

Online ISSN

3007-3197

Print ISSN

3007-3189

<http://amresearchreview.com/index.php/Journal/about>

Stray Dog Population, Rabies Control, and Urban Public Health in Pakistan

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BSS / Govt. of Balochistan 39th SENIOR MANAGEMENT COURSE (SMC)

(Monday, 19 January to Friday, 08 May 2026)

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ABSTRACT

Firstly, I want to thank Allah Almighty Who showered blessings over me at every step, which helped me made it easier for me to start this research. Then, I would like to thankful to Director General NIPA Karachi **Dr. Syed Saif ur Rehman, TI, PAS, Muhammad Ibrahim Ansari**, CI-SMC, **Syed Ghous Ali Shah**, ADS-SMC & **Shaquat Hussain Shah**, DD(P)-SMC who rendered valuable guidance to me from time to time. Furthermore, the support and prayers of my family was my strength which boosted my morale all the time. I would like to thank different organizations like Primary & Secondary Data getting from Federal and Provincial Department providing me relevant data. I also thank selected professionals, my friends and SMC participants for their assistance, views and feedback.

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Keywords: Policy Options for Stray Dogs and Rabies Control in Pakistan.

INTRODUCTION

Rabies is a viral disease of the central nervous system, which is fatal in all cases. However, it is also completely preventable. Clinical forms of rabies are paralytic and furious form of rabies. Another form is furious rabies. Regardless, rabies is a considerable but neglected public health issue worldwide. In spite of the existence of effective vaccines and post-exposure prophylaxis, rabies causes a great deal of morbidity and mortality, predominantly in Asia. This ideally impacts low- and middle-income countries, whose health systems are structurally, financially, and governably constrained (Hemachudha et al., 2013). Dog population uncontrolled, public awareness low, institutional responsibility lacking and ineffective urban governance mechanisms especially in fast growing cities are all responsible for the disease burden.

In Pakistan rabies is not simply a biomedical issue it is a multi-dimensional policy problem involving public health local government animal control and service delivery. Policymakers should devise integrated and evidence-based responses. According to Jabbar et al. (2024), the whopping rabies burden in Pakistan is due to the large population of stray dogs, weak disease surveillance system along with fragmentation of institutional response systems.

Rabies, in urban areas of Pakistan, has become an ongoing health issue as shown by rising number of dog bites and repeated pressure on hospitals' emergency departments. Research in major cities such as Karachi and Peshawar suggests that most incidents of dog bites occur due to community dogs in public places. Children and low-income communities suffer the most negative impacts (Khan et al., 2023; Ahmad et al., 2023). Rabies in Pakistan is not just a clinical or veterinary problem, it is also an urban governance problem that manifests in terms of municipal service provision, environmental management and public policy co-ordination.

The strategies deployed by Pakistan's stray dog policy have been reactive and inconsistent. A monument to the resilience of the men and women who dedicate their lives and limb to high stakes, behind the scenes drug war. With wit and realism in equal measure. Worldwide evidence shows that both the culling of free-roaming dogs and rabies-vaccine-only approaches could not reduce rabies transmission sustainably neither take into consideration ecological dynamics of free-roaming dog populations (Krebs et al. 1995; WHO 2018). To control rabies, it is recommended that mass vaccination of dogs be undertaken. In addition, it is also important to regulate responsible ownership and facilitate sustainable institutional involvement. Usually, this has been designed through a One Health Approach having human, animal and ecological health.

In Pakistan, rabies control and stray dog management are being done by a range of entities including local governments, departments of health and veterinary services. Coordination between these agencies is low and accountability is unclear. It is the constitutional municipal function to get the population of stray dogs abated, but the urban local governments often lack the technical ability, financial means, and clarity in law to deal with stray dogs in a humane and evidence-based manner. As a result, the control of rabies is fragmented, underfunded, and vulnerable to political and administrative discontinuity.

Online ISSN

3007-3197

Print ISSN

3007-3189

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The paper examines how the management of stray dog populations is inextricably linked with rabies control and wood public health in Pakistan in terms of policy and governance. The research determines its significant and ambit and will assess the national and international literature on the subject. This outlines the problem and the research gaps. The research identifies important institutional and policy discrepancies around urban public health in Pakistan relating to rabies. In the end, it discusses the significance of these findings for Pakistan's urban governance, along with providing a sustainable rabies control framework that is consistent with the governance level public health and policy reform objectives.

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3007-3197

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SIGNIFICANCE AND SCOPE OF THE STUDY

This study is important as it proposes to reframe rabies and street dog population management as a governance and policy coordination issue that requires effective policy intervention to resolve the issue instead of a narrowly defined biomedical issue. Rabies elimination from Pakistan is technically possible but not happening. This is primarily due to systemic weaknesses in institutional design, inter-sectoral and inter-governmental (Provincial-LG) coordination, and urban health service delivery. By analyzing rabies like an urban public health disease, this paper sheds light on how available knowledge and tools are inadequate to prevent diseases that don't exist anymore.

The study is particularly relevant to senior civil servants and urban planners, policy makers and citizens in health and municipal services at the country level related policy making. Rabies control is related to local government administration, environmental sanitation, veterinary regulation, public health finance and community participation. Unfortunately, the aforementioned fields mainly function in silos, leading to disjointed interventions and ineffective resource use. The study underlines the need to combine institutional mandates to enable continuous prevention actions.

The study's area will be limited to urban Pakistan. In particular, their large and medium cities. This is where the stray dog population is prominent and dog bite incidents are regularly reported. Rabies dynamics in rural areas have their own a number of challenges but urban sites make the population density, slums and waste management that enhance the H-D (human-dog) interaction. The paper actually makes use of secondary data which includes epidemiological studies, studies related to policy amongst others. It does not do any primary empirical research.

This analysis aligns with the goals of an SMC research paper, paving the way for further policy interventions to enable policymakers to deal with the issue.

