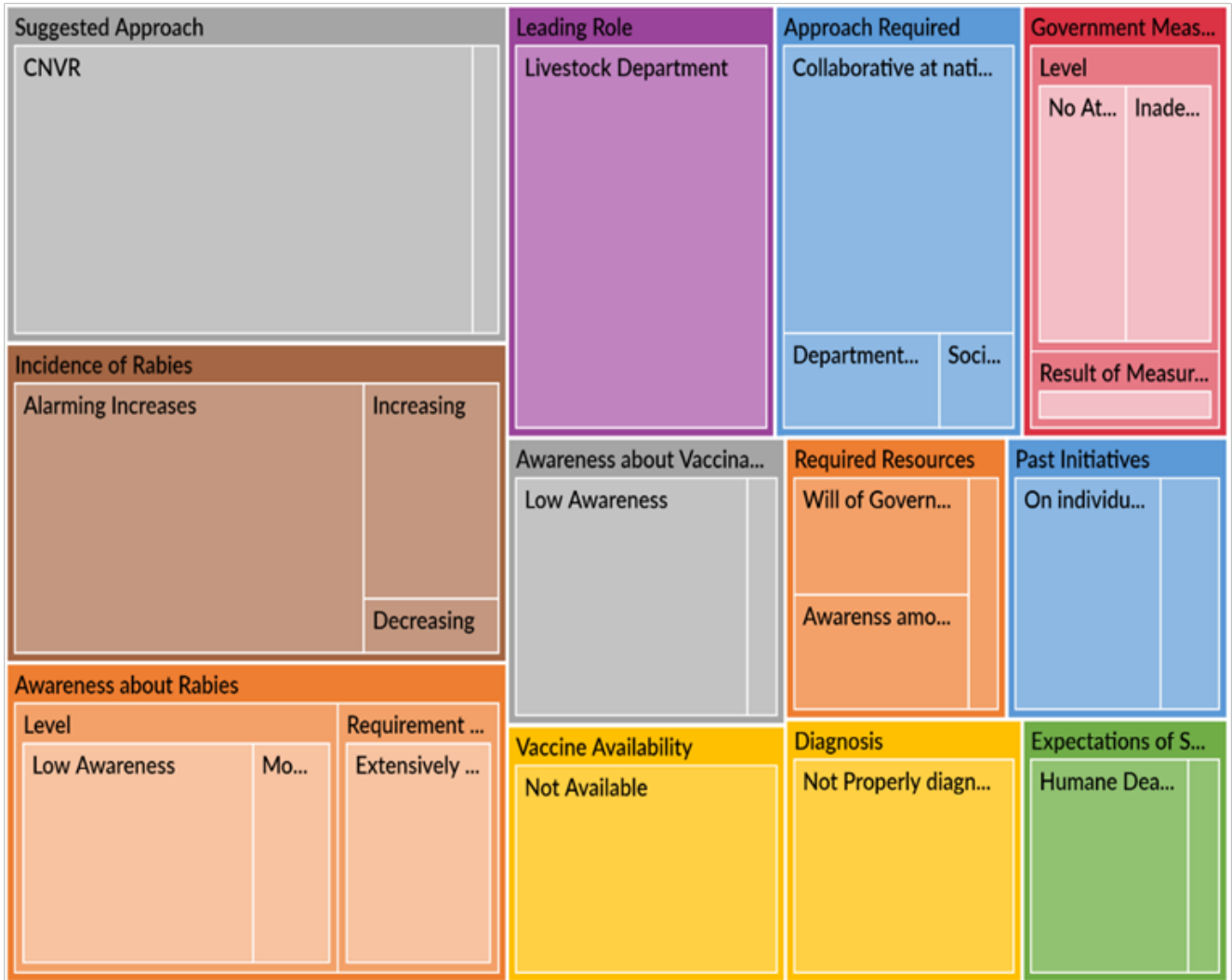


Figure 4-2 Combined Hierarchal chart



### **Vaccine Availability**

The hierarchical chart shows that most of the respondents responded that the availability of vaccines for Rabies is neither available in veterinary hospitals for animals nor in medical hospitals for humans. Only few respondents responded that vaccine is available in their medical hospital but only influential people have access to it. At the same time, almost all the respondents responded that frontline veterinary as well as human professionals are not vaccinated against this deadly disease.

### **Awareness of Rabies**

The hierarchical chart shows that most of the respondents responded that the complete awareness about this disease is very limited in almost all provinces of Pakistan. However, they responded that everyone at least knows that Rabies is very dangerous disease and needs immediate attention, vaccination and treatment. Likewise, all the respondents responded that media campaigns are urgently needed to increase awareness level among masses not only for treatment but also for prevention of this disease and such campaigns should be launched at local, provincial as well as national level. Similarly, awareness campaigns for specific segments of population including the professionals and high-risk groups should be managed.

### **Awareness of vaccination**

The hierarchical chart shows that most of the respondents responded that the complete awareness about the vaccination of this disease is very limited in almost all provinces of Pakistan. However, they responded that everybody has low information about the vaccine availability. As this is very dangerous disease and needs immediate attention, vaccination and treatment. Likewise, some of the respondents have told that they have a little bit awareness about vaccination however majority responded that there is no awareness among society. For prevention of this disease and mass campaigns should be launched at local, provincial as well as national level.

### **Approach**

The hierarchical chart shows that most of the respondents responded that there is a dire need of a National Action Plan to be implemented at national level to control this problem. Furthermore, all the respondents stressed that a collaborative approach is needed to implement it. This collaboration must be among Livestock, Health, Waste Management, municipalities and other interlinked departments. Likewise, role of community and NGOs was also emphasized. Respondents also shows their concern regarding the approach to deal this disease, majority of the respondents show that CNVR is the best approach to use, instead of killing animals CNVR method should use because it is unethical to kill the animals and it is against the animal welfare.

### **Leading Role**

The hierarchical chart shows that most of the respondents responded that in any proposed National action plan for Rabies, the leading role must be given to the Livestock department and other departments must be given supporting role. At the same time, it was also emphasized that other departments must be given due importance.

### **Incidence of rabies**

The hierarchical chart shows that most of the respondents responded that the incidence of rabies is increasing day by day and creating troubles for the society. Majority of the respondents responded that the amount of dog bites and cases of rabies are continuously increasing from many years and now the situation is going at its peak. Likewise, majority of the respondents responded that cases of rabies are alarming increases by every passing day. Only few respondents from AJK respondent that the cases of rabies are decreasing there because they have been involved some kind of projects regarding control of rabies that is the reason of decreasing cases but those are only few respondents.



Similarly, these results are consistent with the results of word cloud and word tree for showing same results.

### **Diagnosis**

The hierarchical chart shows that all of the respondents responded that they cannot diagnose this disease. Diagnostic facilities are not existing in almost all provinces of Pakistan. However, they responded that nobody can examine that either it is a confirm case of rabies or not they are unable to diagnose it properly. Likewise, all the respondents responded that there should be proper facilities to diagnose this disease and it is urgently needed to develop a diagnosis structure so that treatment and prevention of this disease can be possible at local, provincial as well as national level.

### **Past initiatives**

The hierarchical chart shows that all of the respondents responded that in the past mostly initiatives were taken by individuals. They responded that these initiatives were taken by their selves. Most of the respondents responded that they have taken some international projects and, in those projects, they have done some work regarding awareness of rabies and CNVR of dogs. But those initiatives were taken by individual basis. Only few respondents responded that some initiatives were taken by collaboration of some departments but these were only few respondents. These results are similar with the results of word cloud and tree map.

### **Government Measures**

The hierarchical chart shows that most of the respondents responded that government has never put attention towards this problem. Government did not take interest in order to control this disease. However, they responded that if government-initiated any plan to overcome this disease that plan was not properly implemented or functional because of lack of interest shown by the government and other departments. Likewise, all the respondents responded that the measures taken by government resulted totally failure.

### **Expectations of society**

The hierarchical chart shows that majority of the respondents mainly responded that the humane dealing should be done with the animals. Most of the respondents shows their concerns that animal killing is unethical so to overcome this disease dog killing should not allowed rather it should be Bann however, there should be another way to get rid from this disease. Only few respondents that is equal to none, responded that inhumane dealing i.e., dog killing is the best solution to get rid of this disease. At the same time, almost all the respondents responded that it inhumane dealing is unethical and also prohibited by our religion so the only way to control this disease is the humane dealing. Hierarchal chart results are consistent with word frequency query and word tree map for showing the same results regarding the expectation of society.

