Remaking zoöpolis: Human street-dog cohabitation & rabies prevention in India

Preliminary report on selected findings

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Study goals and components

This study was motivated by an impasse in scholarship, policy, and practice on rabies and street dogs in India[12]. Scientific literatures display significant consensus with regard to best practice in rabies control in places with street dog populations: 1) dog population management through neutering and vaccination; 2) education about bite prevention and treatment; 3) accessible and affordable post-exposure prophylaxis. Despite this scientific consensus and more than a century of state-led dog control in India (through killing from the 1800s, and then through animal birth control from 2001), India continues to see regular public controversy around this issue. In an effort to tackle this impasse, in this study, we took a step back, and moved away from the focus on rabies and bites to examine society-street dog interactions more broadly. Undertaking research in Chennai city, which has the country's longest-running animal birth control programme, we examined:

1. Public attitudes towards and perceptions of street dogs.
2. The characteristics of interactions between street dogs and members of the public.
3. Public knowledge about street dog behaviour, human-dog conflict, and conflict prevention and response.
4. The conditions under which negative interactions/conflicts emerge.

The study involved four components:

1. A representative sample survey in Chennai of public attitudes, knowledge, and interactions vis-à-vis street dogs.[3]
2. Semi-structured qualitative interviews with members of the public covering people from different genders and socio-economic backgrounds, and including those who had registered complaints against street dogs in the National Consumer Complaints Forum website.[4]
3. Hospital-based research comprising semi-structured qualitative interviews with (i) patients in the dog-bite outpatient ward in one of Chennai's largest government hospitals, ii) with the parents of dog-bite patients in Chennai's government hospital for children; iii) medical staff, including nurses and doctors.[5]
4. Pilot observational research of street dogs and their interactions with the biophysical environment and people.

The findings that we present here combine selected key findings from preliminary analyses of the social science components of the study (i.e., Components 1, 2 & 3).

Selected Findings

I. Attitudes towards street dogs

Highlights: *i) There is no linear relationship between socio-economic class and attitudes towards street dogs. Ii) Results from different components of the study show a combination of seemingly contradictory views about street dogs: people feel that street dogs are problems, but also think that they belong in the city. Iii) Fear and dislike of street dogs are correlated. Iv) Pavement dwellers and waste workers have strong relationships with street dogs, and display sound knowledge about these animals.*

We asked people eight ***survey (Component 1)*** questions relating to their attitudes towards street dogs. Participants' scores across all eight items were averaged to form one singular measure, which we refer to as the Attitudes Towards Street Dogs (ATSD) scale. Scores on the overall ATSD scale

range from 1 – 5 around a neutral mid-point of 3, with higher scores representing more negative attitudes and lower scores representing more positive attitudes. This 8-item scale was shown to have (just) acceptable internal reliability, with a Cronbach's Alpha = 0.69. ATSD scores for the sample as a whole displayed a relatively normal distribution around a mean of 3.07 (i.e. very close to the neutral scale midpoint), as depicted in Figure 1 below.

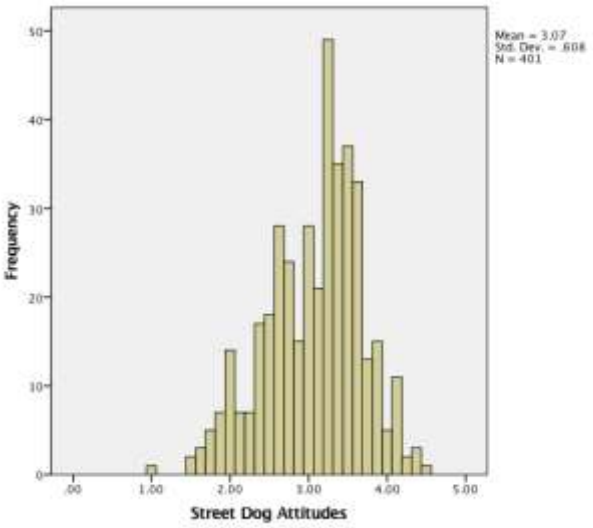

Figure 1. **A frequency histogram of survey respondents' scores on the 8-item Attitudes Towards Street Dogs (ATSD) scale.**

Perhaps more interesting is the seeming contradictions that were evident in overall levels of agreement across the sample with individual questions on the 8-item scale. Across the ***survey (Component 1)*** sample, a majority either agreed or strongly agreed that street dogs were a problem (71.6%), a pest (70.6%) and a nuisance (69.3%). Nonetheless, the majority also believed that street dogs have a right to live on the streets (78.8%), that they belong in Chennai (55.5%), and that they were '*paavam*'[6]/vulnerable creatures (79.3%).

Attitude Item	% who agree or strongly agree
Street dogs as a problem	71.6%
Street dogs are pests	70.6%
Street dogs are nuisances	69.3%
But also	
Street dogs have a right to live on the streets	78.8%
Street dogs belong in Chennai	55.5%
Street dogs are 'paavam' /vulnerable creatures	79.3%

The ***survey*** results also show that dislike for street dogs and fear of street dogs were strongly and significantly correlated ($r = .80$; $p < .001$).