LITERATURE REVIEW

Rabies and stray dog population management literatures include epidemiology, public health systems, veterinary science, urban governance, and social policy. The first epidemiological studies showed that in developing nations rabies transmitted by dogs is the main cause of human infections and that mass vaccination of dogs is the best method of disruption of transmission (Krebs et al, 1995). Further studies have shown that vaccinating around 70 percent of the dog population will provide herd immunity, even in environments with a large number of free roaming dogs (WHO, 2018).

In Pakistan, dog bites and rabies are already serious public health problems. A Karachi and Peshawar hospital-based studies have shown high volumes of dog bite cases, poor wound care practices, delayed presentation to health facilities, and inconsistent access to rabies immunoglobulin and vaccines, as reported by Khan et al. (2023) and Ahmad et al. (2024). The findings indicate service gaps and public awareness gaps, but they also indicate a failure of the health system.

Literature reviews alternative dog population management strategies that exist. Research reiterates that culling is of no use as a population control measure, due to rapid population rebound with increased breeding and migration (WHO, 2018). An assessment of public health literature illustrates that effective rabies control has been

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3007-3197

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3007-3189

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achieved through a combination of coordinated vaccination campaigns and municipal engagement, along with regulatory frameworks that promote responsible ownership. This gives ample proof of coordinated policy interventions could work in Pakistan too. Though often neglected, social science scholarship adds a layer of depth to policy responses to stray dogs by examining how media narratives, public perceptions and moral framings shape them. The attention grabbing dog attacks have been found to create pressure for action (Mica, 2010). As such, people want immediate visible action in response to these attacks. Historical studies from Europe and South Asia shows that fear- and symbolism-driven dog control policies favour reassurance over epidemiological impact.

Recently, rabies control has utilized One Health framework with success as the unifying paradigm. Human health, animal health and ecological condition are interdependent as portrayed in this literature, which advocates for those institutions that share responsibility for each's health to work together. In Pakistan, researchers have identified the weak collaboration between provincial health and livestock departments and local government institutions as a major obstacle in effective rabies control (Jabbar et al., 2024). While people agree on the best way forward, the practicing of evidence of effective interventions is limited.

STATEMENT OF THE PROBLEM WITH RESEARCH QUESTIONS

Despite substantial knowledge and tools for widespread prevention, rabies still creates an important public health problem in urban areas of Pakistan. This analysis focuses on the inability to implement evidence-based rabies control measures in a coordinated, sustainable and institutionally consistent manner. The populations of stray dogs are expanding our cities with poor solid waste management and weak municipal regulation, while the policy response remains fragmented and episodic, following the same pattern of the country.

In charge of rabies control and management of stray dogs are multiple agencies such as health department, veterinary services department, local governments, etc. There is little coordination and accountability. Because different stakeholders took initiatives on rabies, different areas of rabies management received attention. This has led to a lopsided focus on post-exposure rather than post-exposure treatment, inconsistent dog vaccination campaigns, and intermittent culling of dogs without any evidence to support it. Urban local governments are ideally positioned to manage dog population at the local level. However, they mostly lack legal clarity, finance, and technical capacity. Accordingly, this study is guided by the following research questions.

How does the governance structure and practices of Pakistan affect the approach towards dog population management and rabies control in urban areas?

What gaps in policy exist between well-established evidence-based rabies prevention strategies and their actual implantation in Pakistan's urban governance?

How to operationalize a policy-oriented One Health-informed approach through local government provincial inter-sectoral departmental coordination for the sustainable control of rabies.

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These questions frame an inquiry. Hence, this paper employs the following research methodology to explore, which is both analytically rigorous and directly relevant to policy practice and intervention for the issue.

RESEARCH METHODOLOGY

Qualitative Research Method

The qualitative research method adopted for this study is a policy-oriented research informed analysis and interpretation of scholarly literature and relevant secondary data to derive the research questions. A qualitative approach is appropriate because the research investigates rabies control in Pakistan not at all as a biomedical issue but rather a public health governance problem to examine the institutional mandates, coordination and responsibilities of the provincial departments and local government institutions.

The academic literature on the topic is peer-reviewed. According to studies published in well-recognized international journals like PLoS Neglected Tropical Diseases, The Lancet and Preventive Veterinary Medicine, there is a broader empirical understanding of the dog-bite epidemiology and their management. Reputable databases like JSTOR, Sage Publications, Scholar-Link, and others help access these studies.

The literature reveals Pakistan's challenge to rabies, set within the context of rabies elimination, globally. The literature also lays the groundwork for assessing the range of policy options and formulating policy responses to the issue in developing urban contexts in Pakistan.

Analytical Research Approach

The paper also studies the dynamics of scientific evidence, institutional arrangements and policy options in influencing the rabies control outcomes. Several international health bodies offer technical guidance and policy reports which are consulted to find out what the global health fraternity is recommending in terms of prevention. They are also researched in the context of the Sustainable Development Agenda-3. Thus, it is learnt that prevention strategies are not only beneficial for the individual but also society and the economy.

The distribution of responsibilities among provincial health, livestock departments and local governments is assessed, which is a review of national legislation and policy instrument including Provincial Rules of Business and Local Government Acts. The methodology of this study used secondary sources like epidemiological studies, hospital-based surveillance reports and public health data to highlight the pattern of rabies exposure and dog-bites in major urban centers of Pakistan.

Ethical Considerations and Limitations

The material consulted and reviewed was credible, and the authors were objective in their reviews. The study nonetheless has limitations including restrictions of time due to which field investigation could not be conducted to obtain primary quantitative data. Drawing upon an extensive range of scholarly literature, policy documents, and secondary data, stakeholders can sufficiently identify the issue coupled with governance gaps, and assess policy options by recommending policy responses aimed at improving rabies control in urban public health in Pakistan.

