REPORT OF THE LAIKIPIA RABIES VACCINATION CAMPAIGN, 2018

Summary Report

Background

Every year, an estimated 2,000 people die of canine rabies in Kenya (World Health Organization (WHO), 2014). 98% of human rabies cases in developing countries are caused by a bite from an infected domestic dog (Butler *et al*, 2004). Particularly at risk of the disease are populations in remote rural areas, who may find it difficult to access or pay for rabies treatment with post-exposure prophylaxis (PEP) and children under the age of 15 years, who interact most closely with domestic animals.

Mass vaccination of domestic dogs remains the most cost-effective intervention method to control rabies and to prevent transmission of the virus to humans (WHO, 2014). The World Health Organization estimates that vaccinating 70% of domestic dogs for 3 consecutive years in a spatial locale, is sufficient to eliminate the disease from the domestic dog population and, by extension, humans (Cleaveland et al, 2003).

The Laikipia Rabies Vaccination Campaign began in 2015 as a localized effort in 5 pastoralist communities around Mpala Research Centre, where Dedan Ngatia, Karatina University MSc. student, and Dr. Adam Ferguson had been researching the spatial ecology of domestic dogs. The two scientists partnered with veterinarian Dr. Dishon Muloi to found the vaccination campaign in September of 2015. The first year, LRVC vaccinated a total of 821 domestic dogs and cats. In its second year, LRVC took place over 5 weekends, reaching more communities and a total of 4,530 domestic dogs and cats. In its third year, the campaign doubled the coverage to reach 9356 dogs and cats.

The 2018 campaign aimed to incorporate lessons learned from the previous years and reach 15,000 dogs and cats across Laikipia. The campaign aimed to do this both by returning to areas where vaccination has previously taken place and expanding coverage there, employing the use of GIS technology to improve coverage and enhance data collection, and reaching out into new communities around the county.

OBJECTIVES

The ultimate goal of the Laikipia Rabies Vaccination Campaign is to eradicate rabies from the domestic dog populations in Laikipia County, as part of the national rabies eradication effort in Kenya. **LRVC 2018** aimed to increase the campaigns eradication effort in Kenyae rabiomestic dogs and cats across Laikipia County.

Partners and Team

The 2018 field campaign was coordinated by Dr. James Ngatia with support from Mpala Research Centre and Dedan Ngatia throughout the campaign. The field vaccinations were conducted by volunteer veterinarians and students.

In 2018 LRVC received essential support from; Mpala Research Center, the Laikipia County Government, Veterinarians International, and the Kenya Zoonotic Disease Unit - donating all the vaccines used. In addition to Mpala, crucial support was received from conservancies and ranches around Laikipia i.e. Ol Pejeta, Lewa, Borana, Mugie, Lolmarik, Marania, Enasoit, Ol Malo, Ol Lentile and Ole Naishu. Additional support came from the Kenya Rangelands Wild Dog and Cheetah Project, Raw Africa, the Kenya Long-term Exclosure Experiment (KLEE). Numerous individual sponsors also donated funds and vehicles to support the campaign.

Strategy

The 2018 campaign was held over six consecutive weekends, from October 19th to 24th November, with field vaccination taking place all day on Friday and Saturday during this period. The

vaccination teams consisted of around 40 members grouped into six or seven teams, plus an additional Public Address team and a security vehicle. Each team included at least two veterinarian doctors or students, who were solely responsible for performing vaccinations and handling the dogs. Each team also included at least two student volunteers, who were responsible for issuing vaccination cards, and filling in a data sheet/data collection app listing each vaccinated animal and including the animal's age, sex, reproductive status, whether they were vaccinated before, and whether they received additional treatment such as a multivitamin or deworming injection. The vaccination teams were also accompanied by a human doctor, who delivered rabies post-exposure prophylaxis treatment to participants or community members suffering bites.

Vaccination centers were chosen to include previous vaccination centers, to cluster around partner conservancy areas, and to target communities where demand for vaccination was particularly high. Centres were advertised to communities in advance by community organizers and signage, and during the vaccination weekend by the public awareness (PA) vehicle. When turnout was low, teams would sometimes leave stations early, having vaccinated all animals present, and adopt a "roaming"door-to-doorsed to communities in advance by community organizers and signagbomas individually to offer vaccination.

