DOG BITES;
ASSESSMENT OF BURDEN, DETERMINANTS AND PUBLIC SERVICES AVAILABLE FOR THEIR VICTIMS IN DISTRICT LAHORE

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ABSTRACT… Every day, 25–30 new cases of dog bites are treated at the civil hospital in Karachi. In absence of accurate number of rabies deaths, Infectious Disease Society of Pakistan suggests there are around 2000–5000 rabies deaths per year[2]. The estimated prevalence of dog bites in Punjab is 0.03%, but no such estimate is available for Lahore[3]. **Objective & Method:** A community-based survey was carried out to assess the burden, determinants and public services available for dog bites in Lahore district, Pakistan. **Results & Discussion:** The prevalence of dog bites in the study population was 21.3%. The most common site of bites was the legs (68.4%), followed by the abdomen or trunk (12.1%), and hands or arms (5.6%). Among respondents to an exit interview administered to clients seeking care from an antirabies centre, the most frequent age group of victims of dog bites was 16–60 years (53.4%). The majority of respondents had been bitten by stray dogs (63), while 47 respondents were bitten by their own or others' pet dogs. Six respondents reported bites from rabid dogs. One hundred and seven (107) respondents said they had received vaccination at dog-bite centres; 89% of respondents confirmed the availability of vaccine, while 74.1% respondents said that they did not pay fees for services. **Conclusions:** The life-time prevalence of dog bites among respondents was 21.3%. The most frequent age group of victims of dog bites was 16–60 years. Both stray and pet dogs had bitten the victims.

Key words: Rabies, Dog bites, Surveillance, Victims

INTRODUCTION

Rabies has a near global distribution. Approximately 40,000 people die each year worldwide from Rabies. Most deaths occur in China, Bangladesh and Pakistan, where rabies is endemic and healthcare is poor. Rabies is the oldest recorded infection, dating back as early as 23 BC in Egyptian writings. The word Rabies comes from Sanskrit rabbahs, "to do violence". The Italian Girolamo Fracastoro described the disease in The Incurable Wound in1584. Rabies is still endemic due to the large reservoirs in global wild and domestic animal population[1]. Although effective and economical control measures are available[2,3] rabies remain a neglected disease throughout these countries[4]. The dogs constitute nearly 96% of source of infection.

Prevalence of dog bites

Dog bite injuries are an important source of injury in the US population, especially among children[5]. The estimated incidence of dog bites was 18/1,000 population; incidence rate of seeking medical attention by persons sustaining bites was 3/1,000. Children had 3.2 times higher medically attended bite rates than adults (6.4/1,000 children v 2/1,000 adults)[7]. In Belgium each year 1% of the general population needs medical attention after a dog bite[8].

Bites by age group

Children seem to be more at risk of being bitten by a dog than any other age group[9]. In children under 16 years of age, the incidence is estimated at 2.2% each year[10]. Injuries in children are often to the face and neck and may be life threatening[4]. In 1980, the highest bite rate occurred among children 7-12 years old (20 percent). Boys were bitten twice as frequently as girls by neighbors' dogs and strays; the bite rates from family dogs were identical in boys and girls[6].

The Study Done by Harlod, Dedorah and Jeffery Showed 3-year annualized, adjusted, and weighted estimate of new dog bite–related injury visits to US emergency departments was at the rate of 12.9 per 10000 persons. The median age of patients bitten was 15 years, with children, especially boys aged 5 to 9 years, having the

highest incidence rate (60.7 per 10000 persons for boys aged 5 to 9 years). Children seen in emergency departments were more likely than older persons to be bitten on the face, neck, and head (73% vs 30%)[13].

Children were at greatest risk for exposures to rabies, accounting for 60% of all reported animal bite injuries evaluated at the health centre. Also they were more likely than older persons to have received bite injuries to the head, face, and neck[16].