Online ISSN

3007-3197

Print ISSN

3007-3189

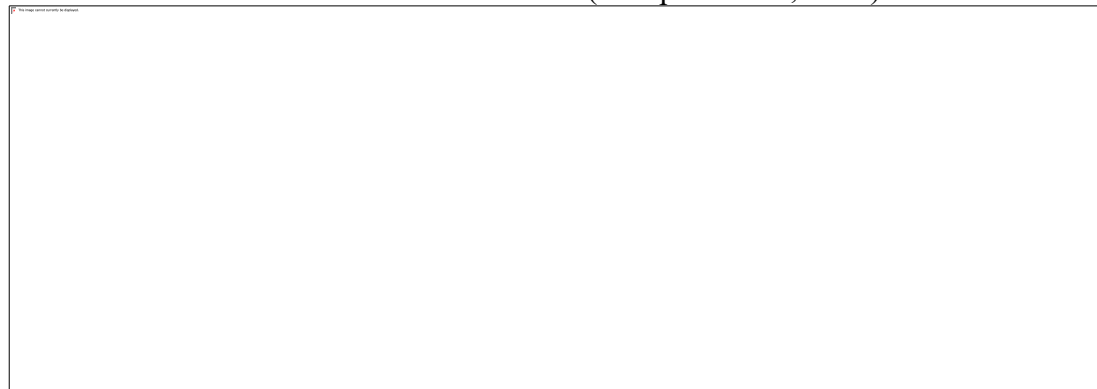
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SECTION-I

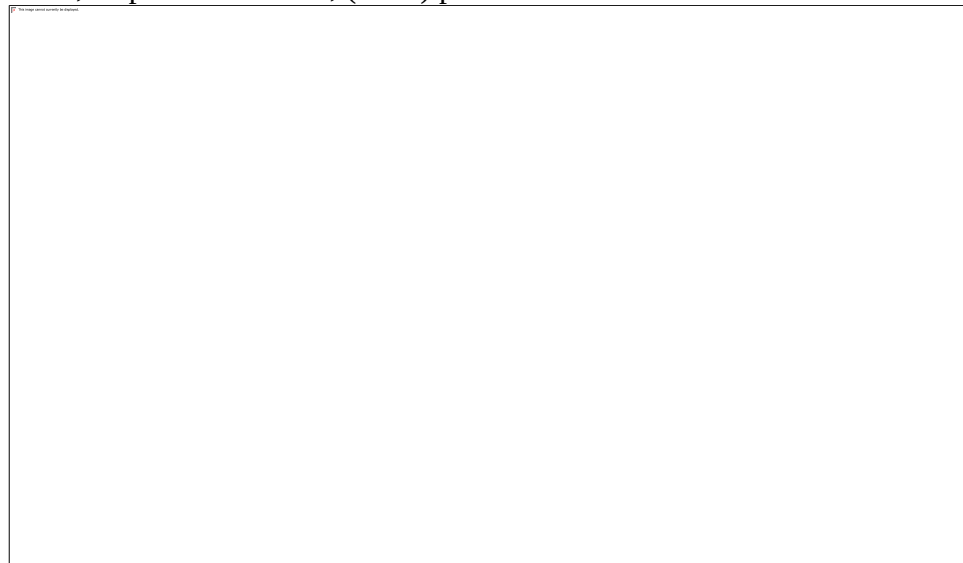
RABIES AS AN URBAN PUBLIC HEALTH CHALLENGE IN PAKISTAN

Epidemiology and Public Health Burden of Rabies

Rabies is a serious public health threat in many parts of world and yet a preventable one, especially in low-and-middle-income countries (LMICs), the public health systems of which suffer from various structural constraints. ‘According to an estimate made at the global level, around 59,000 anaphylactic deaths happen due to rabies. More than 95% of them occur in Asia and Africa’. (Hampson et al., 2015).



The dog is the primary source of rabies transmission to humans. In fact, a report from the World Health Organization states: “Over 99 percent of human rabies infections result from bites by infected dogs, making canine population management the most critical component of rabies prevention strategies. (Fooks et al., 2014)”. This is a grave challenge to cope with and will require systematic policy interventions to tackle the problem. The pie chart shows sources of human rabies transmission worldwide. According to Fooks, dog-mediated disease transmission accounts for the majority of cases, so presented. et al., (2014) pointed out.



Pakistan demonstrates these global epidemiological trends. Even with effective vaccines and treatment regimens, the country is experiencing a heavy burden of rabies

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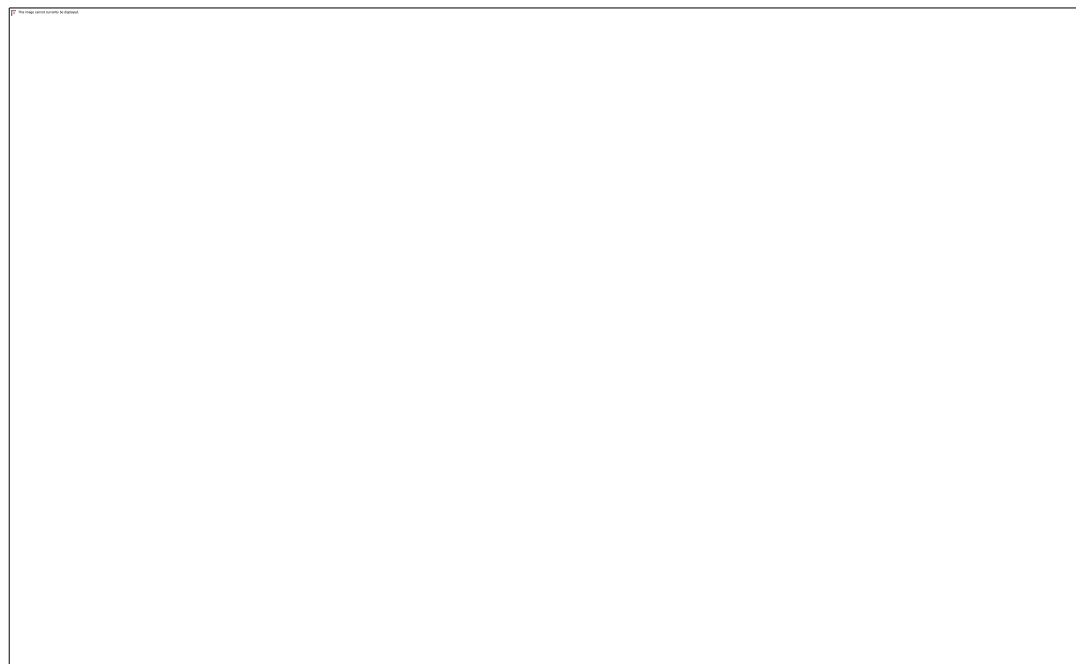
3007-3197