The ***semi-structured interviews (Component 2)*** showed a range of perceptions about street dogs. They supported the survey data in that that a complex of conflicting attitudes was found not only in the sample, but also in individual people. Most interviews would begin with an elaboration of either positive or negative views on dogs, but over time, would evolve to a discussion of an opposing set of views.

Policy implications *These findings suggest that people are used to cohabiting with dogs, and that they see dogs as a regular part of the city, even if these animals may pose problems. In other words, they display attitudes of tolerance even in the face of conflict.*

These contradictions raise further questions. For instance, one may ask whether this ethos of tolerance might explain why Chennai has not seen high-profile culling of dogs in recent years. Alternatively, the lack of high-profile culling could stem from the long-standing animal birth control (ABC) programme in the city. Indeed, 83% of the survey sample reported knowledge of the ABC programme.

The correlation between dislike for dogs and fear of dogs points to the need for campaigns that focus on helping people to be able to successfully decode dog behaviour and share space safely with dogs (like traffic safety campaigns). Such campaigns might be helpful in reducing fear, and therefore dislike.

Demographic differences in attitudes towards street dogs

In the ***survey (Component 1),*** we found no gender differences in ATSD (both in and of itself, and through interaction with socio-economic status)[7]. However, we did observe a statistically significant effect of socio-economic status (SES) on ATSD (p= 0.03). Differences associated with our five different SES categories are depicted in Figure 2 below. Note that higher values represent more negative overall attitudes towards street dogs.

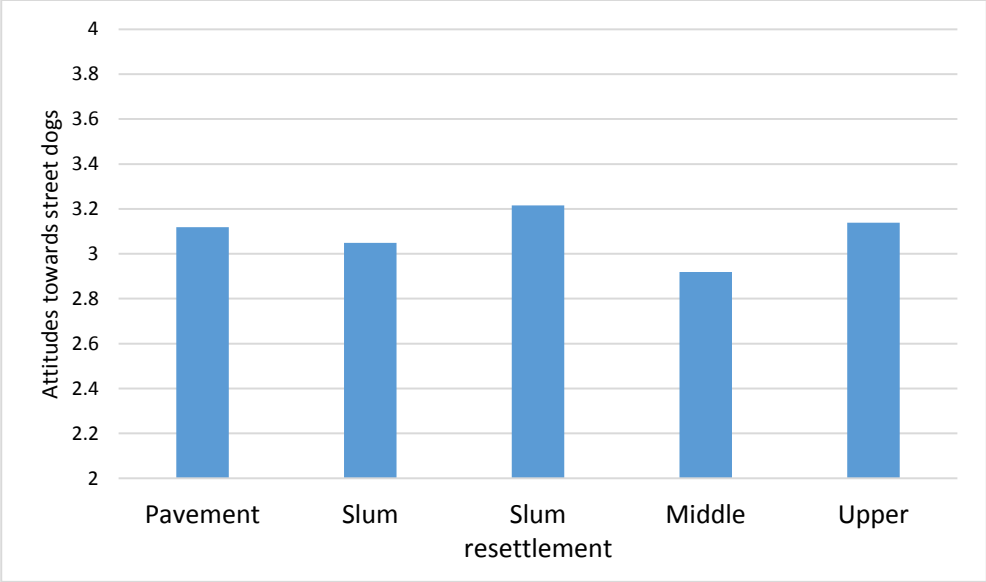

Figure 2. **Differences in street dog attitudes between survey SES groups**

These survey SES group differences would appear to suggest that people in Slum Resettlement buildings have the most negative attitudes to street dogs. The next most negative group is Upper Income, followed by Pavement Dwellers, Slum Dwellers, with the Middle Income group (*better*

understood as lower middle income group if using common parlance) showing the most positive attitudes.

At the very least, these results show that there is, surprisingly, no straightforward linear relationship between SES and ATSD. Public health data and campaigns have tended to suggest that the poor are at the greatest risk of dog bites, attacks and rabies. One would perhaps therefore expect attitudes to be the most negative in the lower rungs of the SES scale. But this is not borne out by the data which shows a more mixed picture.

Furthermore, the ***semi-structured interviews (Component 2)*** generated interested patterns in the links between socio-economic class and attitudes/interactions with street dogs:

i) Pavement dwellers & waste-workers: The interviews with pavement dwellers and waste-workers indicated very strong relationships with specific street dogs. All the waste-workers and pavement dwellers in the sample regularly fed street dogs with leftovers, biscuits, or in the case of waste-workers, by separating food from the waste they sort through. They all were able to identify individual dogs in their areas, by referring to colour, behavioural characteristics, and often, by name. Pavement dwellers acknowledged that dogs could be nuisances, for instance, by barking at night-time, but also highlighted their roles in creating a safe environment and offering security.