Bites by pet/stray dogs

Most dog bites happen at home and involve the family pet. At the same time, dogs remain very popular as pets, and evidence for the physical, psychological, and social benefits of dog ownership is growing[17]. Children were bitten more frequently by the dogs owned by their neighbors, followed by their own dogs, than by strays or by dogs whose owners were not known[6]. The dogs usually were owned by a neighbor (40.2%) or the victim's family (31%)[11]. Almost all cases of rabies in India are due to stray dogs, which act as a reservoir for the disease, according to the National Institute of Communicable Diseases, based in Delhi. The National Institute of Communicable Diseases says that almost 96% of rabies cases in India are caused by stray dogs, the remainder being caused by pet dogs, cats, monkeys, mongooses, and jackals.

Determinants of dog bites

A study done on 431 fatal dog attacks from 1965 to 2001 and reported in The Seattle Times showed that three critical factors are determinants in dog bite-related fatalities: the function of the dog; the owner's level of responsibility; and the gender and reproductive status of the dog[19]. The area of the city and mean household size were significant predictor variables for the population density of rabid dogs around household clusters[12].

Fatalities

Epidemiological data indicate that 50% of bites are not reported to medical or legal authorities[20]. Nearly 2.2 million people a year in India are bitten by animals, only 1.4 million of whom seek treatment. According to recent statistics (1996), out of 37,000 annual human rabies deaths globally, India alone accounts for 30,000 deaths. These statistics are considered to be a gross under reporting. Besides annually an estimated 1,000,000 people in India are known to receive Post Exposure Treatment (PET)[2]. The World Health Organization (WHO) in 2003 says that death due to rabid dog bites in India is increasing every year. About 17,000 people die of rabies in India every year.

WHO's 1999 World survey of rabies reported 1722 human rabies deaths from the study regions: 147 in Africa and 1575 in Asia. The predicted figure of 55000 deaths suggest that only 3% of human rabies deaths are recorded by central health authorities, a rate under reporting of between 20 times (Asia) and 160 times (Africa)[23].

There have been no reported cases of survival of an infected person, the WHO says. Stray dogs inflict about 95 per cent of the bites and "Every stray dog bite needs anti-rabies vaccination as there is no treatment for rabies[10]. A survey conducted in India shows that the dog : man ratio was about 1:12 and the pet:stray dog ratio of 1:2. The annual incidence of dog bites was 1.9% persons. The annual incidence of human rabies was 15 and dog rabies 58 resulting in a ratio of 1:4 approximately as a rabies contagion index[3].

Pakistan, a rabies-endemic country have no effective surveillance network to assess the magnitude of the disease. Every day there are 25 to 30 new cases of dog-bites treated at the civil hospital Karachi (one of the city's biggest public hospital). In the absence any accurate number of rabies deaths a projected estimate by the Infectious Disease Society of Pakistan (IDSP) suggests around 2000 to 5000 rabies deaths per year[4]. The sero-positivity of Rabies antigen was 5.7 % while it was 1.5 % in domestic[22] . An estimated prevalence of dog bite in Punjab is .03% (32 per 100,000 population) while no such estimate is available for Lahore[23].

No rabies immunoglobulins (RIG) or cell culture vaccines were administered. There were frequent power blackouts and no back-up supply at the public hospital. In-house potency testing of the vaccine batch by the

manufacturer was adequate, although it was not tested by the World Health Organization (WHO) recommended NIH test. Samples of SBV of the same batch collected at the peripheral sites showed no potency. Rabies incidence was estimated to range between 7.0 to 9.8 cases per million annually[24].

A dog's tendency to bite depends on several interacting factors, and measures such as breed specific legislation, as adopted by some governments, are inappropriate. Tackling the problem requires a multi-factorial, multi-disciplinary approach[17]. There is no data available regarding burden of dog bite in district Lahore and similarly not regulatory authority for rabies control.

General objective

To assess the magnitude of dog bites and evaluate its management services available in Lahore.