Print ISSN

3007-3189

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exposure. Most of this rabies exposure occurs in urban areas with large populations of free-roaming dogs and human-dog interactions. Epidemiological studies in Pakistan cities show that “most rabies exposures occur through dog bites in public places like streets, bazaars and homes” (Khan et al., 2023; Ahmad et al., 2024). The risk of rabies is not simply an individual risk of an animal bite but is a zoonotic public health risk that originates at the population level, affected by socioecological and institutional factors. Hospital-based monitoring data show how serious the problem is. In Karachi, hospitals in Karachi treat thousands of dog bite victims with rabies each year. Hospitals reported over 40000 dog bites in three major hospitals in a year, showing what kind of exposure urban populations face. Documentation has shown similar patterns in other cities. Mayo Hospital Lahore received about 1,800 cases of dog bites in a span of the last 14 months, while Peshawar and Quetta’s hospitals are receiving more and more bite victims.



Other implications may lie beyond the risk of injury. This will put a huge burden on those emergency departments who are already overloaded with providing PEP for varied conditions. Rabies treatment usually involves multiple vaccine doses given over the course of several weeks, and in serious exposure cases rabies immunoglobulin must also be given to the patient. The cost of these medications causes a financial burden on health systems and households, especially in low-income areas, due to a lack of timely access.

According to the United Nations (2015), from a global development perspective, rabies control is closely linked to Sustainable Development Goal-3, which aims to reduce mortality from communicable diseases, and strengthen health systems capable of responding to emerging health risks. As such, decreased transmission of rabies directly contributes to SDG Target 3.3 (end epidemics of communicable diseases) and Target

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3007-3197

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3.d (strengthen national capacities for health risk management and disease surveillance).

Urbanization, Environmental Conditions, and Stray Dog Ecology

In Pakistan, a complete understanding of rabies transmission depends on insight into the ecological dynamics of stray dog populations in cities. Research on dog population ecology suggests that ‘the numbers of free-roaming dogs is strongly affected by human environmental conditions such as food waste and shelter availability’ (Morters et al., 2014). Open dumping of waste in urban areas entraps stray dogs and provides them with food sources, assisting in their survival and reproduction at an increased rate.

In light of this underlying factor and phenomenon, urbanization in Pakistan has intensified these ecological processes. Over the past two decades, cities like Karachi, Lahore and Peshawar have observed large growth in population without sufficient municipal infrastructure and delivery services (which is in sharp contrast with faster growth of their urban population). Informal settlements and peri-urban areas often do not have adequate sanitation and waste disposal services. Public places accumulate organic waste which can be easily consumed by stray dogs.

Moreover, literature and reports suggest stable food sources favour the survival and reproduction of dogs, resulting in denser dog populations in urban neighbourhoods. In crowded cities, these animals occupy spaces near residential streets, markets, bus stops, and railway stations, along with other human installations. The chances of human-dog interaction increases in such surroundings, and hence, dog bite cases.

There exists an ecological relationship between urban waste management and stray dogs. The municipal governance is important for rabies prevention. Poorly functioning sanitation systems indirectly enhance the rabies risk by sustaining a large dog population that behave as an indirect reservoir for rabies. Dealing with rabies, therefore, requires an improvement in environmental management in the urban landscape, particularly waste collection and disposal systems that can reduce food sources for stray animals. You must strengthen the Local Government institutions.

Institutional Context of Urban Rabies Risk

Pakistan rabies persistence is also affected by institutional arrangements governing public health and municipal services. After the passage of the 18th Constitutional Amendment, public health powers largely passed away from the federal government to the provincial government. Only the powers of sanitation and municipal services were not devolved to the provincial governments and remain the responsibility of local governments. The idea of decentralization was to enhance public service delivery during the times of government. However, in practice, it has led to fragmented governance structures with roles outsourced to different institutions with little or no relationship between the various institutions.

Rabies management is primarily dealt with by health departments through clinical procedures such as wound management, vaccination and rabies immunoglobulin. Essential health services are vital for preventing death post-exposure. But, they’re dealing with the downstream end of the disease, and they’re not dealing with the environmental and ecological drivers of rabies transmission.

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According to Studies exploring service delivery in the health sector Pakistan clinical management system itself has gaps. Studies conducted among health care workers show variable knowledge about rabies treatment protocols and smaller facilities may not have vaccines and immunoglobulin (Ahmad et al., 2024). Many victims after suffering from dog bites ignore and delay treatment thinking it will heal by itself or due to money problems.

Municipal institutions that deal with animal control have problems too. Many cities will resort to periodic dog culling campaigns as their first response to public fear after a dog attack. Although such actions might achieve a temporary reduction in the obvious dog population, it hardly ever changes the environmental conditions that allow the stray dog population to re-establish rapidly. As a result, the urban authorities are often in a reactive mode to repeated outbreaks rather than preventing the incubation of the aforementioned conditions leading to an increase in the dog population in the market and community.