Waste-worker interviewees ***(Component 2)*** said that the introduction of tall, metal waste bins had reduced street dog access to waste food, making them more dependent on the help of waste-workers to secure food. The interviews also indicated that casual feeding of dogs with titbits or leftovers was very common, either by the interviewees themselves, or by other people.

ii) Belonging and ownership: The qualitative interviews ***(Component 2)*** indicated a correspondence between income and views about where dogs belong. Participants from Upper SES backgrounds were far more likely to have the view that dogs don't belong in the city; they tended to draw comparisons between street dogs and people who live and work on the streets, such as vendors or pavement dwellers. People from upper/upper middle SES backgrounds also tended to have more rigid ideas of 'pet' ownership, espousing the view that dogs ***should*** be owned by people who assume complete responsibility for them.

II. Reported sources of complaints and conflict

Highlights: *i) Barking and chasing are the biggest source of complaints about street dogs. Ii) Street dogs with strong attachments to individual people can invite complaints from other people.*

The biggest source of complaint (or perceived problems) regarding street dogs among ***survey*** respondents ***(Component 1)*** were barking (reported by 53.9% of respondents) followed by chasing (50.1%), and then biting (39.2%). As depicted in Table 1 below, other less common complaints related to issues such as infections, dirt (such as faecal matter), dogs causing accidents, aesthetics (dogs are seen as eyesores), fear, as threats to pets, and as not suitable in a developed country. Only 15% of survey respondents mentioned rabies as a problem (a lower percentage than those who found dogs to be 'eyesores'). 5.1% of survey respondents said that they didn't associate street dogs with any problems.

Table 1. **The percentage of the sample of survey respondents who spontaneously mentioned each type of problem in response to being asked whether they thought there were any specific problems that are caused by street dogs.**

Problem	% who mentioned it
Chasing	50.1%
Barking	53.9%
Biting	39.2%
Infections	29.4%
Dirty/faecal matter	27.7%
Cause accidents	23.7%
Ugly	22.9%
Rabies	**15.0%**
Scare people	8.2%
Threat to pets	5.7%
Saw no problems at all	5.1%
Not suitable for a developed country	1.2%

Demographic differences in the types of complaints reported

Our analyses also revealed statistically significant differences between SES groups in relation to the percentage of ***survey (Component 1)*** respondents in each group who reported each type of complaint (with the only exceptions being 'Saw no problems at all' and 'not suitable for a developed country', for which there were no statistically significant differences). But here too, as with ATSD, there was no linear relationship between SES and complaint.