Specific objectives

1. To conduct a community based study in Lahore slum for estimation of dog bites and practices of victims.
2. To study the determinants of dog bites in urban and rural settings.
3. To evaluate quality of care delivered to the victims of dog bites at dog bite management centers in Lahore.
4. To know the Public Services for control of Rabies, elimination of rabid dogs and regulation of pet dogs.

Methodology

The study was conducted in district Lahore, which is the provincial capital with a total population of 6,318,745. The study population is a mix of urban and rural communities. District Lahore is administratively divided into 9 towns having 150 Union Councils. Total sample size is divided into nine groups and being identified from different towns (clusters) of Lahore

Study Subjects

Inclusion Criteria

There was different criteria's for three different target groups:

1. Community Based Survey

Any adult household member present at the time of survey from those households, which were identified by random selection through cluster sampling technique.

2. Dog bite Management Center

One tertiary care center and two RHCs were included in study. Exit Interview of every third victim of dog bite coming to the center for management was conducted. Interview of Manager/In charge of Dog bite management centers, included in the study, was conducted.

3. Regulatory Authorities for pet and stray dogs

Two out of six town Nazims and EDO & DHO Health of District Lahore was

Exclusion Criteria

Those house holds who refused to volunteer the consent for interview.

Those victims at the center who do not volunteer the consent for interview

Study design

Cross-sectional Community Based Epidemiological Study

Sample size

Prevalence of dog bite in Province of Punjab is 0.03 % (32.341 per 100,1000) while the population if District Lahore is 6,318,745 so the sample size estimated, at 95 % confidence interval by keeping 0.14 % worst acceptable value, is 952 but we took 1000 individuals from equal number of households for interview. This sample was identified through Cluster Sampling, by taking 9 towns of district Lahore as 9 clusters having 150 Union Councils.

Sampling technique

Cluster Sampling Technique was used for Sample identification. Total sample was equally divided in 9 towns, comprised of total 150 union councils. 54 Union Councils were Randomly Selected through balloting method so that 9 UC taken by random selection from each of 9 towns. Now 20 households were randomly identified from each of the selected Union Council.

Interview of one adult member from each selected household was conducted for data collection. Making round figures during calculation, total 1080 households which are more than the estimated sample size were interviewed. Every third victim of dog bite visiting Dog Bite Management Center during the days of data collection was interviewed to get total of 100 interviews. Finally Interview of Two town Nazims selected randomly out of nine towns and Interview of EDO Health of District Lahore was conducted.

Data Collection methods, instruments used, measurements

Semi Structured Questionnaire was developed in local language and pre-tested. It was revised after pre-testing and final version was divided into four sections to collect the information on the following topics:

- Consent Sheet
- Personal Profile
- Information about dog bite and practices after the dog bite.
- Information about pet dog

RESULTS

CHARACTERISTICS OF RESPONDENTS

The characteristics of the respondents (n=993) to the structured questionnaire included age, sex, educational status, income and family size. Among respondents 915 were male and 77 were female. 36% respondents were matriculate, while 23 % respondents were illiterate, 22.1% were primary, and only 14.2% graduation and 4.4% reached post-graduation level. Majority of respondents (92.8%) engaged in various occupations including agriculture, industry, office and self-employment. Majority of respondents (92.9%) were earning more than Rs 1500/- per month ($ 1/day). Among them 25 % were earning more than Rs:10,000, and 42.4% were earning between Rs: 5001- 10000/-.