Rabies Prevention and the Sustainable Development Agenda

Pakistan's rabies example illustrates a broader relationship between urban governance, public health and sustainable development. It's a disease that can be prevented, and its continuing existence is due to failures in institutions not defects in technologies. To control rabies, coordinated action needs to take place in the human health, veterinary, environmental and municipal sectors. As seen internationally, sustained reductions in rabies incidence require a commitment to a longer-term preventive intervention, including mass dog vaccination campaigns, dog population management, improved surveillance systems and community awareness campaigns (Cleaveland et al., 2007). Based on the literature reviewed, countries in Latin America have been successful in reducing animal rabies transmission through veterinary and public health integrated programs with strong institutional coordination. The aims of strategies are highly aligned with Sustainable Development Goal 3. Preventing rabies supports SDG-3 as it reduces avoidable deaths and infectious disease morbidity and strengthens public health systems to manage zoonotic risks. Country-level rabies surveillance system enhancement can also contribute to the building of national capacity to monitor diseases and provide early warning with respect to diseases that threaten public health as set out in Target 3.d.

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Consequently, rabies must be recognized, within governance systems, as an urban public health issue for the reallocation of policy priorities away from crisis management and towards preventive engagement. Integrating rabies control into urban planning, public health policy, and environmental management frameworks would likely not only mitigate disease risk but also enhance Pakistan's progress towards global health and development goals, through strengthening coordinated approach among the relevant provincial departments with the LG institutions.

SECTION-II

INSTITUTIONAL FRAGMENTATION AND POLICY IMPLEMENTATION GAPS

Governance Architecture of Rabies Control in Pakistan

In Pakistan's urban areas, rabies persists due to fragmentation of institutions and sustained gaps in implementation of policies. A study of the systems on the ground reveals that responsibility for rabies control and stray dog management is dispersed across various governmental actors provincial health departments, livestock and veterinary services departments, urban local government institutions and others. All of these institutions operate under separate administrative mandates, budgetary structures, and accountability frameworks but with limited coordination. Consequently, a transparent executing agency does not exist that can be held accountable for the outcome of rabies control, allowing such failures to persist without any ongoing corrective action.

Following the 18th Constitutional Amendment of Pakistan that devolved a range of public health issues to provinces, the institutional setup for rabies governance has become even more complex. Decentralization aimed to improve public service delivery and administrative responsiveness by redistributing authority across various institutional layers. As provincial health departments conduct hospital disease surveillance, clinical treatment of rabies exposure, etc., the sanitation service and control of dogs activities remain with the LG institutions. Veterinary and livestock departments involved in monitoring animal diseases and vaccination campaigns operate

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3007-3197

Print ISSN

3007-3189

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under separate administrations which are usually quite detached from urban public health planning and LG institutions.

The scattering of power leads to a fragmented structure of governance where institutions deal only with partial cases of the rabies problem across the provinces that have similar institutional arrangements in place. The provincial health department's primary concern is the clinical treatment of bite victims for post-exposure prophylaxis. At the same time, the municipal authorities respond to public complaints on stray dogs through intermittent dog-catching operations. Veterinary institutions have the knowledge relating to vaccination and disease tracking, but they remain less integrated into urban health governance. As a result, policies that would require multisectoral engagement are seldom becoming sustained actions to deal with an issue.

Pakistan is limited in its implementation of global rabies control measures due to institutional fragmentation. As a result, international public health frameworks increasingly point to integrated governance mechanisms to tackle zoonoses in the human-animal-environment interface. Reiterating the argument made earlier, the achievement of these objectives is the crux of the global development agenda articulated through SDG-3, which calls for 'strengthening the health system... to manage infectious diseases... in addition to emerging public health threats' (United Nations, 2015). Pakistan's rabies prevention programme is fragmented and reactive as a result of a lack of integrated institutional framework involving health administration, veterinary services, municipal authorities.

Municipal Governance Constraints and Urban Animal Control

Urban local authorities are tasked with critical population-level actions like controlling animal population, managing waste and regulating public spaces. Hence, urban local governments has a crucial role to play in rabies prevention. Municipal institutions are in principle the most relevant institutional level to implement prevention measures in respect of stray dog populations. Successful management of dog populations through vaccination campaigns, sterilization programs and environmental interventions aimed at food availability and waste disposal practices are critical for rabies control.

In practice, however, municipal institutions in many cities of Pakistan suffer from such severe capacity constraints that they cannot effectively perform these functions. Many local governments do not have a dedicated animal control unit or trained personnel with reliable financing stream for animal management. Municipalities, who can be called upon to do dog control, are usually also involved with broader service delivery. Consequently, they have little institutional capacity to implement dog control. It has been seen most objectionably that municipal employees at times shoot stray dogs by using lethal weapons and live bullets. This practice is extremely outdated and poses serious risks to public safety when undertaken in residential areas.

Also, even when dog controls do occur, they often function in an ad-hoc way due to political pressure or the media circus. After a dog attack on a child or an event, usually people get more concerned. These incidents get wide media attention and the LG institutions face a huge demand for immediate action. Municipal governments may respond by starting temporary campaigns to cull dogs to show they are doing something in response to concern.

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Although evident in politics, these causes rarely create lasting reductions in the stray-dog population. According to Morters et al. (2014), ‘dog populations rebound quickly after culling when the factors influencing population numbers remain unchanged, such as food availability and breeding’. Taking animals out of their habitat without changing the ecological reasons for their rise means they’ll come back there quickly by moving or breeding. Thus, LG institutions continuously deal with the same cases with no long-term or sustained reduction in dog populations or rabies risk.

The limitations of municipal services governance under this context highlight the challenges associated with the provision of urban service delivery. Waste management systems in a number of municipalities of Pakistan do not consistently collect and dispose of waste. Food sources found on open dumps and unattended food waste sustain large populations of stray dogs in thickly populated areas. This means that the failures of local governance indirectly heighten the risk of rabies by creating an ecological niche for free-roaming dogs to thrive in the market and the community.