Table 1: Summary of Vaccinations Availed per Cluster Area

Weekend	Dates	Area	Total vaccinated
1	Oct. 19-20	OL Malo and Naibunga Group Ranch	954
2	Oct. 26-27	Naibor, Lekiji and Jua Kali	1,683
3	Nov. 2 -3	Loldaiga and Umande	2,022
4	Nov. 9-10	Borana and Ngenia	2,151
5	Nov. 16-17	Ol Pejeta and Ngobit	3,465
6	Nov. 23-24	Rumuruti	4,205
Additional day around Mugie	4th Dec	Ldabas - Louniek - Naibor	95
Solio settlement (county team response)	15-19th Dec	Solio; village 1 to 7	690
		TOTAL	**15,265**

Challenges, Recommendations, and Conclusions

This year's campaign continues to yield several lessons for the coming years learned from the challenges. In the field, the campaign would benefit from community education programming to dispel misconceptions related to vaccines, increased attention to animal welfare, human safety (preventing bites and scratches), and addressing bites and scratches promptly and effectively.

Additionally, several important scientific questions lie ahead for the campaign. The post vaccination sero-conversion rate, the prevalence of rabies in wildlife populations, and the rate of transfer of rabies between wildlife and domestic animals are all unknown in the Laikipia context.

Furthermore, the question regarding what the total population of dogs in the county is and, thus, how many must we vaccinate to reach the 70% target – remains to be determined by ongoing research.

In some areas, community members expressed distrust of the vaccination and the false assumption that the 2016 vaccinations were the cause of dog mortalities caused by a canine distemper outbreak after the campaign. Turnout in these communities was extremely low. By improving education about both rabies and rabies vaccination, at the vaccination centres before the campaign, during the campaign, and in schools beforehand, we can fight these misconceptions and assure the long-term success of the campaign. The campaign could expand its reach, increase trust, and fight misinformation by increasing involvement from within the communities themselves. Although we have seen great success in terms of vaccination numbers and extremely high turnout in new communities, increasing education and trust alongside vaccination numbers is critical to the LRVC's ultimate success as the campaign continues and expands over the next 5 or more years.

LRVC 2018 ultimately reached 15,265 domestic dogs and cats across the county. This number is well above the years number is well aboanimals and represents a major step towards the ultimate goal of eradicating rabies in Laikipia County, and the nation of Kenya. This year's expanded partnership and lessons learned are important to the campaignrabies in Laikipia County, and the nation of Kenya. Therm

FULL REPORT

Introduction

Rabies Eradication: Science and Policy

Every year, about 2,000 people die of rabies in Kenya (World Health Organization (WHO), 2014). A viral disease that causes progressive fatal inflammation of the brain and spinal cord, rabies kills almost 100% of its human victims and up to 86% of rabid dogs. Other domestic and wild mammals are also vulnerable to rabies; during outbreaks, the disease can threaten livelihoods and conservation efforts. A significant number of livestock, especially cattle, die from rabies annually: between 2011 and 2012, a total of 123 cases were reported in Kenya to the OIE World Animal Health Information System.

Over 98% of human rabies cases in developing countries are caused by a bite from an infected domestic dog. Particularly at risk of the disease are populations in remote rural areas, who may find it difficult to access or pay for rabies treatment, and children, who interact most closely with domestic animals.

Mass vaccination of domestic dogs is the most cost-effective intervention to control canine rabies and to prevent transmission of the virus to humans (WHO, 2014). The economic costs of rabies can be broken down as follows: economic loss due to premature death (55%), followed by direct costs of post-exposure prophylaxis (PEP, 20%) and lost income whilst seeking PEP (15.5%), with only limited costs to the veterinary sector due to **dog vaccination (1.5%)**, and additional costs to communities from livestock losses (6%) (Katie Hampton *et al*, 2015). The World Health organization estimates that vaccinating 70% of domestic dogs for 3 consecutive years is sufficient to eliminate the disease from the domestic dog population and, by extension, humans.

Implementation Background

Due to both logistic and financial hurdles, rabies vaccination is rare in many rural areas of Laikipia. In communities where the LRVC has not previously visited, almost 100% of animals are not vaccinated, according to surveys of animal owners conducted as part of the campaign. Less than 5%, a very low number, of the total number of dogs have been vaccinated by the County Government because the communities are never willing to pay the vaccination fees charged.

