Rabies in rural Cambodia

A pilot study on social acceptance of an oral vaccination campaign of dogs and community rabies awareness

Zara Webjörn

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Swedish University of Agricultural Sciences, SLU
Faculty of Veterinary Medicine and Animal Science
Veterinary Medicine Programme

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Rabies på landsbygden i Kambodja: en pilotstudie om social acceptans för en oral vaccinationskampanj hos hundar och samhällets rabieskunskaper

Zara Webjörn

Supervisor:	**Johanna Lindahl, Swedish University of Agricultural Sciences, Department of Clinical Sciences**
Assistant supervisor:	Dr Sothyra Tum, National Animal Health and Production Research Institute, Cambodia
Assistant supervisor:	Emelie Pettersson, National Veterinary Institute
Examiner:	Mikael Berg, Swedish University of Agricultural Sciences, Department of Biomedical Sciences and Veterinary Public Health
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Swedish University of Agricultural Sciences
Faculty of Veterinary Medicine and Animal Science
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Abstract

Rabies is a deadly zoonotic disease that kills approximately 60,000 people every year, with around 60% of the cases in Asia. There exists no treatment for rabies once symptoms have started to appear and the disease always leads to death of the patient. Therefore, prophylactic treatment, such as pre-exposure prophylaxis (PrEP) or post-exposure prophylaxis (PEP), is of uttermost importance. 99% of human rabies cases is caused by transmission from a rabid dog, most commonly by dog bites. Cambodia is one of the countries in the world with highest incidence rate of rabies, with 3.5 times as high incidence rate as India. Together with the highest dog-human ratio in the world and 95% of dog bite victims not getting PEP, rabies is a serious threat to the Cambodian people.

The best way to stop human rabies is to stop dogs from being infected. This is done by vaccinations, traditionally as injections. To reach herd immunity, 60-70% of the dog population needs to be vaccinated. However, since the majority of the dogs in Cambodia are free-roaming and are not used to being restrained and has never seen a veterinarian, it is hard to reach all of the dogs during vaccination campaigns.

This is why oral rabies vaccinations (ORV) might be a good alternative or complement to vaccine injections. Since there is no need to handle dogs when giving ORV, it is possible to reach the dogs that otherwise would have been impossible or dangerous to give injections to, and this way, it is possible to reach the threshold for herd immunity in the population.

This study aimed to evaluate the social acceptance of ORV in rural villages with unvaccinated dogs in three provinces in Cambodia and evaluate the general rabies knowledge in the same areas. This was done through mixed method, with dog owner questionnaires, key informant interviews and focus group discussions. The study found that the social acceptance towards ORV is very good and almost everyone in all of the provinces were positive towards ORV. The will to vaccinate the dogs was high, as long as the vaccine is free of charge or cost no more than $3. However, the general rabies knowledge was surprisingly low in all the provinces compared to earlier studies done in Cambodia, with 40% not knowing what rabies is and about 50% not knowing that rabies has a 100% mortality. Other studies have found that villages with unvaccinated dogs generally have a lower level of rabies knowledge, which can explain these findings.

Keywords: zoonosis, canines, Southeast Asia, rabies, vaccines

Sammanfattning

Rabies är en dödlig zoonotisk sjukdom som dödar ungefär 60 000 människor per år, med ungefär 60 % av fallen i Asien. Det finns ingen behandling mot sjukdom när symtom väl har uppkommit och sjukdomen leder alltid till döden. Det är därför av yttersta vikt att tillämpa profylaktisk behandling, så som preexpositionsprofylax (PrEP) eller postexpositionsprofylax (PEP), för att förhindra sjukdom. 99 % av alla humana rabiesfall är orsakade av smitta från hundar, oftast via hundbett. Kambodja är ett av de rabiestätaste länderna i världen, med 3,5 gånger så hög incidens som Indien. Landet har även den högsta hunddensiteten i världen, men enbart 5 % av hundbettsoffren i Kambodja får PEP. Således är rabies ett mycket allvarligt hot mot den kambodjanska befolkningen.

Det bästa sättet att stoppa rabies är att förhindra hundar från att bli infekterade. Detta görs traditionellt med vaccinationer genom injektioner. För att nå flockimmunitet behöver 60–70 % av hundarna i en population bli vaccinerade. Då hundarna i Kambodja generellt är lösgående, inte vana vid att bli fasthållna och de flesta aldrig har träffat en veterinär, är det svårt att vaccinera alla hundar vid vaccinationskampanjer.

Orala rabiesvaccinationer (ORV) kan vara ett bra alternativ eller komplement till injektionsvaccinationer. Eftersom hundarna inte behöver hanteras vid ORV är det möjligt att vaccinera hundar som annars hade varit omöjliga, eller farliga, att ge injektioner till. På detta sätt är det möjligt att uppnå flockimmunitet i populationen.