Health System Orientation and Preventive Policy Gaps

While the LG organizations face challenges of environmental management and dog-population control, rabies is managed in Pakistan mainly through clinical intervention. Hospitals and emergency department are the main institutional links between rabies exposure and public health response. Taking immediate treatment of bite wound and rabies post-exposure prophylaxis if bitten by potentially rabid animal prevents the onset of disease.

By preventing deaths from exposure, provincial health departments are critical to rabies case management. Under the Rules of Business, the institutional mandate of health departments places greater emphasis on curative medical-care than preventive population-level interventions. The provincial health departments mainly provide rabies vaccines, administer immunoglobulins if available, and treat complications due to rabies exposure. Although these interventions save lives, they do not interrupt transmission cycles within dog populations.

Studies of rabies governance in Pakistan have persistently identified this institutional orientation as a major obstacle to preventive policy formulation and interventions. Jabbar et al. (2024) note that hospitals owned by provincial health departments possess technical skills regarding treatment for rabies but preventive functions often receive little attention requiring inter-sectoral collaboration.

As far as the provincial livestock and veterinary departments are concerned, mostly all their attention is directed toward village livestock disease control. The problems related to dog health in urban centres do not seem to attract much institutional interest.

In addition to these structural barriers, operational constraints within the health care systems also restrict the implementation of prophylactic management. As mentioned earlier, the knowledge levels of health care staff with respect to rabies post-exposure and wound management has been found to vary. As reported by some establishments, the absence of vaccine and drug makes treatment difficult. Public health systems in Pakistan are currently facing resource constraints reflected in each of these challenges. Nonetheless, a clinical response system that worked perfectly would not be enough to eliminate rabies risk if the dog reservoir wasn’t addressed. Post-exposure prophylaxis

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Print ISSN

3007-3189

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protects individual patients but does not stop infected animals from circulating freely in urban areas. As a result, there is a policy structure that depend solely on clinical treatment which institutionalizes an ex-post system whereby authority's response to an exposure event instead of preventing them.

Data Fragmentation, Surveillance Gaps, and Policy Learning

Issues with rabies governance are exacerbated by mismatches between policy and implementation including surveillance systems and data integration mechanisms. The information on stray dog population, vaccination and biting is generic and scattered across agencies. The provincial health department's information on dog bite victims is hospital based. Limited records of animal disease monitoring are kept by the livestock and veterinary departments' subordinate. Along lines similar, even municipal officials often don't have a systematic record of stray dogs.

As a result of this fragmentation, evidence-based decision-making and targeted interventions becomes difficult. Without reliable estimates of dog population size or vaccination coverage, both provincial and LG authorities cannot design effective vaccination campaigns or monitor progress toward disease elimination. Similarly, the absence of integrated bite surveillance systems limits the ability of public health authorities to identify geographic hotspots where preventive interventions should be prioritized.

The lack of integrated data systems also constrains policy learning and program evaluation. Effective public health policies require feedback mechanisms through which interventions can be monitored, evaluated, and refined over time. When surveillance systems remain fragmented, policymakers lack the information necessary to assess whether particular interventions are reducing bite incidence or rabies transmission.

In such structural governance, symbolic interventions often substitute for evidence-based policy interventions. Sociological studies of risk governance suggest that 'reactive policies frequently emerge in contexts where public fear and political pressure shape policy agendas more strongly than empirical evidence' (Mica, 2010). In the case of rabies governance, high-profile dog attacks may trigger highly visible interventions such as culling campaigns, which generate political visibility but produce limited long-term public health benefits.

Taken together above, these institutional dynamics explain why evidence-based rabies control strategies have struggled to gain traction in Pakistan's urban settings. The central challenge lies not in the absence of scientific knowledge regarding effective prevention strategies, but in the administrative systems responsible for translating policy design into practice aimed to control systematically stray dog population. Addressing rabies therefore requires institutional realignment and strengthened coordination mechanisms capable of integrating public health, veterinary services, and LG municipal service management within a coherent preventive policy framework.

Strengthening such institutional integration would contribute directly to the objectives of the SDG-3 by improving national capacity to manage communicable diseases and zoonotic health risks. By building coordinated surveillance systems and improving

Online ISSN

3007-3197

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3007-3189

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cross-sectoral collaboration, all provinces in Pakistan can strengthen their ability to address rabies while simultaneously enhancing broader public health governance.

SECTION-III

POLICY OPTIONS FOR URBAN GOVERNANCE IN PAKISTAN

Institutionalizing Rabies Control within Local Governance

Pakistan's cities need a shift towards governance frameworks and away from reactive crisis management of rabies that focuses on prevention, coordination, and institution accountability. As we have seen in the arguments and analyses above, rabies is maintained in urban Pakistan not so much because of any technological or biomedical shortcomings but because of fragmented governance structures which mitigate against a systematic implementation of preventive measures to control stray dog-population. As a result, policy reform must focus on strengthening the institutional architecture through which rabies control is planned, financed, and executed.

It is a key policy imperative to make rabies control a normal municipal public health function instead of an emergency response due to dog attacks or media hype. Urban local bodies should be given clear legal and administrative mandates to lead the management of the stray dog population. Along with these mandates, there must be an assurance of predictable budgetary allocations, trained human resource and dedicated department within the LG institutions to be able to carry out the long-term interventions such as dog vaccination campaigns, sterilization program, and registration systems for pet animals.

Overall LG systems are particularly important because rabies transmission is closely linked to environment in cities. It is the duty of local governments to regulate public spaces, manage sanitation systems, and deal with animals interfacing directly with people. This would thus align administrative authority with the level of governance most capable of addressing the environmental drivers of disease transmission – namely – municipal institutions.

Such governance arrangements are well-supported by international experience. Evidence from different regions of sustained rabies control programs of mass dog vaccination plus dog population management initiatives are significantly more effective at lower cost than post-exposure prophylaxis after dog bite occurs. According to the World Health Organization (WHO), “preventive interventions targeting dog populations represent the most efficient long-term strategy in endemic regions for reducing rabies transmission.” Interventions that cut transmission at the animal reservoir level lessen human death and costs to the health system in their human impact. If these functions are institutionalized within local governance, then it will also directly contribute to national progress towards SDG-3.