The canine rabies vaccine used in the LRVC is guaranteed for one year and must be repeated annually. Vaccinated animals are normally issued with a vaccination card or certificate, signed by a veterinary doctor, which documents the immunization and releases the dog or cat owner from liability in case of a bite. Though, the LRVC is though focused primarily on dogs, which are the main vector of the rabies virus to humans, the campaign also offers vaccination to domestic cats.

LRVC History

The Laikipia Rabies Vaccination Campaign began in 2015 as a localized effort in 5 pastoralist communities around Mpala Research Centre, where Dedan Ngatia, Karatina University MSc. student, and Dr. Adam Ferguson had been researching the spatial ecology of domestic dogs. The two scientists partnered with veterinarian Dr. Dishon Muloi to found the vaccination campaign in September of 2015. The first year, LRVC vaccinated a total of 821 domestic dogs and cats. In its second year, LRVC took place over 5 weekends, reaching more communities and a total of 4,530 domestic dogs and cats. In its third year, the campaign doubled the coverage to reach 9356 dogs and cats.

The 2018 campaign aimed to incorporate lessons learned from the previous years and reach 15,000 dogs and cats across Laikipia. The campaign aimed to do this both by returning to areas where vaccination has previously taken place and expanding coverage there, employing the use of GIS technology to improve coverage and enhance data collection, and reaching out into new communities around the county.

Campaign Goals

The main objective of the Laikipia Rabies Vaccination Campaign is to eradicate rabies from domestic dog populations in Laikipia County as part of the national rabies eradication effort in Kenya. Doing so requires sustaining approximately a 70% vaccination rate for at least 3 consecutive years (Cleaveland *et al*, 2003), although further research is needed to determine the total domestic dog population of Laikipia, rates of wildlife-domestic and domestic-domestic rabies transmission, and the exact vaccination rate needed to eliminate the disease from domestic dogs in Laikipia.

LRVC 2018 specifically aimed to increase the campaignc-domestic rabies transmission, and the exact vaccination rate needed to eliminate t campaign campaign rate needed to eliminate t campaigne from domesticabies exposure and least access to rabies vaccination, treatment and awareness, but also included a semi-urban center with a relatively large population (Rumuruti).

Partners and Team

LRVC 2018 campaign was coordinated by Dr. James Ngatia, and supported by Dedan Ngatia, campaign co-founder and scientist at Mpala Research Centre. The field campaign was conducted over 6 weeks by volunteer veterinarians and students, with staff from Mpala Research Centre assisting throughout the campaign.

Fundraising and campaign planning were conducted by a partnership of Mpala and Laikipia Wildlife Forum staff.

Team members and roles included, in no particular order: Dr. James Ngatia (campaign manager, community outreach and veterinarian mobilization), Dedan Ngatia (field coordination, logistical support and campaign publicity), Ciara Nutter (publicity, US-based crowdfunding, and field support), Rebecca Composto (publicity, US-based crowdfunding, and field support), Dr. Arlene Gardsbane (fundraising and logistical support), Dr. Dino Martins (partner organization recruitment, fundraising and scientific support), Peter Hetz (partner organization recruitment and publicity), Dr. Adam Ferguson (fundraising and scientific support), Dr. Duncan Kimuyu (field support and volunteer recruitment and coordination), Dr. Njiru (veterinary and county support), DJ Mach (public address and community mobilization), Mpala staff (various support roles).

Mpala Research Centre (MRC) provided all meals for the campaign teams (around 40 persons), from Thursday evening through Sunday mid-afternoon, for all six weekends of the campaign. MRC also provided accommodation for all volunteers at the Centre for 6 weeks, two vehicles, and one driver for the duration of the campaign, in addition to logistical support.

Ol Malo Lodge also provided food, accommodation, one vehicle and public awareness during the first weekend for two vaccination teams.

The 2018 Campaign partner organizations included.

- **The County Government of Laikipia**, generously donated all pharmaceutical supplies (gloves, dog markers, hydrogen peroxide, povidone iodine, Ivermectin, human PEP vaccine etc.) as well as contributed a vehicle and driver for the duration of the campaign and covered the costs associated with the public announcement system and campaign t-shirts.
- **The Kenya Zoonotic Disease Unit**, generously provided all 15,000 canine vaccines.