### **Required Resources**

The hierarchical chart shows that majority of the respondents mainly responded that there is a dire need of Govt.will for taking action regarding prevention of rabies and to take control on this disease. Majority of the respondents responded that without the govt. will there can be nothing possible. Similarly, respondents also responded that awareness among society is also a crucial part which is needed. There is lack of awareness among society regarding rabies, people just know about that if they will bite by dog, they will die they don't bother the vaccine or they don't have awareness so there is also a need to create awareness among the society. Some of the respondents also shows their concerns regarding financial resources they responded that if they will have financial resources, they can buy vaccine they can develop system for the prevention. Word cloud and word tree map is also showing the same results as shown in hierarchal chart.







In response to the above question, Figure 5 shows majority of respondents (57%) responded that the responsibility of dog population control is of Livestock department. Whereas, 35% responded that the responsibility is of City district government however only 8% responded that health department should take responsibility.

#### **Q4. The dog population may be controlled by?**

In response to the above question, Figure 6 shows majority of respondents (47%) responded that the dog population may be controlled by providing extra resources to existing departments. Whereas, 30% responded that it may be controlled by the existing government departments. However, 23% respondents responded that new department is needed.

#### **Q5. What is your preferable strategy to control dog population?**

In response to the above question, Figure 7 shows majority of respondents (61%) responded that the preferable strategy to control dog population is Capture Neuter Vaccinate and Release (CNVR). Whereas, 18 % responded that the preferable strategy is castration of dogs. However, 14% responded about any other option and 6% responded that dog killing is the preferable strategy and only 1 % responded that launching awareness campaigns to avoid dogs is a choice

#### **Q6. Controlling dog population in animal welfare perspective?**

In response to the above question, Figure 8 majority of respondents (78%) responded that Controlling dog population in animal welfare perspective is desirable. Whereas, 11 % responded that it is not desirable. However, 5% responded that it is prohibited 4% responded that it should not be adopted at all only 2 % responded that it does not come in this category.

#### **Q7. I have observed some attempts to control dog population by?**

In response to the above question, Figure 9 shows majority of respondents (43%) responded that they have observed some attempts to control dog population by NGOs. Whereas, 34 % responded that they have observed some attempts by Municipal corporations. However, only 23% responded they have observed some attempts by Government L&DD department.

#### **Q8. These attempts were a complete failure?**

In response to the above question, Figure 10 shows majority of respondents (41%) responded that they have observed the attempts taken to control dog population was total failure Whereas, 30 % responded that these were partially failure. However, 24 % responded that these were partially successful only 5% responded that these were total successful.



**Q9. The main reasons of success of these measures were?**

In response to the above question, Figure 11 shows majority of respondents (40%) responded that the main reasons of success of these measures were support from all of the departments. Whereas, 27 % responded about Government support. However, 18% responded about public support while only 15% responded about private support.

**Q 10. The main reason of failure of these measures were?**

In response to the above question, Figure 12 shows majority of respondents (64%) responded that the main reasons of failure of these measures were lack of government support. Whereas, 17 % responded that support from all of the above. However, 13% responded about public support while only 6% responded about private support.

**Q11. What is the importance of public awareness campaign for controlling dog population?**

In response to the above question, Figure 13 shows majority of respondents (83%) responded that public awareness campaign for controlling dog population is most important. Whereas, 14% responded that it is moderately important. However, only 3% responded that it is not important.

**Q12. While designing National action plan regarding controlling dog population, inclusion of the public awareness campaigns?**

In response to the above question, Figure 14 shows majority of respondents (85%) responded that While designing National action plan regarding controlling dog population/ Rabies, inclusion of the public awareness campaigns is must Whereas, 12% responded that it is moderately needed. However, only 3% responded that it is not important at all.

**Q13. Without public awareness campaigns, the chances of success of national action plan ?**

In response to the above question, Figure 15 shows majority of respondents (74%) responded that without public awareness the chances of success of national action plan would be least. Whereas, 14% responded that it would not have impact at all. However, only 12% responded that it would be more.

**Q14.The recent situation of medical support for patients affected by Rabid dogs in your city/province?**

In response to the above question, Figure 16 shows majority of respondents (45%) responded that recent situation of medical support for patients affected by Rabid dogs in



their city/province is moderate arrangements. Whereas, 28% recent situation of medical support for patients affected by Rabid dogs in their city/province is adequate. However, 27% responded that recent situation of medical support for patients affected by Rabid dogs in their city/province is no arrangements at all.

**Q15. Do you have any medical facility dedicated to dog bite cases in your city?**

In response to the above question, Figure 17 shows majority of respondents (50%) responded that they don't have enough medical facility dedicated to dog bite cases in their city/province. Whereas, 22% responded that they have no enough medical facility at all. However, 28% responded they have enough medical facility.

**Q16. Are you well aware of medical facilities for treatment/first aid of dog bite cases in your city/province?**

In response to the above question, Figure 18 shows majority of respondents (44%) responded that they are well aware about medical facilities in their city/province. Whereas, 29 % responded that they don't know at all. However, 27% responded they know few of these.

**Q17. Do hospitals in your vicinity deal dog bite cases?**

In response to the above question, Figure 19 shows majority of respondents (50%) responded that only few hospitals deal dog bite cases. Whereas, 21 % responded that all hospitals deal. However, 14% responded specific centers deals dog bite cases and 15% responded that no hospitals deal

**Q18. To which age group you belong?**

Majority of respondents, Figure 20 shows (93%) responded belongs to age group between 18 and 35 years. Whereas, 4% responded belongs to less than 18 years. However, 2% responded belongs to less than 50 years and 1% belongs to more than 50 years.

**Q19. What is your level of education?**

Figure 21 shows, Majority of respondents (68%) responded having bachelor's degree. Whereas, 24% responded having master degree. However, 7% responded having matric degree and 1% having PhD degree

**Q20. To which profession/Organization do you belong?**

Figure 22 shows, Majority of respondents (87%) belongs to veterinary/livestock department. Whereas, 5% belongs to Animal Welfare organization/NGO. However, 4% belongs to Health Department 3% belongs to municipal corporation and 1% belongs to wildlife department.



**Q21. Have you been part of any campaign for controlling dog population?**

Figure 23 shows, Majority of respondents (62%) responded that they have not been the part of any campaign at all. Whereas, 23% yes but occasionally been part of any campaign for controlling dog population. However, 15% responded that yes, many times they have been part of any campaign.

**Q22. The dog population in our city/province is under control?**

Figure 24 shows, in response to the above question, majority of respondents (30%) disagree with this statement that dog population in their city/province is not under control

**Q23. I see stray dogs frequently in our surroundings?**

Figure 25 shows, majority of respondents (45%) strongly agree with this statement that they see stray dogs frequently in our surroundings

**Q24. I face negative consequences of stray dogs in my surroundings?**

Figure 26 shows, majority of respondents 34% agree with this statement that they face negative consequences of stray dogs in their surroundings.

**Q25. We need to implement some strict measures to control dog population in our city?**

Figure 26 shows, majority of respondents 57% strongly agree with this statement that there is need to implement some strict measures to control dog population in their city

**Q26. I appreciate if National Action Plan for Rabies control is approved and implemented?**

Figure 27 shows, in response to the above question, majority of respondents 67 % strongly agree with this statement they appreciate if National Action Plan for Rabies control is approved and implemented.