Den här studien ämnade undersöka den sociala acceptansen för ORV på landsbygden i byar i tre provinser i Kambodja med ovaccinerade hundar och undersöka rabieskunskapen i samma områden. Studien genomfördes med blandade metoder, inklusive hundägarenkäter, nyckelpersonsintervjuer och fokusgruppsdiskussioner. Studien fann att den sociala acceptansen för ORV är mycket god och att nästan alla i samtliga provinser var positivt inställda till ORV. Viljan att vaccinera hundarna är hög, så länge vaccinet är gratis eller inte kostar mer än $3. Dock är rabieskunskapen lägre i dessa byar jämfört med tidigare studier som har gjorts i Kambodja, med 40 % som inte vet vad rabies är och ca 50 % som inte vet att rabies har 100 % mortalitet. Andra studier har sett att ovaccinerade byar har generellt lägre kunskap om rabies än vaccinerade byar, vilket kan förklara dessa fynd.

Nyckelord: zoonos, hunddjur, sydostasien, rabies, vaccin

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Abbreviations

IPC	Institute Pasteur Cambodge
FGD	Focus Group Discussion
MLV	Modified Live Vaccines
MSG	Monosodium Glutamate
NAHPRI	National Animal Health and Production Research Institute
ORV	Oral Rabies Vaccination
PrEP	Pre-exposure Prophylaxis
PEP	Post-exposure Prophylaxis
RIG	Rabies Immunoglobulin
SLU	Swedish University of Agricultural Sciences
SVA	National Veterinary Institute
VBV	Vector Based Vaccines
WHO	World Health Organization

1. Introduction

Rabies is a 100% fatal, zoonotic disease (WHO 2022a) that kills approximately 60,000 people every year, of which around 60% of the cases occur in Asia (Hampson *et al.* 2015). However, the true number is probably much higher because of underreporting (Li *et al.* 2019). Approximately 40% of all the human cases are in children younger than 15 years (WHO 2022a). As soon as the infected individual has started showing symptoms, be it human or animal, there is no treatment against the disease and the infected individual will die. This is the main reason why prophylactic measures is of uttermost importance when fighting rabies. Almost every human infected with rabies has contracted the disease from a rabies infected dog, why the most important and cost-effective measure to stop human rabies is to vaccinate dogs against the disease. Mass vaccinations of dogs with coverage above 70% in areas with endemic rabies has been shown to stop the spreading of the disease from dogs to humans (WHO 2018).

Oral vaccinations to control rabies have been used successfully in Europe and in USA since 1978 (Yale *et al.* 2022). There have been propositions of implementing this in Asia for more than 30 years, but to this day oral vaccination has not been used in a bigger scale in this area. An oral vaccination programme has the potential of cutting the costs for the vaccination but also increase the effectiveness of mass vaccinations, since when vaccines are given parenterally it not only demands trained professionals, but also requires dogs to be captured and injected with the vaccine. Oral vaccinations are not labour intensive to the same extent.

In Cambodia there is approximately 800 human deaths due to rabies every year (Li *et al.* 2019). The country has no recurring vaccination programs against the disease in dogs, which is why an oral vaccination campaign could have a large positive impact on the country.

The main goal with this pilot study is to investigate whether an oral vaccination campaign would be socially accepted and identify what possible social obstacles there might be, and further investigate how much dog owners in rural Cambodia knows about rabies and rabies vaccination.

2. Literature review

2.1 Rabies

Rabies is a zoonotic disease with extremely high case fatality, caused by the rabies virus, which is a *Lyssavirus* in the family *Rhabdoviridae* (Rupprecht 1996). The virus can infect all warm-blooded animals (SVA 2021). The virus is secreted in the saliva of an infected individual, and transmission of the virus happens when saliva from an infected individual comes in contact with mucosal membranes or non-intact skin in a healthy individual (Rupprecht 1996). This can happen for example either through bites or licking on damaged skin. After inoculation, and initial replication, the virus migrates to the brain through neuromuscular junctions to peripheral nerves. The virus replicates extensively and then spreads from the brain to other organs, including the salivary glands. The incubation period has a wide range and can vary between 5 days and more than 2 years, although the most common is 1-3 months. The closer the exposure is to CNS, or if it is a child that is exposed, the shorter the incubation time.

The virus causes an acute encephalitis with multiple clinical signs following (Rupprecht 1996). However, the most common in most species is changes in behaviour: tame animals becomes shy and aggressive, while wild animals becomes less shy and can seek human contact (Folkhälsomyndigheten 2018; SVA 2021). The disease always ends in death for both humans and animals since there is no treatment for the disease.

2.1.1 Human rabies

Every year there is approximately 60,000 human deaths due to rabies globally, of which 60% of the cases occur in Asia (Hampson *et al.* 2015). However, the true number of deaths is thought to be much higher because of underreporting of the disease (Li *et al.* 2019). Out of the total number of deaths, approximately 40% are children younger than 15 years (WHO 2022a).