- **Veterinarians International,** contributed $1,000, dog muzzles and microchips to the campaign and the time of Dr. Arlene Gardsbane for the planning of the campaign and field support for the fifth vaccination weekend.
- **Karatina University,** helped recruit and coordinate volunteer students.
- **Ol Pejeta Wildlife Conservancy,** contributed a vehicle, during the fifth vaccination weekend.
- **Borana Conservancy,** contributed a vehicle, driver and a veterinary surgeo during the fourth vaccination weekend.
- **Ol Malo Conservancy,** provided accommodation food, accommodation, one vehicle and public awareness during the first weekend for two vaccination teams
- **Mugie Ranch,** contributed a vehicle and the time of their veterinary surgeon during the sixth vaccination weekend.
- **Ol Lentille Conservancy,** contributed a vehicle during the first vaccination weekend.
- **Loisaba Conservancy,** contributed a vehicle during the first vaccination weekend.
- **Laikipia Wilderness Camp,** contributed two vehicles with drivers for the third vaccination weekend.
- **Ole Naishu Ranch,** contributed a vehicle during the sixth weekend.
- **Marania farm,** which contributed $250 to the campaign.
- **Enasoit farm,** which contributed $300 to the campaign.
- **Lolmarik ranch,** which contributed $250 to the campaign.
- Lewa Conservancy, which contributed $500 to the campaign.**World Wide Vets (WVS),** contributed examination gloves and markers and also allowed us to use their magnificent data collection app throughout the campaign.
- **Kenya Rangelands Wild Dog and Cheetah Project** (KRWDCP), contributed one vehicle and the time of Dedan Ngatia, KRWDCP Project Manager.
- The **Kenya Long-term Exclosure Experiment (KLEE)** research project contributed the use of one vehicle through Dr. Duncan Kimuyu.
- **RAW Africa;** provided one vehicle and a driver for the 2 vaccination weekends.
- **The Smithsonian Institution**; allowed the time of their fellowship staff Dr. Maureen Kamau to participate as a senior veterinary volunteer.
- **British Army Training Unit Kenya (BATUK) W.O. Bernice Dewar,** contributed a vehicle and her time during the first vaccination weekend.
- **Dr. Sara Weinstein,** contributed a vehicle during the second weekend.

Numerous individual sponsors; donated funds to the campaign through a Kenyan M-Pesa Platform (total funds raised: Ksh155,700), and a US-based crowd-funding account established by Mpala (total funds raised: $2,405).

Strategy

The 2018 campaign was held over six consecutive weekends, from 18 October to 24 November 2018. The vaccination teams consisted of around 40 members: approximately 12 veterinarians, 12 volunteer students, and about 3 drivers, in addition to around 5 other volunteers based at Mpala Research Centre and a security team deployed from Mpala Research Centre.

For all the six weekends, the full vaccination teams were hosted at Mpala Research Centre. (With the exception of week one where 8 volunteers were hosted at Ol Malo Lodge).

Each week, the teams arrived at Mpala on Thursday evening before dinner. In the evening, the volunteers were briefed and grouped into six or seven vaccination teams, plus an additional Public Address team and a security vehicle. Each team included at least two veterinarian doctors or students, who were solely responsible for performing vaccinations and handling the dogs. Each team also included at least two student volunteers, who were responsible for issuing vaccination cards, and filling in a data sheet or data app listing each vaccinated animal and including the animal's age, sex, reproductive status, whether they were vaccinated before, and whether they received additional treatment such as a multivitamin or deworming injection. The vaccination teams were also accompanied by a human doctor, who delivered human rabies vaccines to any participants or community members suffering bites.

Vaccination centers were chosen to include previous vaccination centers, to cluster around conservancy areas, and to target communities where demand for vaccination seemed high.

The teams departed for the field each morning between 6.30am and 7:30 am (depending on travel distance). Most weekends, each of six vaccination teams visited one center in the morning (9 a.m. - 1 p.m.) and a new center in the afternoon (2 p.m. - 5 p.m.), with all the teams taking a break and meeting up for lunch in the field around 1 - 2 p.m. Teams convened again and returned to camp in the evening for dinner.

Volunteers typically arrived at Mpala Research Centre on Thursday evening, vaccinated all day on Friday and Saturday, and left Mpala again on Sunday, in the morning or shortly after lunch.