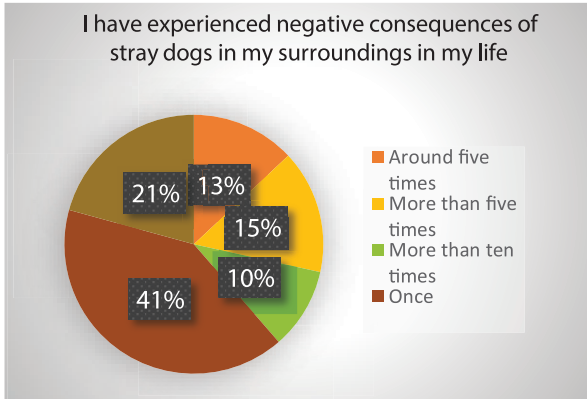


Figure 4-4

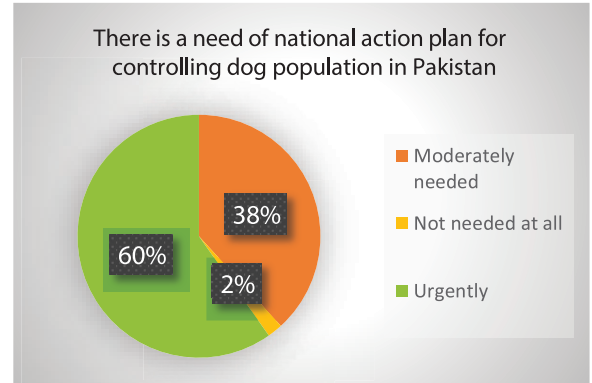


Figure 4-5

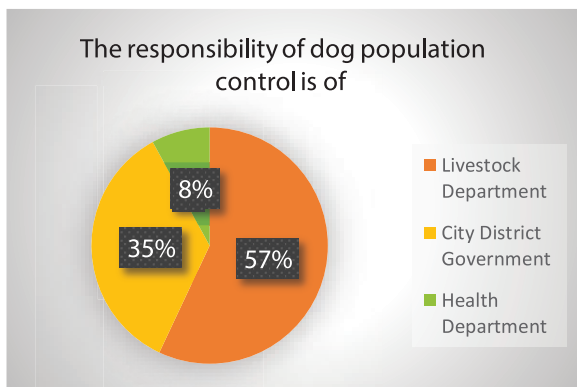


Figure 4-6

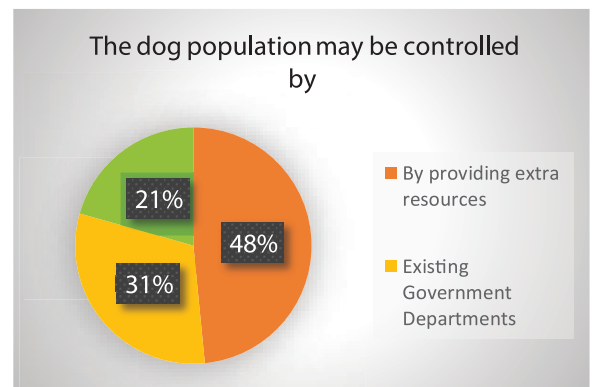


Figure 4-7

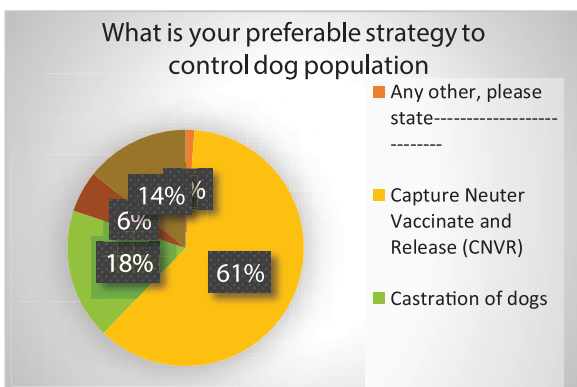


Figure 4-8

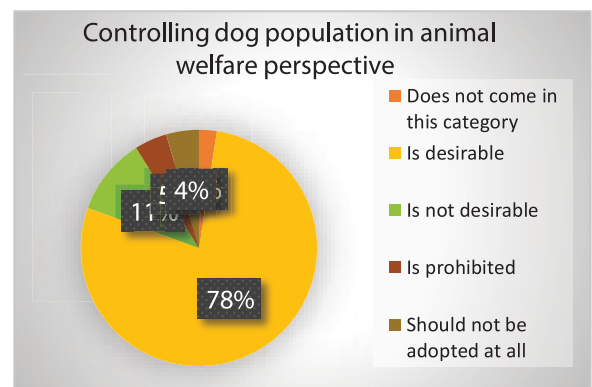


Figure 4-9

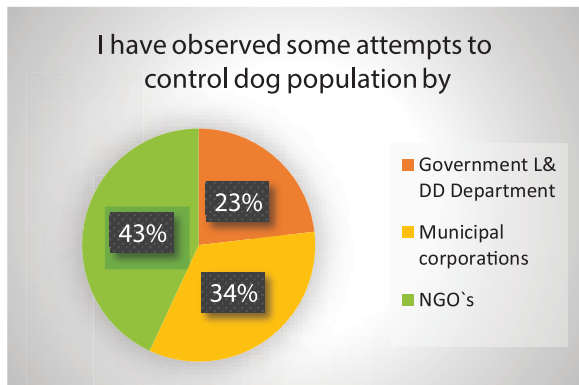


Figure 4-10

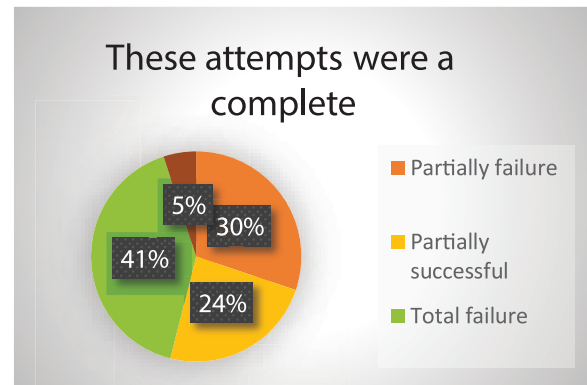


Figure 4-11

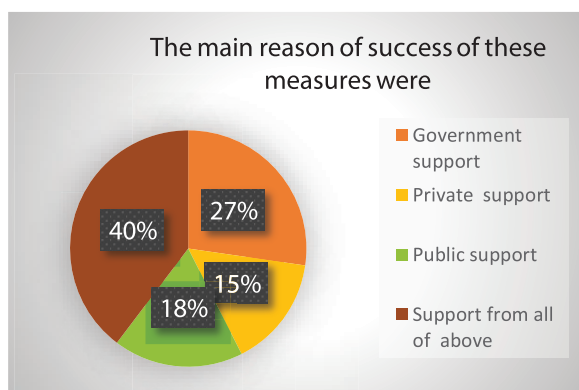


Figure 4-12

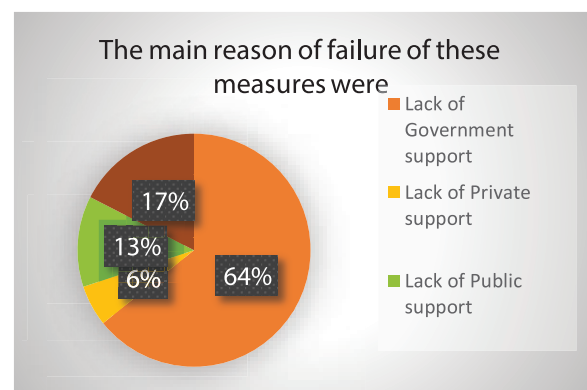


Figure 4-13

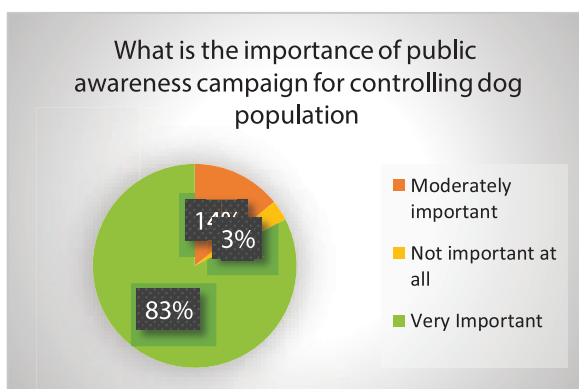


Figure 4-14

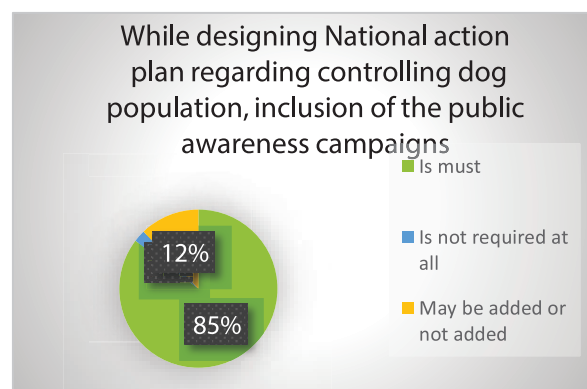


Figure 4-15

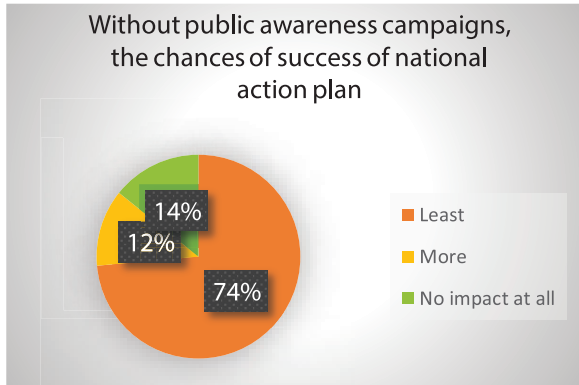


Figure 4-16

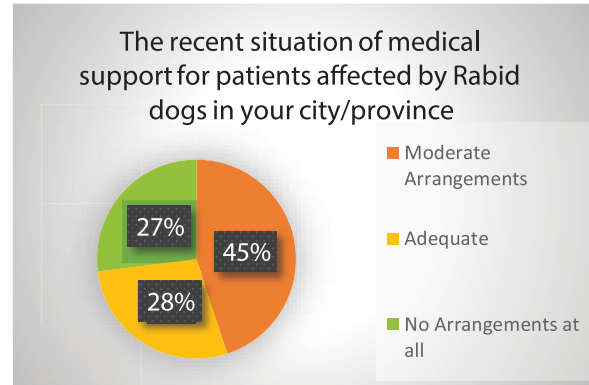


Figure 4-17

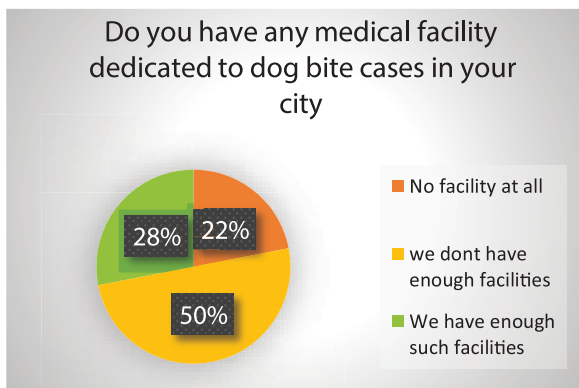


Figure 4-18

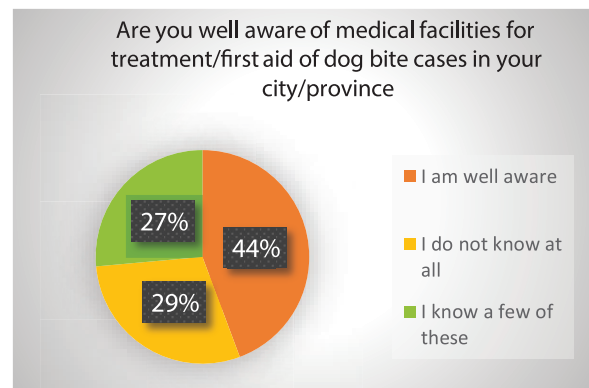


Figure 4-19

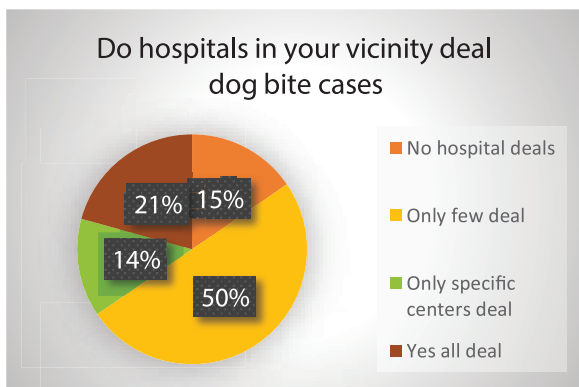


Figure 4-20

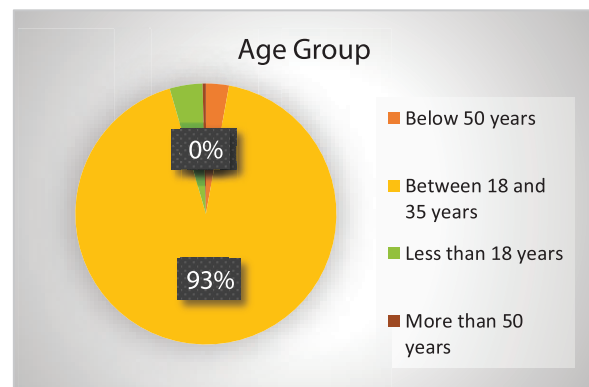


Figure 4-21

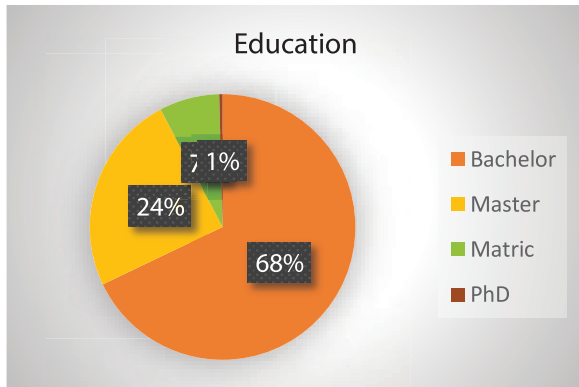


Figure 4-22



Figure 4-23

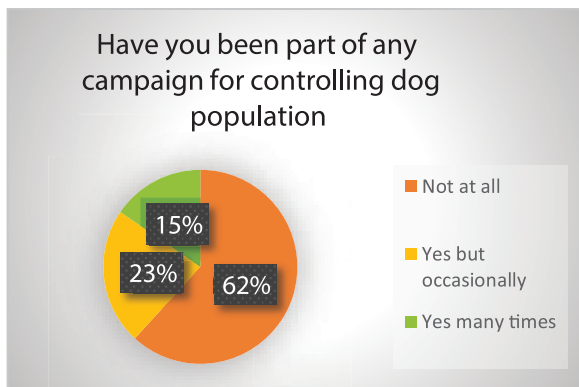


Figure 4-24

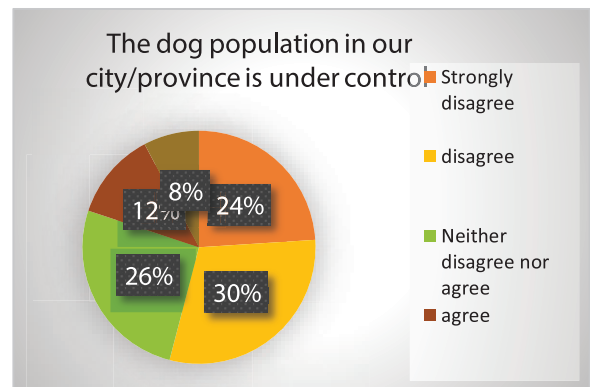


Figure 4-25





Figure 4-26

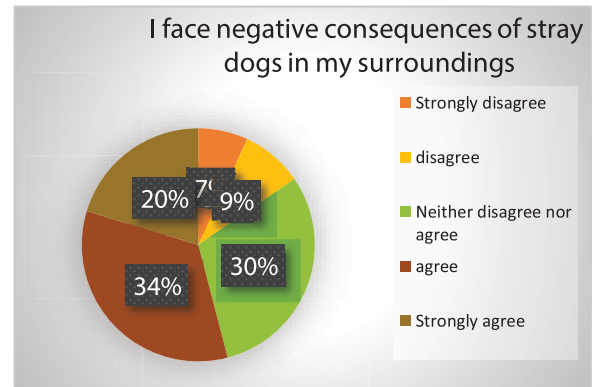


Figure 4-27

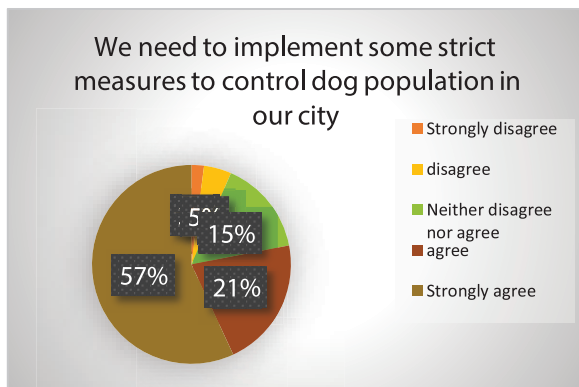


Figure 4-28

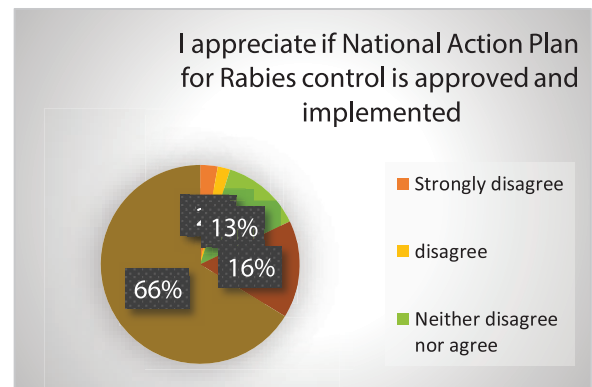


Figure 4-29



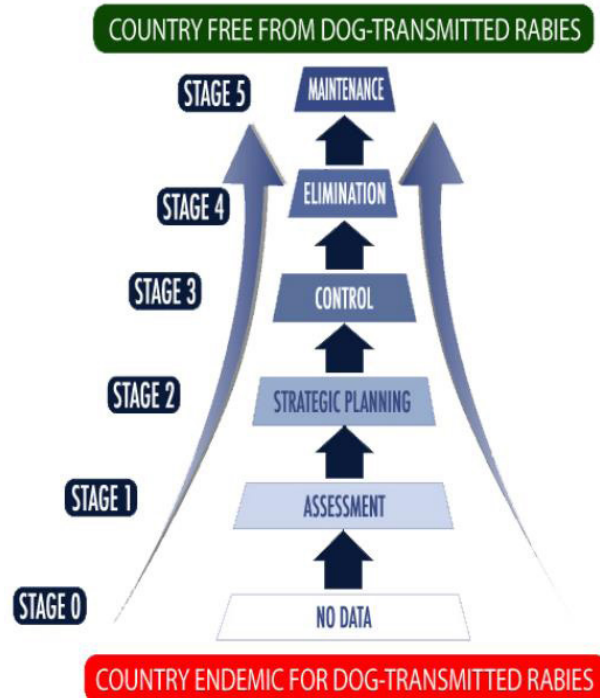
## 5 ACTION PLAN FOR RABIES CONTROL IN DOGS IN PAKISTAN

### 5.1 Main Components

Protecting the society, economy, and the environment from the risks of animal disease is a priority for the government of Pakistan. This document sets out a framework for how the prevention and control of the risk of rabies transmission would be managed in Pakistan. It covers general control principles for the most likely scenarios for cases of classical rabies virus and the rationale for such controls. There are several components of a national action plan. For national action plan to control Rabies in Pakistan, we have proposed important components that include coordination, communication, legal framework, human dog bite case management, pet dog vaccination and registration, stray dog population management, Rabies transmission from other animals, research and diagnosis, improved surveillance, capacity building and stakeholder involvement. By describing national action plan within this framework all parties will be better placed to respond quickly and effectively to control the Rabies to protect public health, attain our disease-free status (“Zero by 30”) as quickly as possible, and minimize the wider impact on the public and the natural environment.