Transmission

Almost all cases of rabies in humans are caused by transmission from rabid dogs (WHO 2018). Other routes of transmission are however possible. Although not recommended, there is no known risk in consuming raw meat or milk from infected animals.

Clinical symptoms

The disease is divided into five stages in humans: incubation, prodrome, acute neurological period, coma and death (Rupprecht 1996). In very rare cases the patient doesn't die, but recovery occurs instead, with at least 14 documented cases of recovery among human patients (Hattwick *et al.* 1972; Porras *et al.* 1976; WHO 1977; Alvarez *et al.* 1994; Madhusudana *et al.* 2002; CDC 2004, 2012; Willoughby *et al.* 2005; ProMED-mail 2008; Holzmann-Pazgal *et al.* 2010; Karahocagil *et al.* 2013; de Souza & Madhusudana 2014; Manoj *et al.* 2016; Weyer *et al.* 2016). Clinical symptoms occur in the pro-dromal period and are often non-specific in the beginning (Rupprecht 1996). The person can experience general malaise, fever and lethargy, respiratory symptoms, gastrointestinal symptoms, or symptoms from the central nervous system. It is also common to experience paraesthesia or pain from the site of the infection.

In the acute neurological period, the patient gets more specific central nervous symptoms (Rupprecht 1996). In this phase, the disease is categorised either as furious or paralyzing rabies based on what symptoms the patient is experiencing. Furious rabies has symptoms such as hyperactivity and hydrophobia, while a patient with a paralyzing rabies experiences paralysis. Both types can, however, have symptoms such as nuchal rigidity, paraesthesia, focalised or generalised seizures, and hypersalivation. In the end of this phase the patient may get fast, irregular breathing that is followed by paralysis, coma, respiratory arrest and death.

Treatment and prophylaxis

Once symptoms have occurred, there is nothing to be done that can stop the course of the disease (Rupprecht 1996; Folkhälsomyndigheten 2018; World Health Organization (WHO) 2022a). Therefore, it is of uttermost importance to give patients with even the smallest possibility of rabies exposure post-exposure prophylactic treatment (PEP) (WHO 2022a). This includes several treatments: thorough washing of the exposed area immediately after suspected exposure, vaccination with potent and effective vaccine meeting WHO's demands and, if necessary, administer rabies immunoglobulin (RIG) intradermally around the exposed area depending on the severity of the exposure (i.e. small abrasion without bleeding or transdermal bite(s) with bleeding).

Apart from PEP, humans can be pre-exposure vaccinated against rabies as well (WHO 2022a). However, the most important and most cost-effective way of preventing human rabies is to stop dogs from becoming infected with rabies, and to prevent people being bitten by dogs, since almost every human case of rabies can be traced to rabid dogs.

2.1.2 Canine rabies

Dogs, just like humans, develop an acute encephalitis if they are infected with rabies, and the disease is always fatal.

Transmission

Just as in humans, rabies is transmitted to and between dogs by saliva from an infected animal getting in contact with mucosal membranes or wounded skin, for example, when an infected dog bites a healthy dog (Evidensia 2020).

Treatment and prophylaxis

There is no treatment against rabies in dogs, except for humane euthanasia (AniCura Sverige 2017). In some countries, for example Sweden, this is the only legal option if a dog is suspected to be infected with rabies. Prophylaxis, i.e. pre-exposure rabies vaccination, is therefore the only way to prevent rabies in dogs. There is no commercially available veterinary equivalent to PEP for dogs (Hanlon & Rupprecht 2003).

2.1.3 Rabies in Cambodia

Rabies is an endemic disease in Cambodia with an estimated number of deaths of at least 800 people per year, which exceeds the amount of people killed by both dengue fever and malaria (Ly *et al.* 2009). This makes Cambodia one of the countries with the highest incidences of deaths due to rabies in the world, with an incidence rate of 3.5 times higher than India, where the disease kills most people in the world (Institut Pasteur 2017). This also means that 1.3% of the total global rabies-caused deaths is suffered by the Cambodian people, when the population only represents 0.2% of the affected countries population.

The estimated human deaths caused by rabies in Cambodia are probably greatly underestimated (Baron *et al.* 2019). The geographical distance to the capital Phnom Penh probably affects the reporting of both canine and human rabies cases (Baron *et al.* 2019), since both human and canine rabies diagnostics only are performed in Institute Pasteur Cambodge (IPC) in the capital (Ly *et al.* 2009). This might have a negative impact on the amount of rabies cases being reported in rural areas with larger geographical distance to the capital (Baron *et al.* 2019). The study estimating

the number of deaths, done by Ly *et al.* (2009), is built on a decision tree analysis and passive reports of dog bites, which also contributes to the under-estimation of actual rabies cases, and hence a greater under-estimation of the amount of human rabies-caused deaths in the country (Baron *et al.* 2019).