Centres were advertised to communities in advance by community organizers and signage and during the vaccination weekend a public address (PA) vehicle. The PA vehicle drove through the communities playing music and a loudspeaker message urging community members to bring their animals to the vaccination center. Advance signage was usually posted in the few days preceding vaccinations, with signs mounted on a signpost, wall, or tree at the site of the vaccination center. These signs typically gave the time for morning centers as 9 a.m., and for afternoon centers as 2 p.m. This caused the highest rush of community members and animals at the beginning of each session, with crowds diminishing over time.

When turnout was high, the teams adjusted their schedules, adding extra hours to ensure that all animals that arrived at the stations were vaccinated. When turnout was low, teams would sometimes leave stations early, having vaccinated all animals present, and adopt a "roaming" strategy, in which they drove through the communities and visited homes or bomas individually to offer vaccination.

Campaign calendar

Dates	Cluster	Communities	Total vaccinated	Comments and additional information
Oct 19-20	Naibunga, ilmotiok, Ol malo	Ilmotiok, Ewaso, Loreto, Kimanjo center, Daraja, Monishoi, Lariak lenkai, Nkiloriti, Lemis church, Nasirai, Naiperere, Tura junction, GTi church, Nkirashi, Musul center, Ngnterre, Lorubai, Koija/ewaso, Loshieki, Tiamamut, Ol Malo, Ol Malo, Kijabe	954	Poor turnout (Koija mostly) due to misinformation about vaccination (occasioned by a distemper outbreak that coincided with the 2016 vaccination). Ol Malo on the other had a good response
Oct 26-27	Naibor, Jua Kali , Endana	Naibor center, Murua Nalara/Idikir, Muramati, Two two, Naibor corner, Loruko, Muramati Uwanja, Ereri, Lekiji, Nursery, Mukima, Ngarengiro, Mara moja, Ntonyari, Endana center, Segera gate, Korana, Murua e-lpira, Karionga, Endana kishagi, Tangi Nyeusi, Jua Kali, Moromong/reteti, Mbogoine primary, Segera, jerusalem, Lemponkonyek, Kimakadura, Poyws	1,683	Good response
Nov 2-3	Umande, Lolldaiga	Kwa Mwaura, Katheri, Seiyo, Kirimara, Mwishuiri, Tetu B, Loldaiga Junction, Maili Saba, Nyariginu, Bingwa (kwa dam), Gikandi, Maili nane, Daiga primary, Karashi-1, Kwa Gatamu, Kalalu, Nyariginu Quarry, Karuai Kamoja, Karashi-2, Kongoni, ACK, Mugumo, Ngaragari, Kongoni gate, Kaheti, Murungai Primary, Umande Center, Mwireri, Maili Tisa	2,022	Good turn-out but complicated by heavy rains and publicity likely affected by national examinations
Nov 9-10	Ngv 9-1, Borana	Kairigire, Kibiro nursery, Ngenia Primary, Nturukuma Mukuri, Baraka AP post, Kibo, Ngenia Center, Lotasha, St Luke Nturukuma, Ruai, Mia moja, Gitugi center, Ositat, Melogon, Baraka Center, Sirimon Primary, Konyes borehole, Chumvi, Nkando Police post, Sweetwaters	2,151	Good turnout in most area except; (Chumvi, ositat, Lotasha) Had to cancel some area due to expected low response I.e. Ethi, ngarendare, sangn, losieku, etc