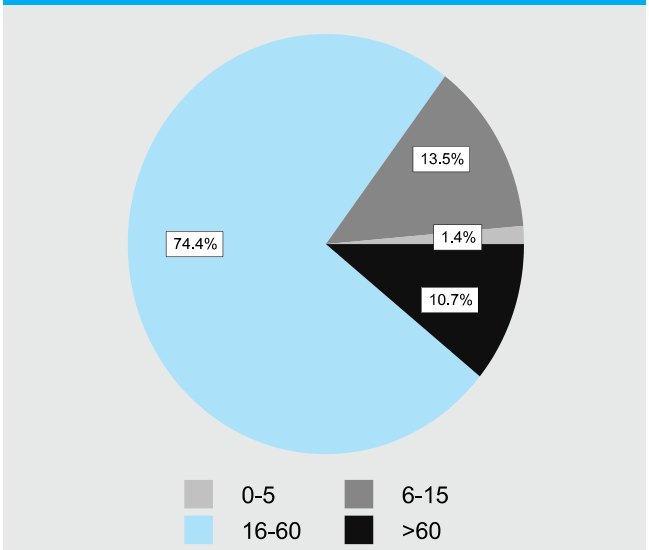
FEAR FROM DOGS

59.6% of respondents said that they are afraid from dogs, while 40.4% had no fear from dogs. Of 915 male respondents, 543 said they had fear from dogs, while 26 out of 52 female respondents had fear from dogs. Effect of educational status on respondents getting fear from dogs was almost same in all categories , except in the category of post-graduates where in respondents getting fear were double in numbers than those feeling no fear from dogs.

BURDEN OF DOG BITES

It was found that a total of 137 (13.8%) respondents had been bitten by dogs, while 74 family members of the respondents were bitten by dogs, which means that the prevalence of dog bites among the study population was 21.3%.

Fig-1. Age distribution of victims of dog bites in the community



Major victims of dog bites fall into the category of 16-60 years which is the age group having maximum mobility and have to go out for social anc economical activities.

Type of Dog

Of 215 cases of dog bite victims, Eighty (81) were bitten by pet dogs and (115) cases by stray dogs.

Site of Bite

The site of bite in 187 cases were legs (68.4%), followed by abdomen or trunk (12.1%) and hands or arms (5.6%). Only 2 cases have bitten on face corresponding to the very few cases (3) of aged 0-5 years.

Clothes wearing

The clothes wearing at the time of bite included shalwar & qameez (92 cases), pent & shirt (24), dhoti & qameez

(21) and nicker (2).

Time of Bite

Fifty four (54) cases were bitten at noon or during after noon, followed by 34 in the morning, 24 in the evening and 21 during night.

Deaths due to Dog Bites

In response to the question to assess the number of deaths due to dog bites, four respondents reported that death had occurred due to dog bites in their families.

TREATMENT OPTIONS AND SERVICES AVAILABLE

In response to the questions regarding treatment options, 45 respondents treated their bite wounds at their home, while 38 went to general practitioner ,36 to health care center, 8 to hakims and 6 opted for spiritual healers. The respondents of the exit interview said that they apply chilli Powder. Regarding availability of services for the management of dog bites in the areas , the respondents were residing, only 17.7% of respondents said that services for the management of dog bites are available in their area, while 82.3% of respondents said that there are no services available in their areas.

Among types of dog bite management centers the respondents said there were clinics of private doctors (60 respondents), dispensaries (45), rural health centers (26), basic health centers (13) . While 18 respondents said they did not know any center. Distance of dog bit management center was less than 1 Km (8.5%), 2 to 5 Km (2.1%), 5 to 10 Km (0.5%) and more than 10 Km (0.5%). Regarding type of services , 9.3% respondents said wound management services were being provided ,while 2.8% said about vaccination services.

CHARACTERISTICS OF PET DOGS

It was found that 9.9% of respondents were keeping pet dogs. On asking respondents that do they feel fear from their pet dogs, only 8 % of respondents said that they feel fear from their pet dogs. Regarding vaccination status, one-third of respondents (25 out of 98) said they had got their pet dogs vaccinated; while of these, 14 were asked by authorities to get their pet dogs vaccinated. Giving reason for vaccination, 8 respondents said that they did on the instruction of government authority, 9 said they were asked by friends , while 2 respondents did it out of self-motivation.