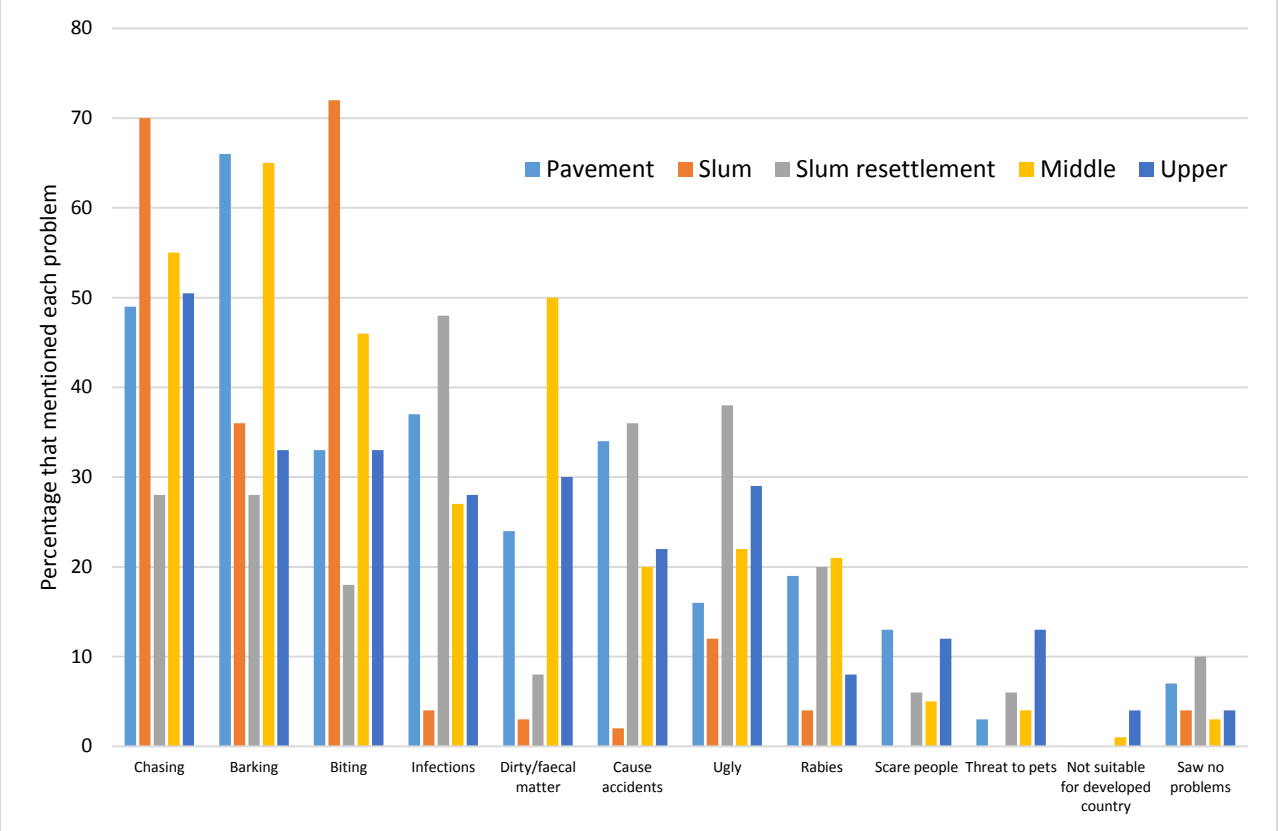

Figure 4. **Percentages of respondents in each SES group who mentioned each form of problem when asked if they thought there were any associated with street dogs.**

Policy implications: *The survey data on complaints points to the need to rethink the emphasis on rabies in many public health and dog welfare campaigns. Rabies is not the biggest worry from the point of view the person on the street. Therefore, programmes aimed at addressing human-dog conflict need to move beyond a narrow focus on rabies to address a broader range of human-dog interactions (barking, chasing etc.) that arise over everyday experiences of cohabitation.*

This is all the more so because wider literature and interviews with key stakeholders involved in international CNVR (capture-neuter-vaccinate-release) programmes suggest that cases of successful outcomes from programmes that focus on anti-rabies vaccination (and CNVR) tend to be located in contexts very different to India[8]. These differences include more spatially bounded biophysical environments or different ecological characteristics (such as reduced food waste, which means that most dogs are in some sort of relationship with human households, which is not the case with most dogs in India). Therefore, more multidimensional strategies may be required in the Indian context to address the range of issues at stake, as well the diverse social and ecological conditions. Such strategies need to address multiple aspects of human-dog interactions (positive and negative) as well as the biophysical and socio-ecological conditions that influence these interactions, as opposed to focusing on just dog population management and rabies prevention. Multidimensional strategies are likely to generate positive outcomes for both human health and animal welfare - human health because of the reduced incidence of negative interactions, and animal welfare, because of reduction in reactionary culling.

The ***semi-structured interviews (Component 2)*** also suggested that dogs that triggered complaints were associated with specific people in the same neighbourhood, including pavement dwellers. This raises two questions: 1) are street dogs with strong attachments with people more likely to display territorial behaviours (like pet dogs do)? 2) are people-dog conflicts also tied associated with people-people conflicts?

III. Incidence of actual experiences of dog-on-human conflict (bites and chasing)

Highlight: *Experiences of bites (and chasing) were more likely to be attributed to street dogs than pet dogs.*

We asked ***survey*** respondents ***(Component 1)*** very direct yes/no questions regarding whether they (or their children) had actually experienced specific negative encounters with street dogs themselves.

Of the full survey sample, 25% had experienced dog bites, and 28% had experienced being chased by a dog. Surprisingly, and contradicting public health research on this topic.[9] 70% of those who had experienced bites said that the bites were caused by street dogs. Less surprisingly, 77% said that the chasing they had experienced was by street dogs.

It is perhaps interesting to note however that having more negative attitudes towards street dogs (as measured on the ATSD scale) also had a statistically significant relationship (p=.02) with them being more likely to have reported that their chasing experience had involved a street dog rather than a pet dog. There is, of course, an issue of direction of causality here that one cannot unpack with the current data. Is it the case that starting with more negative street dog attitudes makes people more likely to perceive (or remember) a problematic dog encounter as having involved a street rather than pet dog? Or perhaps these negative past encounters with street (rather than pet) dogs are what led to the more negative attitudes?

IV. Human-on-dog conflict and care

Highlights: *i) The experience of having been bitten or chased by a dog is correlated with human-on-dog conflict (hitting/throwing stones). ii) A substantial proportion of those surveyed had offered food or water to street dogs at least once.*

Of the entire survey sample of 401 respondents, 83 people (20.69%) reported having hit or thrown stones at street dogs. However, there was no significant difference between their ATSD scores and those of the remaining 318 people who said that they had never hit or thrown stones at dogs. In other words, reported attitudes towards street dogs do not seem to be tied to propensity to inflict harm on the dogs. However, having been chased or bitten by a dog did appear to be related to likelihood of having hit/thrown a stone at a dog. 45% of those who'd been chased and 48% of those who had been bitten said that they had hit or thrown stones at dogs, as compared to 11% of those who had never been chased, and 12% of those who had never been bitten. In other words, past negative interactions with dogs appeared to be correlated with human-on-dog conflict (hitting/ throwing stones).

Of the entire sample, 64% indicated that they had offered food or water to a street dog at least once and 19% indicated that they had taken regular care of a street dog. Those who engaged in positive interactions with dogs (caring, feeding, giving water) were found to have less negative attitudes, as one might predict. This held true for both people who reported being engaged in regular caregiving

and those who reported once-off/occasional feeding. More interestingly, negative interactions such as being chased or bitten did not affect the propensity to engage in care activities.