### Stepwise Approach Towards Rabies Elimination (SARE)

It is a comprehensive risk-based model that proposes a graduated approach in the reduction of disease risk. The Rabies SARE consists of six stages (stage 0 to 5). Each stage has a set of activities that build on each other to continuously reduce the risk of disease, with the area and or country being declared completely free of dog mediated human rabies when it reaches stage 5



The SARE diagram depicting the pathway to rabies elimination, beginning at Stage 0, where little or no data is available for rabies, and progressing through different stages until Stage 5 where a country is declared free from dog-mediated rabies.

**Figure 5 1: The SARE Diagram (Source: GARC, 2018)**

The 6 stages are summarized below;

Stage 0: Limited information is available

Stage 1: Development and adoption of the National Rabies Prevention and Control Plan (NRPCP)

Stage 2: Implementation of the NRPCP in priority areas

Stage 3: Rabies risk reduction through full scale implementation of the strategy

Stage 4: Maintaining freedom from dog mediated human rabies and canine rabies

Stage 5: Declaration of freedom from rabies in humans and canines

### SARE scoring of Pakistan

As per Workshop on Enhancing Progress Towards Rabies Elimination 'Zero by 30' in the SAARC Region Pakistan is currently at stage 1.5. For the country to move from one stage to the next one, a set of targets must be reached and verified. For example, to move from stage 1 to stage 2, the country must have developed a national rabies control and elimination strategy. The score for Pakistan was calculated during "In country workshop SARE analysis 26-28 June, 2019, Nepal" on the basis of following components of SARE.



There are seven components for calculation of SARE score; (i) prevention and control (ii) data collection and analysis (iii) laboratory diagnosis (iv) dog population management (v) information education and communication (vi) legislation and (vii) cross cutting issues. While calculating the score for each component, both the activities pending and activities accomplished were considered.

## Prevention and Control

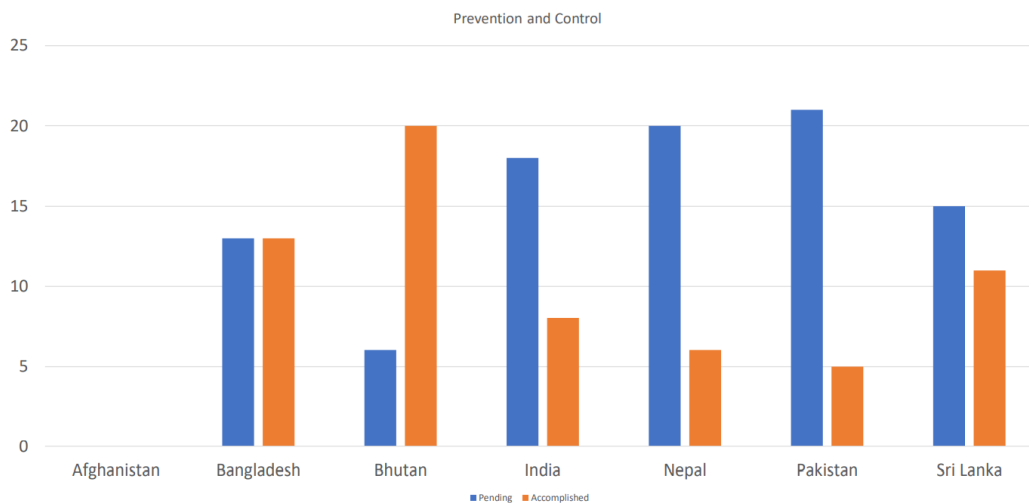


Figure 5-2: SARE Score of Component: Prevention and Control  
(Source: In country workshop SARE analysis 26-28 June, 2019, Nepal)