CHARACTERISTICS OF CLIENTS OF DOG BITE CENTER

Age Groups of Dog Bite Victims

Among the respondents seeking care from Anti-Rabies Center, the most frequent age group becoming victim of dog bites was 16 to 60, which included 53.4% of the respondents followed by 5 to 15 including 32.8%. Only 8.6% and 5.2% of victims belonged to the categories of age groups of 0 to 5 and 60 & above respectively.

Type of Dog

Majority of respondents, in this study were found to be bitten by stray dogs (63), while 47 respondents were bitten by their own or of others' pet dogs. Six respondents reported that they have been bitten by rabid dogs.

Treatment and services

One hundred and seven (107) respondents said they received vaccination at dog bite centers. While 9 respondents said that they bite wound was only managed at the center. Regarding availability of vaccine, 89% respondents answered in yes while 10.3% respondents said that vaccine was not available at the center. As per cost of vaccine, 74.1% respondents said that they did not pay, while 25.9% said that they had to pay for the vaccine. It was also found that vaccine costed Rs:300/= for some to Rs: 5000/= for a few others.

In response to the question regarding site of administration of vaccine, 62.2% respondents said that they were given vaccine at para-umbilical region , whereas 38.0% of victims were given vaccine intramuscularly.

Prior Treatment

On questions regarding treatment prior to reaching Anti-rabies center, most of the victims (44.4%) said that they treated their wounds with chilli powder. Only a few victims (5.4%), got tetanus toxoid vaccine, applied pyodine or polyfax (6.2%), went to spiritual healers (2.7%), to hakim (0.9%), and had their wounds stitched (0.9%).

DISCUSSION

Dogs have been known as man's best friend for decades. Owning a dog can be a positive, enjoyable experience for the entire family. But the same time his bites sometimes are responsible for 100% mortality for his best friend. Dog bites are a serious health issue. Bite wounds account for about 1–2% of all emergency department visits annually in the USA, costing over US $100 million annually (26). In the USA, an estimated 3.5–4.7 million dog bites occur each year[27].

In Pakistan, It is estimated that 2500 human rabies deaths may occur each year. Dogs are the main animal reservoir and transmitter of the disease.

This study provides the results of the first community-based survey to assess the burden, determinants and public services available for dog bites in district Lahore.

In our study, the prevalence of dog bites among respondents was 21.3%. This prevalence reflects the number of respondents ever bitten by dogs. The most frequent age group becoming victim of dog bites was 16 to 60. The second in frequency was age group of 5 to 15. A few victims belonged to the categories of age groups of 0 to 5 and 60 & above respectively. Of 140 cases of dog bite victims, Eighty (80) were bitten by pet dogs and fifty one (51) cases by stray dogs. While on exit interviews it was found that Majority of respondents, in this study were found to be bitten by stray dogs (63), while 47 respondents were bitten by their own or of others' pet dogs. Six respondents reported that they have been bitten by rabid dogs. This higher number of stray dog bites among respondents from exit interviews indicating that stray dog bites have perceived more dangerous while pet dog bites were often ignored in view that dog was known to the victim.

Viewing the findings of our study in the perspective of the other studies done in the world, our study showed high burden of dog bites. The study done on Pennsylvania children, ages 4 to 18 years showed that 45 percent of children had been bitten during their lifetimes[6] which is almost double the burden found in our study. The high magnitude of dog bites can be understood by the fact that in over 70% of such cases, people are bitten by their own pets or by an animal known to them[29]. Nearly 2% of all Americans are bitten by a dog each year[28].

Males are more likely to be bitten than females, and are more likely to be bitten by dogs[30]. But our study among 140 victims of dog bites, 128 were male and 12 were female found that there was no significant difference between males and female on being victim of dog bites. The study done in India also showed results higher rates for males than females[31].