V. Knowledge about conflict

Highlights: *i) Public awareness about how to respond to barking and chasing, and how to avoid conflict, can be improved. Ii) Knowledge about what causes canine aggression is fairly sound but could be improved. Iii) Misconceptions about mange and salivation need to be addressed.*

The ***survey (Component 1)*** included open-ended questions about how to respond to situations of conflict such as barking or chasing. As detailed below in Table 3, the response with the highest frequency (48%) pertained to 'shouting' at the animal, followed by 'walking slowly away' (39%), throwing stones (37%), and 'stand still and look away' (24%). 24% of respondents said they would do 'nothing', while 12% said that they would 'run away'. A small proportion of the sample said they would take actions to befriend the dog, by either 'giving it food' (13%) or 'talking' to it (3%). 0.7% of the sample said that they 'did not know' what to do, while 4% said that they would 'avoid eye contact' with the animal.

Table 3. **The percentage of the sample of survey respondents who spontaneously mentioned each type of option in response to being asked what they thought might be the best thing to do if a dog barks at you or chases you.**

Response	% of people who said it
Shout at it	48%
Walk slowly away	39%
Throw stones at it	37%
Stand still and look away	26%
Nothing	24%
Give it food	13%
Run Away	12%
Become friendly with the dog(s)	5%
Do not make eye contact	4%
Talk to the dog(s)	3%
I don't know	.7%

These responses indicate a mixed situation with regard to knowledge about conflict. While a relatively small proportion of the sample said that they would run away, 37% said that they would throw stones, and 24% said that they would do nothing. These are arguably not the best responses in situations of conflict.

A similar set of survey responses were generated to the question of what people would do if chased by a dog while on a bike, as detailed in Table 4 below. Other than 'stop the bike', none of these responses reflect appropriate knowledge about how to respond to conflict in the form of chasing as they are either ineffectual or have the potential to cause accidents

Table 4. **The percentage of the sample of survey respondents who spontaneously mentioned each type of option in response to being asked what they thought might be the best thing to do if a dog chases you while you are riding a bicycle or motorbike.**

Response	% of people who said it
Avoid riding too fast	42%
Stop the bike	41%
Avoid braking suddenly	27%
Carry and use stones and sticks with you	24%
Put up your legs and continue riding	19%
Avoid neighbourhoods where there are chasing dogs	20%
Avoid making weird noises	16%
Become friendly with the dog(s)	10%
Offer food to the dog(s)	9%
Talk to the dog(s)	5%
Do not make eye contact	4%
I don't know	1.7%

The ***semi-structured interviews (Component 2),*** especially those with pavement dwellers and waste-workers, generated a wealth of knowledge on how to prevent conflict.

Problem	Response/preventive measure	What *not* to do
Barking/growling	Stand quietly	Do not make sudden or fast moves
	Ignore the dog	Do not hit as this will aggravate the animal and increase future conflict
	Distract it	Do not run
	Foster familiarity (from waste-workers)	

	Avoid wearing hats (from waste-workers)	
	Move away slowly	
	Talk to the dog in a gentle tone (from waste-workers)	
Chasing (of vehicles)	Stop the vehicle; if in an auto, shake the vehicle a little bit	
	Raise your voice and shout at the dog	
	Pretend to pick up a stone	
	Pretend to hit it with a stick	
Chasing (of people)	As above (raised voice, pretend to throw a stone)	Do not run
	Offer biscuits/food	
General	People familiar with the animal usually intervene and tell (successfully) the dog to stop barking/chasing	
	Ensure children are accompanied by adults	
	Avoid early morning walks	

Key misconceptions that emerged in the ***semi-structured interviews (Component 2)*** included: 1) the conflation of mange and rabies; 2) the attribution of rabies to any salivating dog; 3) the idea that dogs can spread viral infections like the flu.

An analysis of ***survey (Component 1)*** participants' free-responses to being asked to what causes aggressive behaviours in dogs indicates that the respondents' knowledge in this area was fairly sound. As shown in Table 5 below, only 10% of respondents said that it is simply in the nature of dogs to be aggressive.

Table 5. **The percentage of the sample of survey respondents who spontaneously mentioned each potential factor that might make street dogs act aggressively**

Reason for Street Dog Aggression	% of people who said it
When they have puppies	41%
At night-time	34%
When strangers enter the area	32%
When they are hungry	30%
When they see people running	22%
When they see moving vehicles	20%
When they are scared	18%
When people are aggressive towards them	18%
When they are in groups	12%
That is just their nature	10%

When they are hurt or injured	7%
During the mating season	1%

Policy implications: *These datasets indicate that there is much potential for sustained campaigns that focus on how to prevent or respond to these situations of conflict, as opposed to just focusing on animal birth control and anti-rabies vaccination programmes and the promotion of responsible dog ownership. While there is a lot of public health material on how to interact safely with pet dogs, there is much scope for the development of materials that are specific to street dogs in India, and that focus on addressing misconceptions. However, there is also relatively sound knowledge about what causes dog aggression and conflict prevention. This might be related to the long history of dog-people cohabitation, and dismantling of current modes of cohabitation (e.g., through adoption or elimination of street dogs) might adversely affect existing knowledge levels.*

VI. Knowledge about bite management

Highlights: *i) There is room for improvement in knowledge about bite prevention. Ii) There is a high degree of trust in the government hospitals in Chennai. Iii) Variations in vaccine schedules between private and government hospitals can cause confusion among patients.*

Knowledge about post-exposure prophylaxis appeared fairly sound in the ***survey (Component 1)***, though with room for improvement.