Inter-Sectoral Coordination and the One Health Framework

Rabies management cannot take place in administrative silos even though municipal services are also important. Many sectors such as provincial health and veterinary services, local governments and environmental management will need to come together to control zoonoses. In the current governance architecture of Pakistan, however, these

Online ISSN

3007-3197

Print ISSN

3007-3189

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institutions largely work independently in silos, leading to fragmented policy implementation and limited information sharing.

Second priority is to strengthen inter-sectoral coordination in health. There is a need for formal legal mechanisms through the legislation of an Act of Assembly for One Health approach to ensure that there could be integration of provincial health department and livestock & veterinary services department and local government institutions. Potential solutions involve the establishment of common policy planning processes through joint surveillance systems and the establishment of interdepartmental working groups as well as coordinated performance indicators that align sectoral institutional incentives.

The One Health framework serves as the basis for integrating these components. Disease control interventions need to be multidisciplinary, coordinated and integrated to have the maximum impact on human health, animal health and the environment. Rabies illustrates this interlinkage: the virus circulates in stray dogs, crosses over to humans, and is influenced by the environment – for example, urban refuse management and settlement structure.

Scholarly research on rabies control governance in Pakistan has time and again diagnosed ‘the absence of institutional integration is a major barrier to effective prevention’ (Jabbar et al., 2024). As we have assessed before and wish to reiterate here that provincial livestock and veterinary departments generally do not focus on stray dogs in rural areas. While the health departments work on the clinical treatment of victimized individuals of stray dogs’ bites. On the other hand, LG institutions take on stray dogs from time to time for control without systematically coordinating with the veterinary or health department. Due to fragmentation, comprehensive strategies that interrupt transmission at the population level cannot be developed.

Coordination between these institutions will be strengthened with the adoption of a framework. Efficient and effective connectivity of hospitals, veterinary laboratories, local authorities will be helpful in real-time monitoring of dog bites, rabies and vaccination coverage. Joint planning processes can facilitate the design of coordinated vaccination campaigns and public awareness efforts. If improved, it would enhance Pakistan’s public health system’s capacity to address zoonotic disease risks and strengthen institutional accountability for policy outcomes.

Legal and Regulatory Reform for Urban Animal Governance

Legislative and legal reform is another important policy lever for preventing rabies within urban settings in Pakistan. Many provincial animal control laws are outdated and not always enforced. Laws are also limited to nuisance issues rather than public health ones. Regulatory frameworks are often silent on matters of the vaccine or humane population control.

A stronger legal framework can provide the institutional basis to design rabies preventive strategies. The laws of the land relating to the compulsory vaccination of owned dogs, dog registration systems with which local authorities can monitor vaccination compliance and a scientifically-managed approach to dog population management are amended. By having regulations, it would enhance accountability mechanisms identifying municipal and veterinary services departments’ responsible for implementing rabies prevention measures.

Online ISSN

3007-3197

Print ISSN

3007-3189

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Lessons learned around the world indicate that clear regulations will assist with sustained rabies control. As per research studying dog vaccination and its population management in Latin America, if you have a useful legal framework for the population management of the dog and its vaccination, the control program for human rabies will be more effective (Krebs et al, 1995). Thanks to such frameworks, authorities were able to command vaccination campaigns, monitor compliance and deploy resources on an urban-rural basis.

In Pakistan, regulatory reform may also assist in changing the policy narrative away from a dependence on coercive measures. An example is mass dog culling campaigns. Disqualification actions are often taken following dog attack incidents. When dog attacks receive media attention or a public outcry, the authorities often respond by culling the dog. However, the reports say that culling does not achieve long-lasting declines in the number of dogs or rabies figures. The vaccines and sterilization are among the strategies used to control the population of animals which are less harmful. Moreover, they reduce the probability of transferring the virus. Strengthening regulatory frameworks will help policymakers adopt evidence-based solutions that would ensure more effective long-term public health outcomes than short-term political capital.

Public Communication, Community Engagement, and Policy Sustainability

To prevent rabies, communication strategy should target the social and the political aspect of rabies control. As residents are frequently exposed to high-media coverage of lone incidents of dogs attacking people, their perceptions of stray dogs and risk of rabies generally shape their responses to policies. Public pressure usually compels the authorities to act quickly. Other authorities respond with culling the stray dog populations through their policy. Such occurrences create a cycle of moral panic that is devoid of logic.

To ensure the sustainability of rabies prevention and control, one must frame them as a public health issue rather than an urban cleanliness/security issue. Public campaigns should promote that rabies is preventable. Medical treatment in cases of dog bites is vital. Vaccination can protect humans from vaccinated-dogs. Awareness-raising campaign through activities such as washing the wound immediately and then consulting a doctor as soon as possible can reduce mortality and build the participation of the community in rabies control.

It is vital that the community gets involved when we vaccinate and sterilize the animals. Mass vaccination campaigns for dogs require local people's assistance, said the experts. They might assist in recognizing dog populations. Any cases of dogs biting should be recorded and reported to the appropriate authorities. Veterinary vaccination teams will be assisted in accessing dog populations. So, educational programs targeted at schools, community groups and local leaders can be crucial for enhancing public support for prevention.

These policy decisions reflect the important role played by administrative leadership in supporting senior civil servants to convert scientific knowledge into lasting governance solutions. The organization of control measures necessitates a concerted and integrated public health effort, an establishment of institutions, investment to be made on preventive line, and involvement with rabies-affected public.

Online ISSN

3007-3197

Print ISSN

3007-3189

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Implementation of strengthening the local government and; Improving institutional coordination through One health legal framework; reforming regulatory system, and improving public awareness can together lead to reduced risk of rabies in the urban sector of Pakistan. Considering the implementation of these strategies, Pakistan will not only lessen the burden of rabies, but also improve its capacity to mitigate the risk of zoonotic disease in an ever-increasing urbanizing world.