In our study the most requent site of bites in were legs , followed by hands or arms and abdomen or trunk . The study done in Dehli and surrounding areas on epidemiological characteristics of rabies also showed that majority of the cases were bitten on lower extremities alone[32].

While 19% of cases stated that the biting animal was rabid. In our study among 5.2 % cases the biting animal was rabid.

Our study found that majority of victims (44.4%) said that they treated their wounds with chilli powder prior to reaching anti-rabies center to receive prophylaxis treatment.. In India, a community-based study done on a rural community of ten villages served by a primary health centre, which showed that half of the dog bite victims treated their wounds with chili powder. The use of chilli powder to treat dog bites is an indigenous practice[31].

This study highlights the importance of tetanus toxoid vaccination following the animal bite wounds. The prophylaxis against tetanus following the dog bite was received by only 5.4% victims. Comparing this with the rate of receiving tetanus toxoid following road injuries (55%), there is large gap between getting tetanus toxoid prophylaxis for road injuries and for animal bites.

The developed world diametrically differs from the developing world. The first world is very sensitive towards human rights and has grown even greater sensitivity towards animal rights. Keeping animal pets is an almost norm. While in third world, the issue of human rights has yet to find a place on the agenda of authorities.

Talking of animal rights only brings sarcastic smiles.

However both the issues, whether human or animal in coming years are to become the main areas of concern while developing strategies to control disease.

The issue of dog bites revolves around two different aspects; one is ensuring human safety from dog bite injuries and second is creating rabies-free society. Public Health authorities have always used the risk of disease transmission to humans as an excuse to justify the indiscriminate extermination of animals But this practice of extermination being going on for decades has proved only a failure, as has been shown in India and China , two countries with largest population. The public health authorities in the hope of finding a quick solution, only discover that the destruction had to continue, year after year with no end in sight". Dogs move in from the outskirts in search of easy access to food. This process of migration of dogs from rural to urban presents a very interesting phenomenon. Dogs don't trespass the territories of the other dogs. But once an area is cleaned of dogs population by human hand, the dogs from all sides around rush to occupy the vacated area, and the area gains the dogs population not in the same proportion but often one dog killed is replaced my his brethren.

To eliminate stray dogs, A special cell headed by Epidemic Control Officer, works at the level of City District Government. This cell submits weekly reports to Executive District Ht Officer. In 2005 this cell killed 18000 stray dogs in urban area and 2744 dogs in rural area. Dogs are routinely killed as planned and in response to the complaints receiving from various areas. Under this programme 14 Kilogram of Strychnine was bought.

City District Government provides Anti-rabies Vaccine of Nerve Tissue type, Rural Health Centres and District Health Quarter hospitals. EDO told that the vaccine provided by National Institute of Health is neither effective nor of good quality.

Regarding training of health personnel, EDO told that they are given refresher training on rabies prophylaxis and treatment at district health development centre (a unit for health promotional and health personnel development). But on interview with Director DHDC, it was discovered that no such specific training has been imparted to health personnel. However as part a few other health topics, rabies has been in general was discussed.

On question of vaccination of pet dogs, EDO said that we run health campaigns among the owners of pet dogs to immunize their dogs. The health education comprises of various topic including rabid dog killing, importance of wound cleaning and intoxications.

Interviewing Nazim of Shalimar Town, it was found that dog killing operation is directly supervised from district. Towns or Union Councils are not involved in eradication of stray dogs, neither at the planning level nor at the time of implementation. If ever such situation arise we request District to make arrangement for the killing of the dogs. She further said we do not have any regulation for the vaccination of pet dogs. Regarding health education she said that it is very difficult to educate the people as most of the residents of this two are poor and Health Education is not their priority.

The problem of dog bites is of similar magnitude in both developed and deveveloing countries. But More than 99% of all human deaths from rabies occur in the developing world[2]. despite effective and economical control masures are available[2,3]. Which means that dog bites do not lead to similar outcome in both worlds. In the developed world majority of bites are done by pet dogs and in the developing world more bites are done by stray dogs. This explains why childern become victims of dog bites.