About 80% of Cambodia's population lives in rural communities (Institut Pasteur 2017). The dog density in rural Cambodia is the highest reported in the world (Institut Pasteur 2017), with one dog for every three people (Chevalier *et al.* 2021). This means that rural Cambodia inhabits more than four million dogs. Cambodia is also reported to have one of the highest cumulative dog biting incidences in the world.

The IPC has tested 200 biting dogs each year since 2000, and nearly 50% of them were positive for rabies virus (Institut Pasteur 2017). With an estimated amount of 600,000 dog bites per year, and 95% of dog-bitten people not receiving PEP, the rabies situation in Cambodia is really serious.

2.2 Vaccination

Since Louis Pasteur developed the first vaccine in the late 1800's, including the very first vaccine against rabies (Ullmann 2022), a lot of vaccines against different infectious diseases have been developed and have saved countless of lives, both among humans and animals. Vaccines even made it possible to fully eradicate two infectious diseases: rinderpest in cattle and smallpox in humans (WHO 2022b; WOAH 2022).

Herd immunity

The immunization caused by vaccinations does not only protect the vaccinated individual against the disease and make it less susceptible to infection, it also makes the vaccinated individual less prone to transmitting the disease to others even if the vaccinated individual gets infected (De Jong & Bouma 2001). This means that the chain of transmission is broken, and it will be harder for the microorganism to infect other individuals, replicate and spread through a society or group of individuals. The effect that this has on population level is called herd immunity. It means that if enough individuals that lives together are immune to a disease, the other immunologically naïve individuals will also be protected indirectly against the disease.

The critical vaccination level is defined by Fine *et al.* (2011) as "the proportion of the population that must be vaccinated to achieve herd immunity threshold, assuming that vaccination takes placed at random". It depends on both the characterristics of the infectious agent, i.e., the transmissibility and how it spreads in

populations, and the nature of the vaccine used, i.e., the characteristics of the induced immunity and distribution of the vaccine (Fine *et al.* 2011). Apart from the nature of the vaccine and the infectious agent, it also depends on how the population behaves and mixes, and what the immune status against the disease was in the population before vaccination.

Administration

Vaccines are possible to administer in different ways, depending on their characteristics. For example, it is possible to vaccinate a dog against rabies in two different ways; with an injection, or orally with a bait prepared with a vaccine inside.

2.2.1 Canine vaccination

The traditional way to vaccinate dogs against rabies is to give them an injection with a killed-virus vaccine. This requires trained professionals, and that the dogs that are to be vaccinated are caught and handled for the injection. This is not only time consuming and expensive; it is also very stressful for the dogs that are not used to being handled like this. It is also dangerous, as it is a possible source of rabies exposure for the people handling the animals.

Herd immunity regarding canine rabies and protection of humans

A previous study showed that for foxes in Europe, the critical vaccination level for ORV was 70% if the fox density is about 3/km^2 (Anderson *et al.* 1981). However, a newer study using spatial patterns has showed that herd immunity can be achieved if 60% of the foxes living within the same population are vaccinated (Eisinger & Thulke 2008).

In a study examining rabies transmission dynamics in dogs using a mathematic model, the authors found that a 66% vaccination coverage is the threshold that gives herd immunity among dogs, and hence is the minimal vaccination coverage to protect humans (Asamoah *et al.* 2017). This corresponds well to the two earlier mentioned studies about herd immunity thresholds in foxes.

2.2.2 Vaccination in Cambodia

In Cambodia, there is no national vaccination program against rabies in dogs (Chevalier *et al.* 2021), even though the authorities pledged to eliminate canine rabies in Cambodia by 2020 (Tarantola *et al.* 2015). Since the excepted life span of dogs in Cambodia is very short, with only one third of the dogs surviving more than 2 years in some provinces, the vaccinated animals are quite quickly replaced with

younger unvaccinated animals (Chevalier *et al.* 2021). This means that for a village to be protected against rabies, vaccinations need to be re-done frequently.

For humans with suspected exposure to rabies, PEP with or without RIG is only free in one hospital in Cambodia (Tarantola *et al.* 2015). Even with a fee, that in 2012 was 50-100% of a Cambodian farmer's monthly income, it is hard to get access to PEP with or without RIG since it is only a few institutions that has access to these drugs.

Pre-exposure vaccinations are generally not administered to the citizens of Cambodia (personal communication Rortana Chea 2022-09-23).

Issues with traditional vaccination campaigns

Although highly immunologically effective, parenteral vaccination has some practical limitations when vaccinating large groups of stray dogs (Yale *et al.* 2022). It is difficult to reach a 70% vaccination coverage and it has logistical, financial and operational limitations since it requires large skilled dog-catching teams as earlier mentioned.

2.3 Oral vaccination with bait

Oral rabies vaccination (ORV) is a different way to vaccinate animals against rabies compared to the traditional parenteral way of administration. There are today two types of ORVs used; Modified Live Vaccines (MLV) and Vector Based Vaccines (VBV) (Yale *et al.* 2022). Both of these are recommended by the WHO for the control of rabies in wildlife (Maki *et al.* 2017).