Table 6. **The percentage of the sample of survey respondents who spontaneously mentioned each type of action as being a good thing to do if bitten by a dog**

Action	% of people who said it
Go to the doctor/hospital	81%
Wash it with soap and water	47%
Observe the dog	28%
Find out if the dog has been vaccinated	9%
Seek Ayurvedic treatment	6%
Apply some form of herb or spice	4%
Magico-religious treatment (faith healing, witchcraft etc)	3%
Apply chunaambu	2%
Apply kerosense	1%
Do nothing	1%

The ***hospital-based research (Component 3)*** also indicated that knowledge about how to deal with dog bites was fairly sound among the patients interviewed (which corroborates the findings of the survey). The importance of washing with water (and soap) as a first aid measure was mentioned by most patients. However, knowledge among bite patients about preventing dog bites was rather weak. People talked about staying away from unknown dogs, generally being 'more careful', avoiding dogs, avoiding dogs with puppies, vaccinating pet dogs, and street dog eradication/confinement. While none of these are 'incorrect' answers, they nonetheless point to the need for educational materials on how to live safely along street dogs.

Furthermore, there was confusion among patients about the number of vaccines that they need/are given. Since each vaccine dose is administered intradermally on two arms in government hospitals, the general perception was that two injections were given each time (private hospitals give the entire dose intramuscularly on one arm). Interviews with medical staff pointed to issues with delays in seeking of appropriate treatment (by patients), and the tendency to seek out traditional medicine facilities (especially among older people). Hospital procedures (right from registration to receiving the vaccine) are quite complicated and involve multiple visits to different sections.

On the whole, patients seemed to trust rabies treatment at government hospitals (hospitals that were mentioned at Madras Medical College, Stanley Medical College and Chrompet Primary Health Centre) more than treatment at private hospitals. There were concerns that private hospitals, in addition to being more expensive (approximately INR 325 per vaccine dose), might stock out of date vaccines, and not be very scrupulous about discarding open multidose vials of the vaccine. The general sense from the patients interviewed was that the facilities and treatment offered at the Madras Medical College and Egmore Children's Hospital, including interactions with medical staff, were of very high quality. The medical staff interviewed also said that the government hospitals and primary health care centres in the city were well stocked with the necessary medicines and staffed with experienced doctors and nurses.

Policy implications*: The differences in the treatment protocols offered by public and private hospitals has the potential to cause confusion among patients, especially since it appears that many people get the first dose of the vaccine at a private hospital. It is laudable that the government hospitals and primary health centres in the city have sound reputations with regard to the dog bite treatment offered. While all the patients interviewed expressed satisfaction with the treatment offered at government facilities, the extremely complicated procedures involved, which include having to go back and forth between one part of the hospital to the other, could be streamlined.*

There is potential for interventions that focus on how to avoid dog bites. Pamphlets on dog bite prevention could be included with the schedule of vaccinations provided to patients. This is especially important given that some patients had had prior experiences of being bitten. Clearer information on the vaccination schedule could be provided so that patients do not get confused about the number of doses they have taken/need to take (all of them double-counted each dose).

VII. Views on dog management

Highlight*: Most people were against the killing of street dogs, but a majority supported their relocation to other neighbourhoods or removal to institutions. Indeed, those who held the view that street dogs are 'paavam' were more likely to support their removal to shelters. This suggests that people are not aware of the adverse animal welfare implications of shelters.*

Survey (Component 1) respondents' levels of agreement with the various dog management policies is presented below in Table 8 in terms of the percentage of participants who indicated that they

either agreed or strongly disagreed with each policy, as well as the mean level of agreement on the 5-point scale.

With respect to all dogs (i.e., not just diseased ones) killing was the least favoured option (with 38.4% either agreeing or strongly agreeing with this approach) while removal to shelters was the most strongly favoured (85.3%), far more than neutering and vaccination (55.4%). Indeed, even relocation to other neighbourhoods was favoured over ABC (83.5%). Inaction (46.4%) was favoured over killing.