### 5.2 Outputs and activities

National action plan for Rabies control in Pakistan is based on activities mainly under One Health approach. Several activities, roles and responsibilities of this action plan belong to animal and health sector with involvement of multiple stakeholders. Main outputs of these activities include but not limited to improved coordination animal and health sector, better communication and awareness on rabies in large, improvement in existing legal framework, improvement in integrated human dog bite case management, assurance of pet dog vaccination and registration, stray dog population management, focus on operational research to develop some product or process that may help in control activities for rabies, strengthening of diagnosis and improved surveillance and capacity building.

### 5.3 Implementation Methodology

For implementation of Rabies control activities across Pakistan, strategy based on the ground realities, existing arrangements and futuristic vision is proposed. Following is the detailed implementation methodology for National Action Plan

### 5.4 Coordination Among Federal and Provincial Government

At the federal level establishment of the Rabies Control Unit (RCU) or sub-office should be done exclusively in the office of the Animal Husbandry Commissioner (AHC). Moreover, a Federal Expert Committee (FEC) will be established. This committee will be chaired by AHC and will comprise seven to nine members, which may include a representative from academia, livestock department,



health department, and other relevant departments. This committee will be finalized by the AHC. At the provincial level similar unit (RCU) will be established in The Secretariat of Livestock. Moreover, for coordination of the rabies control activities from the respective province with FEC, the Provincial Experts Committee (PEC) will be on a similar pattern. The main role and activities will include following;

Animal Husbandry Commissioner (AHC) or Chief Veterinary Office (CVO) lead office, should be specially designated to work for the next ten years and control rabies to achieve “zero dog mediated rabies by 2030”. Be responsible for planning and management of National Action Plan (NRPCP) in accordance with the plan at federal and provincial level. To Establish Nation Rabies Prevention and Control Committee (NRPCP). To coordinate and monitor activities regarding rabies control from other provincial level RCUs. The office will work as the lead office. The responsibilities should include the overall monitoring of rabies control strategies at federal and provincial level respectively.