Safety for humans

Safety for humans is one major concern with dogs getting ORV with an attenuated vaccine, but a study on SAG-2 (a type of MLV) found that the oral clearance one hour after vaccination was very high with only 1/57 oral swabs coming back positive for SAG-2 virus (Orciari *et al.* 2001). Another study examined the safety of a SAG-2 vaccine by evaluating if the dogs started hypersalivating, showing adverse clinical signs, and if the vaccine strain started to replicate in the brain and salivary glands in the vaccinated dogs (Cliquet *et al.* 2007). None of this happened, even in immunosuppressed dogs, and hence, the authors concluded that the vaccine posed no threat to humans.

Similarly, in a review study regarding the use of ORVs in India, Yale *et al.* (2022) noted that no adverse effects in humans following contact with MLV ORVs had

ever been reported, nor any cases of field reversion to pathogenicity of today's generation of MLVs.

The most common VBV has been used frequently since 1985 with no adverse reactions reported in wildlife and domestic animals (Maki *et al.* 2017). VBVs were made to prevent the theoretical risk of a MLV reverting to pathogenicity (Yale *et al.* 2022). However, in humans exposed to V-RG, a VBV, there have been reports from the USA regarding severe skin-inflammation and complications in immuno-compromised persons and pregnant people (Rupprecht *et al.* 2001; Roess *et al.* 2012).

Efficacy

ORV is highly effective in protecting the dogs against clinical rabies (Orciari *et al.* 2001; Cliquet *et al.* 2007), even if the dogs have not seroconverted before infection (Cliquet *et al.* 2007).

In a study made on Haiti evaluating the immune response in dogs vaccinated with ORV under field conditions, they found that 77.8% of the dogs had rabies anti-bodies after 17 days, compared to 92.7% of dogs who received parenteral vaccina-tion (Smith *et al.* 2019).

Distribution of ORV

The ORV can be distributed in different ways depending on the nature of the dog and how the dogs live: by door-to-door oral vaccination of owned dogs, by handing out ORVs to dog owners to give to their dogs at home, by placing ORVs in places known to be visited by free-roaming dogs, or by presenting the bait directly to dogs (both owned and/or unowned) (WHO 2007).

Risk of plastic pollution of the local environment

Since the vaccine is contained within a plastic blister inside the bait, the plastic blisters need to be collected post vaccination, or else the plastic satchels will pollute the local environment. This can be an issue if the ORV bait is lost, for example if a dog carries it away where it cannot be found or if the blister blows away before the vaccinators are able to pick it up etc. In a study made on Haiti where they were vaccinating dogs with ORV, only 4.8% of the blisters could not be retrieved by vaccinators and were therefore possibly left in the environment (Smith *et al.* 2019).

There does not seem to be any information to be found on how the plastic blisters are handled when vaccinating wildlife with ORV.

2.3.1 Oral vaccination with bait in Europe and North America

ORV has been used in Europe and North America since 1978 to control rabies among wildlife (Yale *et al.* 2022). A recombinant virus vaccine is used together with an edible bait and is then distributed either by hand or by air to vaccinate red foxes against rabies. This has led to almost total extinction of rabies in Western Europe (Rupprecht *et al.* 2004).

In North America, the tactics have been the same regarding vaccination in wildlife against rabies with focus on grey foxes, raccoons, and coyotes (Rupprecht *et al.* 2004). They have not been able to make rabies disappear, but the disease is concentrated to small areas and do not seem to spread from those.

2.3.2 Oral vaccination with bait in South Asia

In the Philippines, a study was done to compare parenteral rabies vaccination to ORV (Estrada *et al.* 2001). A total of 216 previously unvaccinated dogs were included in the study, and of these, only 17 could be vaccinated parenterally because of problems with restraining. However, another 126 could be vaccinated with an ORV consisting of a locally made bait made of boiled intestine containing a vaccine-filled capsule. After 15 and 29 days 10/14 tested dogs had rabies virus neutralizing antibody titres, and there were no reports of any unintentional contact between the vaccine virus and any nontarget species, including humans.

A review article about the application of ORV in dogs in India found that it would benefit India to use ORV complementary to parenteral vaccination in parts of the dog population that are not accessible for parenteral injections for reasons such as aggressive behaviour (Yale *et al.* 2022). According to the authors, "ORV has the potential to enable the rapid scaling of high-coverage campaigns reaching the free-roaming reservoir population".

In Thailand, a country which has made noteworthy progress to reduce rabies among humans and dogs, a field study was done to examine if ORV could be used to reach and vaccinate the large numbers of free-roaming dogs without an owner (Chanachai *et al.* 2021). Without using special techniques, these dogs cannot be restrained and therefore remain unvaccinated. The study that included 2444 dogs out of which 79% were offered the bait, found that, out of the bait-offered dogs, more than 9/10 accepted the bait, and of these more than 8/10 were considered successfully vaccinated. This means that 65.6% of the previously unvaccinated and inaccessible dogs were vaccinated with ORV. A vaccination rate like this could potentially interrupt the cycle of rabies transmission.