Table 8. **Survey respondents' level of support for various street dog management strategies**

Management Strategy	% Who Agreed/Strongly Agreed with it	Mean Agreement Level (out of 5)
Placement of aggressive or diseased street dogs in institutions like Corporation shelters	85.3%	3.88
Placement of all street dogs in institutions like Corporation shelters	84.3%	3.82
Relocation of all street dogs to other areas	83.5%	3.86
Relocation of diseased or aggressive street dogs to other areas	83.5%	3.86
Killing of diseased or aggressive street dogs	67.3%	3.20
Allowing all street dogs to live on the streets but ensuring they are neutered and vaccinated (i.e., population control and vaccination).	55.4%	3.22
Leaving street dogs alone to live on the streets (i.e. not killing, relocating, putting in institutions or neutering them)	46.4%	3.04
Killing of all street dogs	38.4%	2.65

Reported involvement in dog management by ***survey (Component 1)*** respondents appeared to be quite low, despite a relatively high reported level of familiarity with the ABC programme (83% said they were aware of it). Only 20% of the sample had helped with ABC related interventions, while 17% had actively prevented dogs from being caught.

Policy implications: *Reading the data on dog management along with the data on ATSD points to the following complex grouping of attitudes: people see dogs as problems, but also think that they belong on the streets, and are vulnerable creatures. Killing is not favoured, arguably because of the harm it poses to these animals that they see as 'paavam'. Nonetheless, relocation and sheltering enjoy greater support compared to ABC. Given that killing is not favoured, and people see dogs as having a right to live in the city, it is possible to conjecture that the support for relocation/sheltering is linked to the lack of knowledge of the impacts of these management strategies on the animals.*

Indeed, there is a correlation between the ATSD item on dogs as paavam/inncocent creatures and support for sheltering, i.e., people who think that dogs are paavam, are more likely to support moving them to shelters, arguably based on the assumption that shelters offer better lives for the dogs. The support for sheltering/relocation also indicates a lack of knowledge about street dog ecology and the inevitable influx (of dogs or other animals suited to the niche) that removal will entail. This again points to the need for more considered and effective public health and animal welfare campaigns that present accurate information about dogs, their behaviours and welfare.

Campaigns that better explain ABC, and connect it more carefully with street dog ecology, and that are linked to high-welfare and responsible ABC programmes may be necessary to address this problem area.

VIII. On the animal birth control/anti-rabies vaccination programme

Highlight: *The ABC-ARV programme requires redesign for reasons of effectiveness and animal welfare.*

The interviews with municipal officials and workers involved in the ABC-ARV (animal birth control/anti-rabies vaccination) programme in Chennai highlighted the following:

1. Programme implementation is currently based on administrative boundaries (such as zones) and is fragmented, with different institutions working in different areas without any overarching plan. For ABC/ARV to be successful in addressing dog population sizes (which affects people's attitudes), it needs to be planned and implemented in line with dog territoriality and biophysical boundaries that restrict dog movement (and not administrative boundaries).
2. Programme implementation is largely on a complaint basis, and does not take into account the 70% coverage (of population) that is recommended by the WHO for effective dog population control. Systematic implementation based on dog population numbers within carefully delineated spatial territories (and not complaints) is needed to achieve programme goals.
3. The programme is seriously under-resourced. Veterinary doctors are paid very poorly for their services, which has implications for the experience and competence that can be secured. Cleaning and support staff reported having to work with inadequate infrastructure, and in overcrowded kennels without adequate cleaning equipment, training, and protective gear.
4. This has consequences for not only the efficacy of the programme, but also the welfare of the animals. Prior research[10] indicates that the implementation of the ABC-ARV programme in India goes along with serious welfare implications for the dogs at all stages, from catching, to surgery, recovery, and release. Common problems include mortality during capture/transport and after surgery; dehiscence (where the surgical incision opens) and evisceration (protrusion of internal organs from the surgical wound); post-operative infections; dehydration; nosocomial infections; rough handling; overcrowding; low-quality feeding; loss of identifying information (that contain information about the dog's home neighbourhood); and delayed or incorrect release (in the wrong neighbourhood).

Conclusion: Long-term lessons from other parts of the world

In general, the overarching goal of all street dog control measures, whether killing, institutionalisation, or birth control, is to eliminate or significantly reduce free-living dog populations. The assumption underlying is that the eradication of these *vectors* of disease and conflict is the best of way of eradicating disease, injury, and other issues attributed to street dogs.

However, the experiences of societies that have successfully eradicated free-living dogs suggest that there is a need to revisit this assumption. Take the United Kingdom, for example, which systematically eliminated all free-living dogs in the late 19th century. While the country remains technically rabies-free, other issues that are associated with street dogs in India continue to be prevalent in the UK. These include bites, mauling, attacks, and aesthetic concerns, the only difference being that they are caused by a different set of animals, specifically gulls and foxes, which have come to occupy the ecological niches vacated by dogs. These animals can vary from place to place. In the United States, coyotes pose such problems, and in Canada, a new hybrid called the coywolf has raised much public concern.

The trajectories of these societies that have managed to eliminate free-living dogs indicate that these 'problems' don't go away, and all that changes is the specific animal involved. There is the added complication that the rich knowledge-base on *how* to cohabit with street dogs that this study has found in Chennai is not found in these countries because of the temporary elimination of free-living dogs which have over time been replaced by other animals. These animals reappear after a period of time by which people in these societies have forgotten how to cohabit with other creatures, and this arguably poses greater risks because of the lost knowledge-base.