The elimination of rabies requires the working together of different sectors within government, non-government organizations, international partners, teaching and research institutions and the public. Therefore, the committee must have the representative from; livestock and dairy department, medical & public health sectors, waste management department, environmental department, international organization representative, representative from the local government or city district government, human and animal health professional associations, research institute and NGOs involved in rabies activities. However, animal husbandry commissioner (AHC) or chief veterinary officer (CVO) shall be the head of the committee (chairperson). The role of the committee will include;

Administrative responsibility for implementing rabies control strategy at provincial and district level and to provide reports on regular basis to the lead office of Animal Husbandry Commissioner. Allocate resources and funds for resource mobilization. A funding plan for each phase of the implementation strategy. Define priority areas and areas outside the priority for each province along with the establishment of Rabies Control Unit (RCU) at federal and provincial level. Establishment of Rabies One Health Centers (ROHC) at district level using existing health infrastructure by modifying human i.e., Basic Health Unit (BHU) or Civil Veterinary Hospitals (CVH) depending upon the area and health facilities in the priority areas (district) of each province. Enhancing the laboratory diagnostics, health facilities and cold chain facilities with respect to rabies. Create linkage (MOUs) between ROHC and Commercial Laboratories to test rabies suspected samples. Design vaccination campaigns for Mass Dog Vaccination (MDV). Provide guidelines regarding Dog Population Management (DPM) particularly Dog Population Estimation (DPE) and Capture, Neuter, Vaccinate, and Release (CNVR) program. Establishment of National Rabies Surveillance Center (NRSC) in the ROHC in the priority area of the province to monitor and evaluate data. Provide guidelines to Rabies Control Units (RCU) and Rabies One Health Centers (ROHC). Internally monitor (progress reports) implementation of the plan from lower levels as well as provisionally. Provide regular update to the public and stakeholders on implementation of the rabies and elimination strategy. Training and capacity building, propose changes and amendments of regulations and laws on rabies control.

The rabies One Health Centers at district will be responsible for implementing activities of the rabies control strategy at regional or lower levels, publicity and awareness creation, and provide regular reports on the status of the rabies at community level, staff from human and animal side will participate in various activities as described in their particular section.

For implementation of the National Rabies Prevention and Control Plan (NRPCP) we will have to



identify and select the priority areas in Pakistan on the basis of highest human density, urban areas or big metropolitan cities in each province, area having high number of dog bite incidence, area with poor sanitation and environmental conditions. Rabies control activities shall be started in priority areas under Phase-I of the national action plan. For example, the priority areas can be considered Lahore in Punjab, Karachi in Sindh, Peshawar in KPK, and Quetta in Balochistan etc.

### **5.4.1 Communication (Awareness/ Mass Media)**

Encouraging dog owners to be more responsible will reduce the number of dogs allowed to roam, improve the health and welfare of dogs, and minimize the risk that dogs pose to the community. The promotion of responsible dog ownership through legislation and education is a necessary part of a dog population control program. The health department must conduct intensive community awareness campaigns. In this aspect collaboration with local government authorities, health, veterinary authorities, animal welfare NGOs, private veterinarians, and veterinary organizations will assist in establishing and maintaining educational programs. Educational campaigns on the environmental control of stray dogs by proper food waste disposal will be encouraged. NGOs can supply local knowledge on dog populations as well as expertise in handling, kenneling dogs and the implementation of sterilization programs. NGOs can also contribute, together with veterinarians and the authorities in educating the public in responsible dog ownership. Awareness and education of community using mass media communication tools, village meetings, primary school education programs, special TV & Radio programs, posters, other media channels, and leaflets in public places will enhance the effectiveness of other Rabies control activities.

### **5.4.2 Handling of Dog Bite cases in Humans**

The main responsibility of the health department is to improve the health facilities under the umbrella of existing infrastructure. Training of the healthcare providers must be provided with knowledge and skills required to treat the dog bite victims i.e., local wound management, active and passive immunization in ROHC by the health department. The respective health officer must ensure availability of appropriate rabies pre & post exposure vaccines, and RIG availability to all risk groups in ROHC. The data collected regarding animal bite cases, PEP exposure and Rabies Immunoglobulins (RIG) usage must be reported and recorded at all levels. There should be identification of the high-risk group for example the personnel's dealing with animals who might be at higher risk of rabies i.e., butchers in slaughter houses, medical officers in the dog bite or rabies treatment center, and researcher involved in clinical research related to rabies.

### **5.4.3 Pet dogs Registration and Vaccination**

An essential component of dog population control by the local government is the registration and identification of owned dogs. This may include granting license to owners and breeders. Registration and identification may be emphasized as part of responsible dog ownership and are often linked to animal health programmers, for example, mandatory rabies vaccination and traceability. Therefore, to promote responsible dog ownership vaccination with traceability should be mandatory by legislation. A vaccination certificate by the authorized officer must be issued after inoculation of vaccine. Vaccination of any animal against any scheduled disease (Rabies) in respect is already made mandatory under the provisions of the Punjab Animal Health Act 2019. Registration of animals in a centralized database can be used to support the enforcement of legislation.



#### 5.4.4 Stray Dog Population Control

The livestock will work as the main department for the rabies control in ROHC. The department will participate in various activities of the strategy at district level which include;

- Dog Population Estimation (DPE) of Pakistan along with the identification of source of the stray dogs, and Dog Population Management (CNVR) activities. Studies and surveys in dog population etc. these activities should be carried out first where the human population is high. Such study is necessary to calculate the financial resources required.
- Improve health and welfare of owned and stray dog population Reduce numbers of stray dogs to an acceptable level through Dog Population Management (DPM)
- Promote responsible dog ownership
- Assist in the creation and maintenance of a rabies immune or rabies free dog population through Massive Dog Vaccination (MDV).
- Spaying neutering activities are being implemented at the district level. Such initiatives will be collaborated with NGOs and private clinics. It is recommended to prioritize spaying and castration to stray dogs.
- Environmental control of stray dogs by proper food waste disposal by local municipal corporation and NGOs by raising awareness.

#### 5.4.4. Dog Population Estimation (DPE)

The Dog Population Estimation (DPE) is crucial for the successful implementation of NRPCP. Because this will provide us the basic data to calculate resources in terms of vaccination, human resources and surgical kits required. Different methods are available for stray dog population estimation all are based on two basic principles either on direct observation means i.e. Direct Count Method and another method is Capture Recapture (Sight-Resight Method) in which for counting dog is captured, marked either by photo, tail painting or any other marking for identification purpose. Both methods are recommended by OIE in Terrestrial Animal Code Manual. Population estimation surveys should be conducted in priority areas and then the activity should be spread to the nearby non-priority areas so that the overall demographics of dog population will be clearer. For pet dog specific directory must be maintained with dog registration, vaccination records, and dog ownership. Moreover, the vaccination of pet dog along with owners visiting veterinary health care clinic must be kept mandatory either through legislation or through veterinary practitioner via PVMC (That no veterinary practitioner is allowed to provide treatment without the vaccination records of the owner).

#### 5.4.4. Mass Dog Vaccination (MDV) and Dog Population Management (DPM)

- In Priority areas for example Lahore in Punjab, Karachi in Sindh, Peshawar in KPK, and Quetta in Balochistan etc. The resources must be calculated according DPE surveys from respective priority areas of the province to achieve herd immunity (greater than 70% of dog population).
- During the mass vaccination activity, all apparently healthy dogs aged 3 months and above with no recent bite incident must be vaccinated. All stray dogs and new inclusions must be prioritized. Pregnant dogs, lactating and 1 to 3 months old puppies from unvaccinated mother may also be vaccinated depending on the prerogative of the veterinarian. But vaccination must be repeated when it reaches 3 months old in the case of puppies.
- It is ideal to conduct an intensive vaccination campaign in a period of three (3) months for the vaccination activity to have an impact; especially in areas considered high risk for rabies.
- Along with mass dog vaccination another activity of dog population management i.e. capture,



neuter, vaccinate, and release (CNVR) must be conducted for adult's dog population.

- A team must be supervised by a licensed veterinarian. It is composed of representatives from the area, vaccinators from the veterinary office, dog catchers and/or volunteers from private or non-government and people's organizations. Teams of 4-6 persons are a good number and must be properly identified.

#### **5.4.5 Rabies Control in Other Animals**

Consideration should be given to vaccinating livestock that are particularly valuable. Animals for which there is a licensed rabies vaccine (horses, cattle and sheep), that have frequent contact with humans (e.g., petting zoos, fairs, riding stables, shows, exhibitions, etc.) should be currently vaccinated against rabies. In case of bite to domestic animals by dog or wild animals like fox, jackal, or mongoose etc. the required treatment must be provided, if the prognosis is not good then the animal must be culled.