		center, Ngawa/Magutu, Umande Primary, Gratton , Nturukuma Chief camp, Ruai-2/Mawadi, Makano, Kirurumo, Jikaze, Kenya Fibre, Mirera, Gathingi Junction, Baraka Chiefctionam		
Nov 16-17	Ngobit, Ol Pejeta	Makanisa, Tigithi, Mwiyogo, Kona Mbaya, Riverside, Karai, Marura, Wathituga, Mwiyogo-2, Githira, Kyambogo, Lamuria, Baba Rema, Thome PAG, Hotline, Kahuruko, Intake, Nyakio, Burugutia, Mirera, Hotline village, Kwa Muthoga, Kyambogo sec, Kwa Mwinga, Reli B/Site, Matanya, Pub, Withare , Ngobit, Ol Taveta, Irura Primary, Waguthiru cattle dip, Male, Kijabe primary, Mutaro, Migaita, Burugutia Sec, Chuma Center, Male Highway, Kijabe Mnada, Mutarakwa, Kahuho	3,465	Exteremely fantastic turnout. This mirera-matanya-marura area should be considered on its own weekend in future for optimum coverage.
Nov 23-24	Rumuruti	Veterinary Center, Location Tangi, 51 Village, Or Popongi, Kapkures, Kinamba, Location Bosnia, Dagara, Majimingi, Ol Ari Nyiro, Container, Location Moonlight, Gatudia Center, Morishu, Maria Dam, Marura Narok, Duka Mbili, Mutamaiyu Center, Rumuruti Dam, Karuau, Lorora, Kadutura, Mutamaiyu Village, Nkirashi, GG Sec, Maodo meri, Thome, Magomano, Mouwarak, Nkoisusu, Mathanji, Nkiloriti, Gatundia Cattle dip, Lorien Lacda, Kiriti	4,205	Good community mobilization was done by community liaison officers and there was a great turnout in all the communities. The Rumuruti area is wide and has not yet been covered exhaustively Due to long distances from Mpala considerations should be made to board around Rumuruti Kisiriri skipped due to security reasons
Dec 4th	Mugie	Naibor, Louniek, Ldabas	95	Acceptable response at Naibor and Ldabas, consider these areas in the future, possibly together with Kirimon
Dec 15th to 19th Dec	Solio settlement	Solio settlement; villages 1 to 7,	690	(county team response)

	TOTAL		**15,265**	

Campaign Field Challenges and Recommendations

Logistical

Dog handling: Animal rights and human safety

Several volunteers in the campaign continue to express concern for the welfare of the animals receiving the vaccination, at the same time acknowledged improvement from previous years. Not all of the volunteer veterinarians have experience working with animals that are unhabituated to human contact, especially because the majority were recent graduates or still studying. Sending these vets into the field without training poses a risk for both their health and the animalsng these velt also poses risks for humans at the vaccination center; bites and scratches are caused by poor handling, usually when an owner is trying to restrain their animal, but without knowledge of how to do so properly. The resulting distress at the vaccination center may also deter community members from bringing their animals back for vaccination in subsequent years.

Fortunately, many of the LRVC volunteer veterinarians **do** have experience working with less-habituated animals and have developed excellent strategies for safely and humanely vaccinating even extremely hostile animals. Next year, Short clinic/training prior to the campaign (or each weekend, for new volunteers) to brief the vets on appropriate and inappropriate methods of restraining hostile dogs.

Training all volunteer veterinarians in proper handling techniques will help decrease stress and chaos at the vaccination centers, increase the animalsthe campe, increase vaccine uptake, increase the chances that owners will bring their dogs back the next year, and decrease the chances of a bite or scratch. Similarly, it would be beneficial to train the community guides on how to communicate with the community members on how to handle dogs.

Finally, part of the LRVC briefing should include mention of when it may *not* be worth vaccinating an animal. The drive to increase vaccine coverage led 2018 teams to adopt a "leave no dog unvaccinated" attitude; however, it is not worth vaccinating one animal at the cost of a bite to a human. Going forward, the campaign leadership should critically consider at what point extremely hostile dogs should be left unvaccinated.

Addressing bites and scratches

Treating bites and scratches at the vaccination cites poses a major logistical challenge. From the first weekend, we used a combined report form and waiver to document upon each injury. This form releases the LRVC from liability and ensures that; (a) the bite victim receives their first rabies post-exposure prophylaxis shot, (b) the victim understands the necessity and method to obtain the subsequent four shots, and (c) the vaccine doses are delivered to the clinic with refrigeration located nearest to the victim.

The human doctor who traveled with the vaccination teams through the weekends delivered post-exposure prophylaxis where necessary and filled the necessary paperwork. However, there was room for error if the victim - often a young person or child - did not understand the subsequent procedure; if they forget to visit the clinic for their subsequent vaccinations; and/or if the clinic decides to use the vaccines (which are provided free of charge) for profit. Prior to next year's campaign, the LRVC team needs to conduct a critical assessment of the accident treatment procedure, translate both the waiver and the vaccination information form into Kiswahili, and get a lawyer to assess the waiver and any potential liability carried by the campaign.

Scientific

At this time, several critical questions remain unknown. First, it remains unknown at what rate the animals, which are often sickly, skinny, or malnourished, **uptake the vaccine** (serological conversion - this would need to be established in an independent study). If vaccine conversion to immunity is low, the LRVC will need to achieve a higher-than-expected vaccination rate in order to eliminate rabies in Laikipia.