3. Material and method

3.1.1 Locations

The study was made in rural Cambodia, in Takeo, Kampong Speu and Kampong Chhnang provinces. In each of the provinces, three villages were chosen after recommendations from one of our local supervisors at National Animal Health and Production Research Institute (NAHPRI), after talking to the IPC regarding where there had been rabies cases lately and no vaccination campaigns.

3.1.2 The surveys

There were two surveys done using mixed method: one for the dog owners, and one for the village leader. The surveys were performed at the same time as another study aiming to examine antibodies against rabies in unvaccinated dogs in rural Cambodia (Zachrisson 2023). The owners that volunteered their dogs to the antibody study were also asked to participate in this survey. For the questions included in the survey, see appendix 1. The village leaders in the visited villages were also asked to participate in a key informant interview with questions aimed specifically to them. For the questions included in the key informant's interviews, see appendix 2.

Both questionnaires were written in English and Khmer. Google Forms was used to make both of the surveys web-based, and a local translator read the questions from a smartphone and then wrote down the answers in the web-based questionnaire. However, some of the dog owner-questionnaires were done on paper because of lack of cell service. The questions in the web-based and paper-based dog owner questionnaires were the same, apart from the question about the dog owners age that were a little bit different. In the web-based questionnaire, the question had an open answer where the dog owner answered with the exact age, and in the paper-based questionnaire the question had a multiple choice-answer.

The questions in the survey aimed to get information about the dog owner, main caregiver, and the general knowledge about rabies and vaccination, including PEP, in both human and dogs. It also included some questions about dog bites and

whether the person knew of any suspected or confirmed human or canine rabies cases in the village.

The questionnaire for the village leaders had more open questions and aimed to get a more nuanced picture of the rabies situation in the village, including questions about if the leader knows of any human or canine rabies cases in the village, if there has ever been a rabies vaccination campaign in the village, what the village leader thinks of an oral vaccination campaign and if the leader thinks the inhabitants of the village might accept such a campaign.

To compare the level of rabies knowledge between the different provinces, a point-based system ranking the provinces knowledge were used. Since the number of dog owner interviews varied greatly between the provinces, the "knowledge points system" was needed to compensate for this. Hence, the percentage of the correct answers from each of the provinces were used instead of the total number of persons that answered correctly. The province with the highest percentage per question gained 2 points, the province with the second highest percentage gained 1 point and the province with the lowest percentage gained 0 points. The "knowledge points" where then added together and the province with the highest total amount of "knowledge points" were then considered to have the highest knowledge about rabies.

The results from the dog owner questionnaires and key informant interviews were then entered into Excel, grouped according to themes and then analyzed descriptively.

3.1.3 Focus Group Discussion and Rabies Information

In the end of the interviews with the dog owners in each village, 4-10 dog owners were asked to participate in a focus group discussion regarding ORV. They were then gathered by the end of the day and given a short informational talk about rabies, where the participants were informed about:

1. What rabies is, including most important symptoms (i.e. changes in behaviour/aggressiveness and hypersalivation)
2. That it is a zoonotic disease
3. The case fatality rate
4. Transmission
5. That almost every human rabies case is caused by a dog bite.
6. PEP and prophylaxis

The attendants were then given a copy of an informative presentation printed out on paper about oral vaccination (see appendix 4) and a focus group discussion was held. The group was asked more generally what they think of oral vaccination with bait and if they had any questions or concerns (for questions, see appendix 2). The conversation/discussion was documented in two ways: the discussion was held on Khmer and notes were taken on Khmer in Google Forms, and the conversation/ discussion was also recorded. The recording was then supposed to be transcribed and translated into English. However, this was not possible since the recordings were deleted.

The answers from the FGD's were then entered into Excel, grouped according to themes and then analysed descriptively.

3.1.4 Compensation to dog owners

Dog owners who were willing to answer the study got a subcutaneous injection of ivermectin for their dog/dogs as a gratitude, administered by the people working with the study. For the participants in the focus group discussion, they were given a bag of washing detergent per family. The village leader was also given a bag of washing detergent as a gratitude.

4. Results

4.1 Background information

A total of 60 dog owners were interviewed, and information about 96 dogs were gathered in the different provinces. 31 dog owners were interviewed in Kampong Chhnang, 15 in Kampong Speu and 14 in Takeo province (see table 1). Table 1 describes the gender distribution of the participants in the different provinces. Among the dog owners we interviewed, there were overall slightly more male dog owners than female. In the provinces of Kampong Speu and Takeo, there were approximately double the amount of female dog owners that were interviewed compared to male dog owners.

Table 1. Gender distribution among the dog owners in the different provinces.