#### **5.4.6 Capacity Building**

The Role of NRPPCC is capacity building by providing appropriate guidelines. To strengthen local and national capacity. Training of staff will be conducted as part of building capacity for the implementation of the strategy. The training will target animal and human health workers. This training will focus on Dog vaccination campaigns, rabies surveillance, dog bite wound management, provision of rabies post-exposure vaccine, laboratory diagnosis, community mobilization and sensitization, dog population management, and responsible dog ownership. Sensitization of local leaders and community through meetings. Ensure availability of resources essential for rabies vaccination. Advocate public-private partnership in the implementation of rabies elimination strategy.

#### **5.4.7 Research and Diagnosis**

Research is an important component of any national action plan particularly to control infectious diseases. For Rabies, operational research by doing post-vaccination surveys and impact assessments. Impact assessment is the outcome measure in humans will be the number of animal bite cases, PEP usage, and human rabies cases. In animals, the outcome measure will be the number of confirmed animal cases. Similarly, cost analysis or accurate records of all expenditures on rabies control efforts will be useful to perform the cost analyses during the implementation or at the end of the program. Evaluation of diagnostics, drugs, and vaccines recommended for the Rabies elimination program. Evaluation of interventions for dog control Access to interventions for Rabies. For vaccination already, vaccine production departments must be utilized for vaccine production both at animal and human ends. Moreover, there should be a collaboration between rabies control centers and commercial laboratories available in a particular province in terms of testing suspected rabies samples. On both animal and human sides vaccine availability must be ensured either by importing or preferably by developing indigenous vaccines this would contribute to the overall cost of the resources required.

The NRPPCC should determine sample transport guidelines, as well as the network of official laboratories accredited according to quality management criteria as Reference Lab at the provincial level and a single lab at the national level. The existence of laboratories that implement diagnostic techniques, strategically distributed in different areas of the country is essential for better attention to suspected cases. Likewise, and according to the availability of local resources and infrastructure. There should be compliance with the guidelines to guarantee that each sample reaches the nearest laboratory

#### **5.4.8 Stakeholder Involvement**

Involvement of stakeholders at all stages of national action plan is key to the success. Rabies control being a model of One Health approach involves vast variety of stakeholders that mainly





involve; Health workers, Veterinary officers, Community health workers, public health experts, Local metropolitan or city district government representative, Non-Governmental Organizations, Local leaders or representatives from communities (Political leaders, religious leaders), Communities (pupils, elders, dog owners), Private animal practitioners etc. All activities and expected outcomes depend greatly on the active role of these stakeholders for sustainability and success of the Rabies control program

#### 5.4.9 Legal Framework

In Pakistan, Rabies remained a neglected zoonotic disease both on the human and animal side and it was not even a notifiable disease for many years. In 2017, the Ministry of National Health Services, Regulations, and Coordination (NHS, R&C) declared Rabies as a priority zoonotic disease for surveillance and response in Pakistan (Anonymous, 2017). In 2018, considering the importance of the global goal of zero rabies by 2030, a policy document was developed to raise understanding among the relevant stakeholders about their role to reduce the incidence of rabies in Pakistan (Rahim, Rabbani et al. 2018). The Punjab Animal Health Act was developed in 2019 to regulate the prevention, control, containment, and eradication of scheduled animal diseases. Rabies was included in the list of scheduled diseases of animals (PAHA, 2019).

Recently, Animal Birth Control (Dogs) Policy 2021 for Punjab province was developed. This policy describes the role and duties of different stakeholders to control animal birth inhumane way as per international practices. Detailed guidelines, operational management and recommendations regarding Dog Population Management (DPM) and Animal Birth Control (ABC) through Capture, Neuter, Vaccinate and Release (CNVR) are described in this policy document. Livestock and Dairy Development Department, Punjab has started implementing these measures in the province.

The scope of these recommendations is to deal with stray and feral dogs, which pose serious threats to human health, animal health, welfare problems and have socio-economic, political, and religious impacts. Khyber Pakhtunkhwa Public Health (Surveillance and Response) Act, 2020 covers surveillance and control activities of infectious diseases of public health significance. Punjab Animal Welfare Act, 2021 is also under process to ensure that animals intended for use in research facilities or exhibition purposes or use as pets are provided humane care and treatment. Dog killing to control Rabies will be banned once the animal welfare act is approved and more focus will be on alternative techniques to control the stray dog population. These all acts and policies were developed by different provinces and different departments in Pakistan mostly during the last five years. Furthermore, for implementation of proposed activities legislative framework shall be developed as required.

#### 5.4.10 Improved Surveillance System

Effective rabies surveillance in humans and animals should be established exclusively for Rabies for early detection and reporting of cases and is vital for initiating timely responses and enabling informed decisions about when and where to intensify rabies control efforts. Surveillance is essential in generating relevant data from district level throughout Pakistan to monitor the progress or impact of the control efforts, which is essential for their sustainable implementation. As control efforts progress towards rabies elimination, surveillance will become even more critical in ascertaining rabies-free status. Those provinces having established disease surveillance system either for human or animals should dovetail the Rabies surveillance component to the existing dashboard. If a province is lacking such surveillance system, it should develop the same during Phase I of nation action plan.

##### 5.4.10. 1 Recording and Reporting

Records are related information or evidences collected over a period of time. The availability of records is critical in the successful implementation of the program. These will make sure that



patient's data and management are monitored and appropriately documented.

- The NRPCP shall utilize an official well recognized National Rabies Surveillance System (NRSS) as its official recording forms.
- Quarterly reports on animal bite cases, cohort analysis and summary of human rabies shall be submitted by all levels to NRPCP. All the reports must be delivered to the office of the Animal Husbandry Commissioner.
- Recording and reporting shall include all animal bite cases categorized according to NRPCP guidelines.
- Data gathered from reports may be used for various analytical and research purposes, i.e., review of current strategies and activities; resource and budget allocation, progress and status of patients provided PEP, number of dogs (and other animals) vaccinated, etc
- The NRPCP will conduct annual data quality audits and make official routine rabies surveillance data available on a quarterly basis.
- As part of the commitment to performance monitoring, all stakeholders will meet annually to review achievements against targets and milestones in the strategic plan and annual work plans. These meetings will also define and finalize priorities for the following year.

#### 5.4.10.2 Evaluation

- Evaluations are typically conducted at specific time periods (for example, at the end of the year), whereas monitoring happens on a daily, monthly, and quarterly basis. An evaluation of NRPCP will demonstrate how well the program has met the expected goals and targets.
- For areas declared as Rabies Free Zone, monitoring should include the following in order to sustain free rabies zone
  - Activities to be conducted to sustain rabies free zone
  - Use of a checklist and monitoring for assessment and evaluation
  - Internal evaluation will be done by lead office at all levels under the guidelines that will be developed, and external evaluation will be performed by a consultant or external evaluator.

### Overall SARE Progress in Initial Phase (2022-2026)

After adopting necessary actions as planned, Pakistan will move from Stage1 (Assessment) to Stage 3 (Control) of SARE Scoring.

Final-Phase (2027 and beyond): Rabies Elimination, Self-declaration and Sustainability in the Freedom from Rabies

#### i. Implementation of The National Rabies Prevention and Control Plan (NRPCP) Outside the Priority Areas

Rabies control strategies outside the priority areas along with the routine vaccination in the priority regions. Pros and cons from practices and lesson learnt from the implementation strategies in the priority areas will be utilized for implementation to the rest of the country

##### a. Controls Point on Border Crossing

Rabies Check Points will be established at the portal of entry in the country for humans and dogs will be strengthened

##### b. Self-Declaration for Rabies Free Areas

Vaccination of dogs will be discontinued in a defined area when there are no incidences of dog rabies reported for two years, provided adequate surveillance is in place. If there are no rabies cases within six months when vaccinations have been discontinued within an area/ zone, then the area/zone will be declared as having achieved "freedom from rabies".



This will be self-declaration of freedom by The National Rabies Prevention and Control Committee (NRPCC) as guided by the regulations for self-declaration. Surveillance for rabies will be sustained and there will be adequate vaccine stocks along with advocacy, communication and social mobilization will continue in this phase.

ii. Canine Rabies with Maintaining Freedom from Dog Mediated Human Rabies

Continue with routine dog vaccinations, enough stocks of vaccines and biological for emergency response, continue with surveillance, cross border surveillance -international, advocacy, communication and resources mobilization

iii. Sustainability in the Freedom from Rabies in Humans and Dogs

In this stage, the country will be declared to be free from rabies and The National Rabies Prevention and Control Committee (NRPCC) will apply for certification from international bodies. Surveillance will also be enhanced to detect new cases and timely response mounted.