CONCLUSION

Pakistan's rabies problem is not scientifically insoluble; it is merely an institutional blind spot. This gaping hole is situated at the intersection of public health systems and the governance of animal or stray dog populations. As shown in our analysis, rabies continues to burden not least the urban sprawl of Pakistan as a result of disjointed governance institutional arrangements, reactive policy responses and the absence of sustained preventive frameworks. Evidence at global and national levels for decades has shown that mass vaccination of dogs and population management along with integrated surveillance systems are effective, yet the policy responses of Pakistan's provinces have remained, episodal, crisis-riven, and administratively scattered. Rabies continues to persist not because of a lack of knowledge or technical solutions, but rather a failure to integrate preventive solutions into coherent governance structures.

It was not possible to examine the study from theoretical perspectives as no theory has evolved in the field. Taking this context into consideration, Section-I of this paper located rabies in the urban public health system. Pakistan's cities bear witness to epidemiological patterns exposing rabies risk closely associated with environmental and governance conditions linked to rapid urbanization. Inadequate waste disposal and uncontrolled public spaces, together with the rise of free-roaming dog population, have resulted in the ecological conditions that increase man-animal interaction and exposure to dog bites.

In such scenarios, rabies transforms into a population-level urban health concern rather than an individual case. Figures gathered from hospital-based surveillance from cities such as Karachi Lahore and Peshawar show the extent of the problem of thousands of dog bites treated each year stretching already overburdened health systems even further. The patterns demonstrate that rabies is non-responsive to clinical intervention, and rather requires provision that targets the environmental and governance drivers of transmission.

Section II examined the institutional and governance dynamics that reinforce this. The governance and administration of rabies prevention and control in Pakistan is fragmented as issues related to rabies prevention and control are the responsibility of various government actors, such as provincial health and livestock & veterinary departments and LG institutions. Each of these institutions operates their own administration functions and budgeting processes and troubleshooting mechanisms and processes with limited coordination or joint accountability. The focus of health departments is mainly on the post-exposure prophylaxis and clinical treatment of rabies; that of livestock and veterinary departments on the livestock health in rural areas; and of municipal institutions on a sporadic control of stray dogs. The diffusion

Online ISSN

3007-3197

Print ISSN

3007-3189

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of responsibility due to institutional fragmentation makes it difficult for preventive strategies to take root in policy.

The problem of weak surveillance systems and fragmented data further complicates global governance challenges to intervene effectively to address the problem. Reliable dog population, vaccination coverage, and bite incidence data is dispersed across institutional silos, thereby restricting policy-makers' abilities to design evidence based policy interventions. In such circumstances, much of the policy response is fashioned after a public fear stemming from a major dog attack incident rather than public health planning. This has resulted in various reactive policy responses based on dog culling campaigns, which provide short-term political visibility but do not tackle the structural drivers of rabies transmission.

Section-III of the policy analysis sheds light on the possible ways through which these governance failures may be tackled. To control rabies, it must be repositioned in the area of preventive urban public health governance. Local governmental bodies need to be empowered and resourced to lead population-level interventions such as dog vaccination campaigns, sterilization programmes and environmental sanitation improvements. Inter-sectoral coordination between health and veterinary departments, and local governments; through institutional mechanisms must be strengthened so that these can integrate their surveillance system, policy planning process and performance accountability framework.

In this context, a One Health approach presents a governance framework that holds great promise. One Health serves as a conceptual framework for the development of an effective coordinated policy response to zoonoses. It also emphasises the inter-dependencies of human health, animal health and environmental conditions. Rabies exemplifies a typical One Health dilemma because its disease transmission cycle encompasses many sectors that have historically operated in silos. If institutionalized coordination across these departmental and governance sectors of Pakistan is put in place, then the public health system would be able to progress from crisis management of rabies disease to governance preventing rabies disease risks at source.

The consequences of policy reform of rabies have wider implications. By strengthening preventive governance for rabies, Pakistan will be able to directly progress towards SDG-3 to reduce the deaths of communicable diseases and strengthen the national capacity for health risk-management and surveillance (United Nations, 2015).

By implementing cross-sectoral governance to prevent rabies through the integration of veterinary, municipal and public health programs, we have real-life instances of improving health and strengthening institutional capacities.

Pakistani provincial governments can readily implement the policy recommendations. We must rethink rabies in legislative and policy frameworks as a preventative urban public health priority that is ingrained in local government systems and assisted through inter-sectoral coordination. To achieve such reforms, provinces offer an essential environment by clarifying institutional mandates, regulatory standards for dog vaccination and dog population management, and predictably financing municipal services implementation. Policies and local laws that link public health and humane-animal management can create the sort of stability and continuity that episodic administrative directives have not provided in the past.

Online ISSN

3007-3197

Print ISSN

3007-3189

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The findings of this paper can, therefore, provide a common framework to the provincial government to see rabies as a governance challenge in need of legal clarity, administrative leadership, and long-term institutional commitment. Comprehensively reformed policy and legislation on rabies will reduce preventable mortality and morbidity, strengthen urban public health system and improve effectiveness of the municipal services delivery. If we implement the appropriate changes throughout our public systems as well as policies, we can develop a strong evidence-based approach. In the end, rabies control provides Pakistan the chance to shift from reactive governance to proactive public health policy. The tools to end rabies (vaccination, surveillance, dog-population management, and community education) are tried and tested in public health globally. The relevant question that policy-makers face is not whether solutions effective exist but whether the will at the institutional level will be generated to implement them in a consistent and coherent manner. Pakistan can reduce the burden of rabies significantly by adopting integrated governance approaches rooted in preventive public health principles which can also strengthen the capacity of Pakistan for new zoonotic challenges in an urbanising world.

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