Gender	Kampong Chhnang		Kampong Speu		Takeo		Total	
Female	9	29.03%	10	66.67%	9	64.29%	28	46.67%
Male	22	70.97%	5	33.33%	5	35.71%	32	53.33%
Number of answers	**31**	**51.67%**	**15**	**25.00%**	**14**	**23.33%**	**60**	**100.00%**

Most of the interviewed dog owners were between 35-49 years old (see table 2). The dog owners seem to be younger in Takeo province compared to both Kampong Chhnang and Kampong Speu, with no interviewed owners in the age 50-64 and above 65. Only two interviewed dog owners were above 65 years old, and both lived in Kampong Chhnang.

Table 2. Age distribution among dog owners in the different provinces.

Age	Kampong Chhnang		Kampong Speu		Takeo		Total	
20–34	6	19.35%	3	20.00%	5	38.46%	14	23.73%
35–49	11	35.48%	5	33.33%	8	61.54%	24	40.68%
50–64	12	38.71%	7	46.67%		0.00%	19	32.20%
Above 65	2	6.45%		0.00%		0.00%	2	3.39%
Number of answers	**31**	**52.54%**	**15**	**25.42%**	**13**	**22.03%**	**59**	**100.00%**

The level of education was generally the lowest in Takeo with no dog owners having finished higher secondary school, compared to both Kampong Chhnang and Kampong Speu where 19.35% and 53.33% respectively had completed higher secondary school (see table 3). One person in Takeo had however completed post-graduation education, and she was part of our field team but happened to have her dog live with her parents in Takeo. Apart from this, Kampong Speu had the highest mean level of education among the interviewed dog owners.

Table 3. Level of education among the dog owners in the different provinces.

Education level	Kampong Chhnang		Kampong Speu		Takeo		Total	
No education	5	16.13%	1	6.67%	3	21.43%	9	15.00%
Primary	10	32.26%	1	6.67%	4	28.57%	15	25.00%
Class 5–10	10	32.26%	5	33.33%	6	42.86%	21	35.00%
Higher secondary	6	19.35%	8	53.33%		0.00%	14	23.33%
Graduation and above		0.00%		0.00%	1	7.14%	1	1.67%
Number of answers	**31**	**51.67%**	**15**	**25.00%**	**14**	**23.33%**	**60**	**100.00%**

Table 4 and figure 1 show whether the interviewee knew of any rabies cases in humans or dogs in the area they live in. More than 2/5 of the total interviewed people (43.34%) knew of at least one case of rabies in either a dog or a human in the area that they lived in. Almost all those cases concerned dogs that had been ill, and only one case concerned a human. However, it needs to be noted that the question was “Has any person or dog in the area had rabies (that you know of)?”, and no follow up question was asked whether it was a confirmed case of rabies with laboratory diagnostics done or if it was only a suspected case of rabies.

Table 4. Rabies cases in the provinces.

Knows of any rabies cases in the area	Kampong Chhnang		Kampong Speu		Takeo		Total	
No	15	48.39%	12	80.00%	7	50%	34	56.67%
Yes, dog	16	51.61%	3	20.00%	4	28.57%	23	38.33%
Yes, dog, but not recently		0.00%		0.00%	1	7.14%	1	1.67%
Yes, dog in another village		0.00%		0.00%	1	7.14%	1	1.67%
Yes, human, but not recently		0.00%		0.00%	1	7.14%	1	1.67%
Number of answers	**31**	**51.67%**	**15**	**25.00%**	**14**	**23.33%**	**60**	**100.00%**

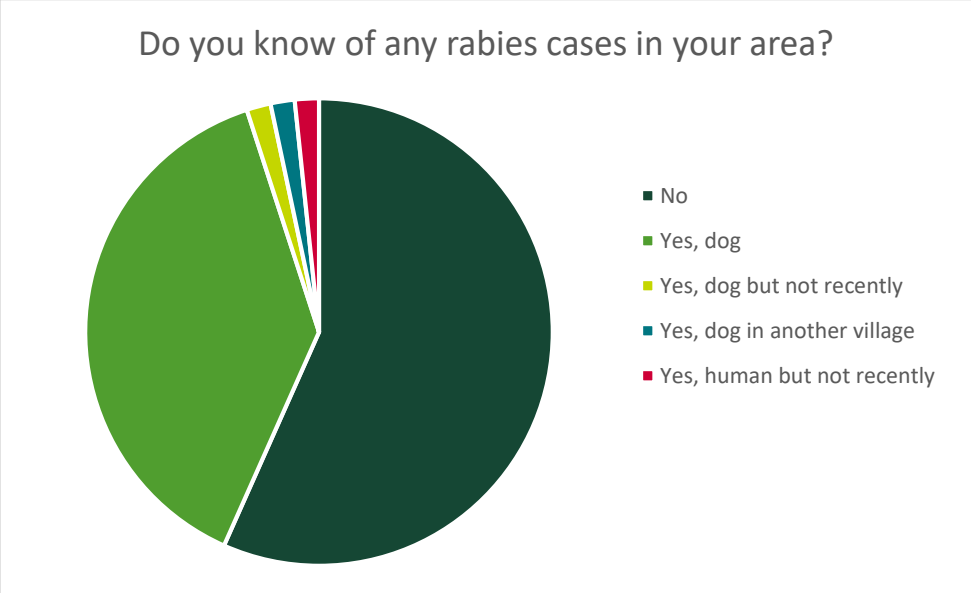

Figure 1. Answers to the question if people knew about rabies cases in humans or dogs.