### 5.5 Overall SARE Progress in Final Phase (2027 and beyond)

After adopting necessary actions as planned, Pakistan will move from Stage 3 (Control) to Stage 5 (Maintenance) of SARE Scoring.

### 5.6 Monitoring and Evaluation Plan

Monitoring and evaluation is needed to verify the progress of National Action Plan at the federal, provincial, and district levels e.g. to verify whether program guidelines, strategies and activities have been implemented as planned, to ensure accountability, and to detect any problems and/or constraints. The main scope of this chapter will include; logistic management, animal rabies vaccine computation, human rabies vaccine requirements and computation, Rabies Immunoglobulins (RIG) computation, vaccine wastage, physical inventory, recording and reporting.

Evaluation plan shall be conducted at specific time interval preferably on yearly basis. Internal evaluation will be done by lead office at all levels under the guidelines that will be developed, and external evaluation will be performed by a consultant or external evaluator.

### 5.7 Financial Outlines and resources required

Following is the outline of budgetary requirements and financial resources as a pre-requisite to perform the activities of national action plan for Rabies control.

#### 5.7.1 Personnel Cost

Cost of following personnel for entire duration of the project at federal and provincial levels

- i. Animal Husbandry Commissioner responsible officer
- ii. Provincial Focal persons (Rabies Control Units (RCU))
- iii. Focal Personnel (Members of National Rabies Prevention and Control Committee (NRPCC))
- iv. Other personnel may include Research Assistant, Professional/Field expert (e.g. Dog Handlers, Vaccinators, Dog bite management experts, IT specialist) for R&D activities and operational activities (They can be hired as full time, part-time or contract basis)

#### 5.7.2 Vaccine and Supplies

- i. Vaccines for dogs
- ii. Vaccines and RIG for human
- iii. Consumable/Supplies for diagnosis and treatment of dog bite cases
- iv. Equipment for research and diagnosis
- v. Devices/Instruments for dog population estimation and TNVR activities

#### 5.7.3 Travel Cost (total duration of action plan)

Travel Cost for field activities which includes but not limited to following;

- i. Traveling for dog population estimation, TNVR activities, Awareness campaigns in community



and selected specific segments of population in different cities during different phases of National Action Plan

- ii. Travelling for operational and basic research works

**5.7.4 Overhead/Miscellaneous cost**

- i. Overheads of 15% of total cost shall be allowed to compensate the inflation and difficulties in execution of related activities.
- ii. The provision of 0 -15% additional funds may be allowed as required

**Financial Resources**

Budget allocation for the control program will be mainly by the federal government (Ministry of Food Security and Research and Ministry of National Health Services Regulations and Coordination, Health). At provincial levels the relevant Ministry of Livestock and Ministry of Health shall propose budget to PSDP and/or international agencies for the implementation of national action plan for Rabies control. Assistance from private sector and involvement of Non-Government Organizations shall be encouraged. After getting the first-time budget to establish the teams and centers at federal and provincial level, recurring budget for sustainability of the activities shall be proposed in each financial year.

**Table 5 .1: Proposed budget estimation for first phase 5 years**

Sr. No.	Budget Items Description	Quantity/Unit	Cost/Unit USD	Total Cost USD
1.	Personnel (Federal, provincial, dist teams with labor and field workers)	128 Focal persons/ Members/Field Workers	Av. 718.75/ person/year	4,60,000
2.	Animal Vaccine	15,40,000 vials	5.5844/vial	86,00,000
3.	Human vaccine	2.5M doses	4.5/dose	11,25,00000
4.	Rabies Immunoglobulin	0.75M doses	10/dose	75,00,000
5.	Logistic, infrastructure	Estimated / province (once at start of project)	/	42,50,000
6.	Research and Diagnosis	Estimated for development/ sustainability	/	14,00,000
7.	Surveillance and reporting system	Estimated cost of software and hardware	/	20,00,000
8.	Miscellaneous @15% of 136,710,000	/	/	205,065,00
	Grand Total			157,216,500 (157.2165 M USD)



## 6 REFERENCES

- ANONYMOUS. 2017. *Notification of Priority Diseases in Pakistan.pdf* [Online]. Available: <https://www.nih.org.pk/wp-content/uploads/2018/11/Notification-of-Priority-Diseases-in-Pakistan.pdf> [Accessed 14 Decmeber 2017].
- BENJI. 2005. Benji Project for Animal Welfare and Rescue. *CDRS Benji Project for Animal Welfare & Rescue*. Facebook.
- CAW. 2004. <https://www.facebook.com/cawoanimalrescue/> (Accessed 2022 Jan, 15)
- FOOKS, A., BANYARD, A., HORTON, D., JOHNSON, N., MCELHINNEY, L. & JACKSON, A. 2014. Current status of rabies and prospects for elimination. *Seminar*, 384, 1389-1399.
- KESSELS, J., TARANTOLA, A., SALAHUDDIN, N., BLUMBERG, L. & KNOFF, L. 2019. Rabies post-exposure prophylaxis: a systematic review on abridged vaccination schedules and the effect of changing administration routes during a single course. *Vaccine*, 37, A107-A117.
- KHAN, HARIS., MUSHTAQ, M. H. & NAWAZ, M. 2021. *Estimation of stray-dog population and its association with dog-bite cases as the baseline for rabies control in Lahore*. M.Phil Dissertation University of Veterinary and Animal Sciences, Pakistan.
- PAHA. 2019. *THE PUNJAB ANIMAL HEALTH ACT 2019* [Online]. Available: <http://www.punjablaws.gov.pk/> [Accessed].
- PARVIZ, S., CHOTANI, R., MCCORMICK, J., FISHER-HOCH, S. & LUBY, S. 2004. Rabies deaths in Pakistan: results of ineffective post-exposure treatment. *International Journal of Infectious Diseases*, 8, 346-352.
- RUMI, M. A., BARI, M. S., ABID, M. H., RABBANI, G. & HOSSAIN, M. B. 2018. Comparative study on dog bite and rabies in livestock and pet animal with their management in Faridpur sadar upazilla Veterinary hospital. *Research in Agriculture Livestock and Fisheries*, 5, 215-224.
- QAMAR, M. A., ASIM K. M., SAHAR I. & Uzma F. D. 2016. *Comparative Efficacy Of Chemical And Surgical Sterilization In Dogs*. MPhil dissertation, University of Veterinary and Animal Sciences, Pakistan
- SABA KHALID, MUSHTAQ. M. H., AHMAD M. D, AKBAR H. 2019. *Study on Association of Dog Bite and Dog Population in Different Towns of Lahore and Awareness Level Regarding Rabies Control*. M.Phil Dissertation University of Veterinary and Animal Sciences, Pakistan.
- SALAHUDDIN, N., MUBASHAR, K. & BAIG-ANSARI, N. 2014. Use of rabies immune globulin in seven urban emergency rooms in Pakistan. *Asian Biomedicine*, 8, 61-65.
- SHABBIR, M. Z., RABBANI, M., AHMAD, A., YAQUB, T., MUHAMMAD, K. & UR REHMAN, Z. 2011. Detection of Rabies Virus From Equines Showing Nervous Signs. *Pakistan J. Zool*, 43, 608-611.
- SHAH, S. I., BEG, M. A., NADEEM, M. S., FIAZ, M., KAYANI, A. R., RASHID, N. & IRFAN, M. 2016. Occurrence of rabies and dog bite in Rawalpindi district, Pakistan. *Annals of PIMS*, 1815, 2287.
- WASAY, M., MALIK, A., FAHIM, A., YOUSUF, A., CHAWLA, R., DANIEL, H., RAFAY, M., AZAM, I. & RAZZAK, J. 2012. Knowledge and attitudes about tetanus and rabies: a population-based survey from Karachi, Pakistan. *Journal of the Pakistan Medical Association*, 62, 378.
- ZAIDI, S. M. A., LABRIQUE, A. B., KHOWAJA, S., LOTIA-FARRUKH, I., IRANI, J., SALAHUDDIN, N. & KHAN, A. J. 2013. Geographic variation in access to dog-bite care in Pakistan and risk of dog-bite exposure in Karachi: prospective surveillance using a low-cost mobile phone system. 7, e2574.



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