The prevalence of **rabies in wildlife** populations, and the rate or incidences of transfer between wildlife and domestic animals, whether or not the wildlife strain of the disease can be transferred from wildlife, to a domestic animal, to a human are all unknown in the Laikipia context.

While the campaign has been vaccinating some domestic cats alongside dogs, the rabies rate in Laikipia's cat populations is also unknown, meaning it is unknown whether this is an effective strategy or a waste of vaccine.

Finally, one of the most commonly asked questions about the campaign is how much further we have to go. The exact **population of dogs** in the county - and, thus, how many must we vaccinate to reach the 70% target? A publication is set to be released aims to address this question and will guide the LRVC strategy in the coming years. Using this data, we will be able to tell how effective our campaign is over time by conducting further rabies surveillance.

Strategic

Low-turnout communities

In some communities, such as Ewaso, Il Motiok and Koija, turnout was very poor, and many community members expressed distrust of the vaccination. Communities are still mistrustful two years after the canine distemper outbreak that devastated both Laikipia's wild dog populations and the domestic dog populations in largely pastoral communities. Because the outbreak took place shortly after LRVC 2016, some members in the communities assumed that the rabies vaccination was the cause of their dogs' deaths, and that rumor spread rapidly throughout the communities and continue to impact the LRVC to date. LRVC cannot be successful in the long term if communities do not trust and value the vaccination enough to bring their pets to vaccination centres.

The key to improving turnout in these communities is increasing both their education about rabies vaccination, and their trust of the campaign itself. These issues are addressed in the following sections.

Education

During the campaign, the campaign volunteers and vets can make important steps to inform community members about the facts about rabies and the vaccination. For example, although many community members reported having received vaccination previously, few brought their vaccination cards (begging the question on how well these legal documents are kept or regarded). Community members also may not know that vaccination needs to be repeated annually.

Before the campaign, LRVC 2019 with enough time and funding can expand the school programs in key areas to inform students about what rabies is, and reasons vaccination is important, first aid and follow up treatment for bites and scratches. In 2016, the LRVC had worked with the Northern Kenya Conservation Clubs to design lessons and teach primary school students about rabies and how to prevent it. This should be revived as part of the long-term educational program essential to the campaign's long-term success.

Trust

Lack of trust in the LRVC was a central issue in some pastoral communities where vaccination turnout was lowest. As the campaign expands beyond the communities adjacent to Mpala Research Centre, it is increasingly perceived as the work of outsiders, without support from within the target communities. Also, unsurprisingly, turnout at vaccination centers was the highest in communities where the community organizers/community liaison officers were well-known and trusted.

The campaign could expand its reach and turnout by increasing involvement from within the communities themselves. For example, Mpala Research Centre staff might volunteer with the campaign in their home communities (Lekiji, Il Motiok, Rumuruti, etc.). Daraja Academy is also eager to collaborate and could involve students from the target communities as volunteers. Moreover, the vaccination teams that targeted the region around Ol Malo in the first weekend worked with the Samburu Trust, who

were well regarded members within the communities and allowed for an extremely high success rate in dogs vaccinated in the total population. LRVC 2019 may want to consider partnering with Samburu Trust as they have well established relationships with many of the communities the LRVC targets as a way to increase trust.

Expansion

The campaign has the potential to be expanded further into more into Laikipia West, which so far has only seen marginal coverage around Rumuruti. It is also important to consider the campaign's expansion holistically and in a long-term context. It may take 5 years for the campaign to expand to 70% vaccination coverage; this coverage must be maintained for at least 3 years; and it must even continue at a maintenance level thereafter, or rabies will inevitably be continuously reenter Laikipia's domestic dog population from wildlife and across the county borders. Although we have seen great success in terms of vaccination numbers and extremely high turnout in new communities this year, increasing education and trust alongside vaccination numbers is critical to the LRVC's ultimate success.

Sustainability

The campaign model has both advantages and drawbacks. The way the campaign is run is fun for the young science-focused volunteers, and has never had a shortage of volunteer students or veterinarians. With the right approach and communications model, partner organizations may become more committed to the campaign over time; for instance, it has become a "given" that Mpala donates accommodation and board for the duration of the campaign, and we may hope that our neighbouring conservancies will come to see the campaign the same way.