These long-term ramifications need to be taken into account while developing street dog or rabies control programmes to ensure that a bigger set of problems are not created in the near future.

Endnotes

[1] Abbas, S S, and M Kakkar. 2015. "Rabies Control in India: A Need to Close the Gap between Research and Policy." *Bulletin of the World Health Organisation* 93: 131–32.

[2] This research was funded by a Wellcome Trust Small Grant Award (203843/Z/16/Z). Team members included: Dr Krithika Srinivasan, Univ. of Edinburgh (Principal Investigator); Dr Tim Kurz, Bath University (Co-Investigator), Prof Anindya Sinha, National Institute of Advanced Studies, Bengaluru (Co-Investigator), Prof Stephen Hinchliffe, University of Exeter (Co-Investigator); Pradeep Kuttuva (Research Associate).

[3] The survey was carried out over two days in November 2017 with the boundaries of Chennai Municipal Corporation; n= 401; stratification was based on gender and socio-economic status (SES). SES was determined by features of the lived/built environment, specifically, type of dwelling and access to municipal services, especially waste management, as earlier research indicated that these characteristics influence exposure to street dogs, including the nature of interactions with them. The overall response rate was 49%.

The final sample had five SES categories: *Pavement dwellers,* who have high exposure and no access to services (n = 100); *Slum dwellers*, who have poor or no access to services, live in informal settlements, and have relatively high exposure (n = 50); *People in slum rehabilitation buildings*, which

changes the characteristics of the built environment, including potentially better access to services (n=50); *Middle class*, who have better access to waste management services (often because of location of dwelling in reasonably well-serviced areas), live in fully built dwellings (often informal extensions) but in higher densities (n = 100) (this category is better described as *lower middle class* if using common parlance); *Upper/Upper middle class*, who have regular access to municipal services and live in fully built dwellings (n = 101).

[4] We used qualitative methods to generate ground-up data that is not restricted by researcher assumptions and questions (which is a limitation of structured instruments such as surveys). The participant sample included the following: 1) interviews with vulnerable groups (with high potential of regular exposure and interaction) such as pavement dwellers, waste-workers, and night-time workers such as auto-drivers; 2) Interviews with people who'd registered complaints about street dogs on the national consumer complaint forum website; 3) interviews with people from wealthier socio-economic groups; 4) interviews with key officials responsible for the ABC programme in the Chennai Corporation and workers at the ABC centres. The interviews with members of the public were done in different parts of the city, including those that were identified through key actor interviews and prior research as being areas of high conflict or with poor reach of the ABC programme. A total of 60 interviews were carried out members of the public (including complainants on the consumer forum website) as individuals or in groups, covering 44 women and 51 men. This data was triangulated with research carried out by Srinivasan in 2015 using similar methods, covering 49 people from upper and lower SES backgrounds.

[5] We used qualitative methods to interview 28 men, 20 women and 4 children in total (mostly middle/low SES, with only 3 patients from upper SES group). These were carried out over 12 days in the period between July to August 2017.

[6] A Tamil word that denotes sympathy and/or the perception of the other person/being as innocent.

[7] Nor did we observe any differences in ATSD between different religious groups, though analyses of religion were limited by the dominance one religious group in the sample (Hindu - 83%).

[8] Lembo, T., Hampson, K., Kaare, M.T., Ernest, E., Knobel, D., Kazwala, R.R., Haydon, D.T. and Cleaveland, S., 2010. The feasibility of canine rabies elimination in Africa: dispelling doubts with data. *PLoS neglected tropical diseases*, *4*(2), p.e626.; Townsend, S.E., Sumantra, I.P., Bagus, G.N., Brum, E., Cleaveland, S., Crafter, S., Dewi, A.P., Dharma, D.M.N., Dushoff, J., Girardi, J. and Gunata, I.K., 2013. Designing programs for eliminating canine rabies from islands: Bali, Indonesia as a case study. *PLoS neglected tropical diseases*, *7*(8), p.e2372.

[9] Bharathy, S. and Gunaseelan, L., 2017. A Cross Sectional Study to Understanding Demographics of Dog Bite Victims Attending Anti Rabies Ward in Chennai City, Tamil Nadu India. *Adv Anim Vet Sci*, *5*(2), pp.78-82; Shivasakthimani, R., Ravivarman, G. and Murali, R., 2018. Compliance of anti-rabies vaccine among dog bite victims in an urban slum of Chennai: a cross sectional study. *International Journal Of Community Medicine And Public Health*, *5*(4), pp.1487-1491.

[10] Srinivasan, K. 2013. "The Biopolitics of Animal Being and Welfare: Dog Control and Care in the UK and India." *Transactions of the Institute of British Geographers* 38 (1): 106–19; Srinivasan, K. 2015. "The Welfare Episteme: Street Dog Biopolitics in the Anthropocene." In *Animals in the Anthropocene: Critical Perspectives on Non-Human Futures*, edited by M Boyd, M Chrulew, C Degeling, A Mrva-Montoya, F Probyn-Rapsey, N Savvides, and D Wadiwel, 201–20. Sydney: Sydney University Press.