During exit interviews it was observed the investigator that victim has to make choice between nerve tissue vaccine, which is available free but is given at para umbilical region for fourteen days and cell culture vaccine, which cost rupees 700 (12$) for two injections and are given on arms. It was found in our study that 62.2 % respondents were given vaccine at para-umblical region where as rest of victims were given vaccine intramuscularly which means that two third of victims could not make choice for a better and effective vaccine

due to their lack of purchasing power.

In 1995 the estimated number of Post Exposure Treatment administered in Pakistan was 81800 with sheep brain vaccine produced at the National Institute of Health (NIH) and 20% received cell culture vaccines. Rabies immunoglobulin of human and horse origin was given to only 2% of the patients, showing that in ten years from 1995 to 2005, Increase in the number of victims receiving cell culture vaccine is only 18%. However this increasing trend is yet needed to be explored that whether it is due to the rising awareness among the victims about the advantage of cell culture vaccine or simply a better compliance of three intramuscular injections as compare to the 14 para umbilical injections.

The most striking improvement which has been recorded in the field of rabies over the past few years is a very drastic reduction in some Asian countries of the number of human rabies deaths. This decrease is most certainly linked to the increased availability of efficacious and safe cell-culture rabies vaccines for human use rather than to the implementation of effective control measures in the dog population. This phenomenon has been documented in two Asian countries namely China and Thailand where numbers of human deaths were reduced by 80% in 10 to 15 years. In Thailand this followed the increased availability of imported modern rabies vaccines and the development of a new economical regimen for human post-exposure treatment, and in China the local production and wide distribution of large quantities (20 million doses approximately) of a primary hamster kidney cell vaccine (PHKC) for human.

Temporary successes were recorded in other countries, for example in parts of Sri Lanka, where rabies was brought under control following dog mass immunization campaigns and the number of human cases reduced by 60%. Difficulties in maintaining a high enough vaccination coverage in dogs have recently led to an increasing number of reports of human rabies deaths on the island.

CONCLUSIONS

The study concludes that:

- The life -time prevalence of dog bites among respondents was 21.3%.
- The most frequent age group becoming victim of dog bites was 16 to 60.
- The victims had been bitten by a mix of stray and pet dogs.
- Almost half of the victims treated their wounds with chilli powder. The study identified the large gap between getting tetanus toxoid prophylaxis for road injures and following animal bites.
- Most respondents have to rely on nerve tissue vaccine due to lack of purchasing power and on private doctors who have inadequate training in dog bite wound management.

RECOMMENDATIONS

In view of the findings of our study following recommendations are suggested:

- Upgrading the quality of rabies vaccine production.
- Conducting epidemiological surveys of rabies.
- Promoting education, information and communication for rabies prevention.
- Initiating studies on methodologies and technologies for effective control of rabies.
- There is a need for effective dog control strategies as well as proper human post-exposure treatment using economical regimens and immunoglobulin administration when indicated.
- Train manpower at all levels and provide information to the community.

Control activities: They should involve:

1. The animal reservoir (mostly dogs) by paying attention to dog population management (destruction, reproductive control) as well as dog vaccination (management /coordination; amount/quality of vaccine);
2. Humans by ensuring pre-exposure treatment of personnel at high risk (dog vaccinators, In either case an hospital personnel) and post-exposure treatment of bitten persons. appropriate amount of safe and efficacious biologicals including immunoglobulin for treatment of severe exposure should be available.

- Intersectoral cooperation (surveillance, follow-up) is again essential to ensure the best use of costly biological products.
- Education/training of medical staff and of the public at large is essential to overcome certain attitudes towards dog vaccination, dog population management and post-exposure treatment; an adapted, enforceable legislation should be adopted.
- Since there is high prevalence WHO recommends capture–mark–recapture studies to estimate the size of dog populations[6].

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