However, the intensity of the campaign, and its on-the-fly organization, may risk exhausting some partners. Crowdfunding is particularly susceptible to "donor fatigue," as donors can be reluctant to re-open their pocketbooks every year for the same "urgent" cause. Campaign funding is a critical variable for the success of the campaign and it is recommended that fundraising begin well in advance to allow for organizations willing to partner to factor it in their financial allocations.

APPENDIX
Week-by-Week Brief

Weekend 1: Ilmotiok, Koija, Kimanjo, Ol Malo

Vaccination was carried out around the nine group ranches of Naibunga. A total of 954 domestic dogs and cats were vaccinated this is including the Ol Malo area which had a far better turnout. There was a very low turnout as the community members were afraid that their dogs were going to die once they receive the vaccination. The low response was especially seen at Ewaso, Nasirai, Monishoi, and Loshieki. Ol Malo conservancy and the Samburu Trust mobilization team did a commendable job hosting two LRVC teams over the weekend and vaccinating over 500 dogs in the door-to-door approach. Nevertheless, good numbers were realized at Tiamamut, Daraja, Ilmotik, NgNgtik, Tura and Kimanjo center.

Dr. James conducting vaccinations at Ilmotiok.

Weekend 2: Naibor, Jua Kali and Lekiji

The second vaccination weekend was held between 26th and 27th October. This was done in areas around Naibor, Maramoja, Endana, Kimakandura, Jua Kali, Lekiji, Tangi Nyeusi, Ngare Nyiro, Segera, Powys etc. Total vaccinations availed during the weekend was 1,683. There was a good turnout (save for two communities ekReteti and Idikir/Murua Nalara, where turn-out was low, as the communities and the authorities supported the campaign. The distances were huge and the PA vehicle was put to extra task to reach all areas.

Vaccination at Lekiji Village

Weekend 3: Umande, Loldaiga, Mugumo

The third LRVC weekend was held between 2nd and 3rd November 2018. A total of 2,022 dogs and cats were vaccinated. Among the challenges experienced this weekend was heavy rainfall and ongoing national examinations. In order to get the most out of the public address system in use, it is advisable to move the dates so as not to coincide in future with the KCPE and KCSE examinations dates.

Laikipia County Veterinary Intern vaccinating puppies in Umande.

Weekend 4: Ngenia, Chumvi, Nturukuma, and Baraka

The fourth weekend took the campaign to Ngenia and Borana areas on 9th and 10th November, with new areas (Nturukuma, Baraka, Ruai and Sweetwaters) incorporated on the second day to avert a foreseen low turnout at Ngare Ndare and Makurian. The team realized 2,151 vaccinations. Turn-out was good despite heavy rainfall on the second day. While the campaign seeks to maximize use of available resources and avail the highest number of vaccinations, the committee understands the need to have the vaccinations done in all areas including those with poor turn-out due to low dog population and/or vaccine misinformation.

One of the vaccination team volunteer's filling out vaccination cards.

Weekend 5: Ol Pejeta, Ngobit, and Matanya

This was on 16th and 17th November. A total of 3,465 dogs and cats were vaccinated. From this number, a fantastic turnout of over 2300 was from Matanya/Marura area. Learning from the previous week's work, the team adopted a strategy of maximum coverage with each team having a minimum of three stations per day (after spending a maximum of two hours per static point hence markedly reducing time wastage and maximizing areas covered in a single day). It is recommended that the Matanya area is accorded more special attention in subsequent years due to the area's high population and expected impact of the canine vaccination.

A community member waiting for his dog to receive a vaccination near Ol Pejeta

Weekend 6: Rumuruti Area

The final vaccination weekend occurred between 23rd and 24th November 2018. A total of 4,205 domestic dogs and cats were vaccinated. The team was able to surpass the target of 4000 dogs and cats and numbers could have been higher had vaccine not been exhausted on the first day of the weekend. The reason for the high turnout of dogs and cats can be attributed to good community mobilization that was done by the well-known Community Liaison Officers of LWF, Franklin, and Lesian, also accompanied by a PA system which was able to move across the communities as well as the incorporation of new areas. The response from communities and the continued demand for the rabies vaccine around this area continues to present new opportunities for the campaign to expand even further westward. Efforts by the county government to reduce the number of stray dogs and unvaccinated dogs in the vicinity of Rumuruti town contribute a great deal to awareness about rabies and good turnout during vaccination days.

The LRVC 2018 Volunteer Team at Rumuruti