Table 5 describes the living situation for the dogs in the respective provinces. Most dogs were only living loose outside, followed by living both indoor and loose outside.

Most of the dogs, 95/96 (99%), were guard dogs. Out of these, six (6.3%) were also held for company. These six were from the same village in Kampong Speu (Thmey Village). The last dog was the only one that was held for company only, and it lived in Kampong Speu.

Table 5. How the dogs are held in the different provinces.

Living situation	Kampong Chhnang		Kampong Speu		Takeo		Total	
Both indoor and outside, when outside loose	8	15.69%		0.00%	16	94.12%	24	25.53%
Both indoor and outside, when outside in a leash	10	19.61%		0.00%		0.00%	10	10.64%
Only outside loose	27	52.94%	15	57.69%	1	5.88%	43	45.74%
Only outside loose but in a fenced area		0.00%	5	19.23%		0.00%	5	5.32%
Only indoor	5	9.80%	6	23.08%		0.00%	11	11.70%
Lives with family	1	1.96%		0.00%		0.00%	1	1.06%
Number of answers	**51**	**54.26%**	**26**	**27.66%**	**17**	**18.09%**	**94**	**100.00%**

Almost no dogs had ever visited a veterinarian or veterinary technician or had ever been vaccinated (see table 7). Out of the three dogs that had been previously vaccinated, only one had been vaccinated against rabies.

Table 6. Information about if the dog has ever seen a veterinarian or veterinary technician, and if the dog has ever been vaccinated.

	Kampong Chhnang		Kampong Speu		Takeo		Total	
Dog ever visited veterinarian or veterinary technician	2	2.08%	4	4.17%		0.00%	6	6.25%
Vaccinated dogs	1	1.03%	1	1.03%	1	1.03%	3	3.09%
Number of answers	**3**	**3.11%**	**5**	**5.2%**	**1**	**1.03%**	**9**	**9.34%**

4.2 Knowledge about rabies and vaccination

4.2.1 Dog Owner Interviews

In table 7, an overview of the knowledge about rabies in the provinces is presented. Kampong Chhnang got the highest score of knowledge points, and Takeo got the lowest score.

Only approximately half of the interviewed people answered that they knew that dogs can spread diseases to humans. 86% of these people (25 persons) answered rabies when asked to specify which diseases they know about. One person answered tetanus, another answered parasites, and a third said that "all of the diseases can spread from dogs to humans". One person answered "yes" when asked if they know about zoonotic diseases but did not give an answer on what disease they knew of.

Almost 2/3 of the interviewed people answered that they knew what rabies is, with a big difference between the provinces. Almost 80% in Kampong Chhnang answered that they know about rabies, while only just above 35% answered the same in Takeo.

About 50% of the total amount of interviewed people answered that both dogs and humans can get rabies, with the highest amount in Takeo (58%) and the lowest in Kampong Speu (40%).

Table 7. Knowledge about rabies in the different provinces according to the dog owners' own answers.

Rabies knowledge	Kampong Chhnang		Kampong Speu		Takeo		Total	
Know diseases can be transmitted from dogs	16	51.61%	7	46.67%	6	46.15%	29	49.15%
Know what rabies is	24	77.42%	7	46.67%	5	35.71%	36	60.00%
Know both humans and dogs can get rabies	15	48.39%	6	40.00%	7	58.33%	28	48.28%
Know how rabies is transmitted	21	67.74%	11	73.33%	10	71.43%	42	70.00%
Know rabies' mortality for humans are 100%	17	60.71%	12	80.00%		0.00%	29	52.73%
Know rabies' mortality for dogs are 100%	22	78.57%	13	86.67%	5	35.71%	40	70.18%
Know symptoms of rabies in dogs	23	74.19%	7	46.67%	9	69.23%	39	66.10%
Know vaccines for rabies exists for both dogs and humans	4	12.90%	1	6.67%	3	21.43%	8	13.33%
Takes person to hospital if suspects rabies infection	20	71.43%	15	100.00%	7	58.33%	42	76.36%
"Knowledge points"		**14**		**8**		**5**		

For the question about how rabies is transmitted, people got a correct answer for answering either “bites”, “contact with dog saliva” or both. 70% of the interviewees answered that they knew how rabies is transmitted and gave the correct answer when asked to specify. Although, two additional people that answered “no” on the first question still answered correctly on how rabies is transmitted.

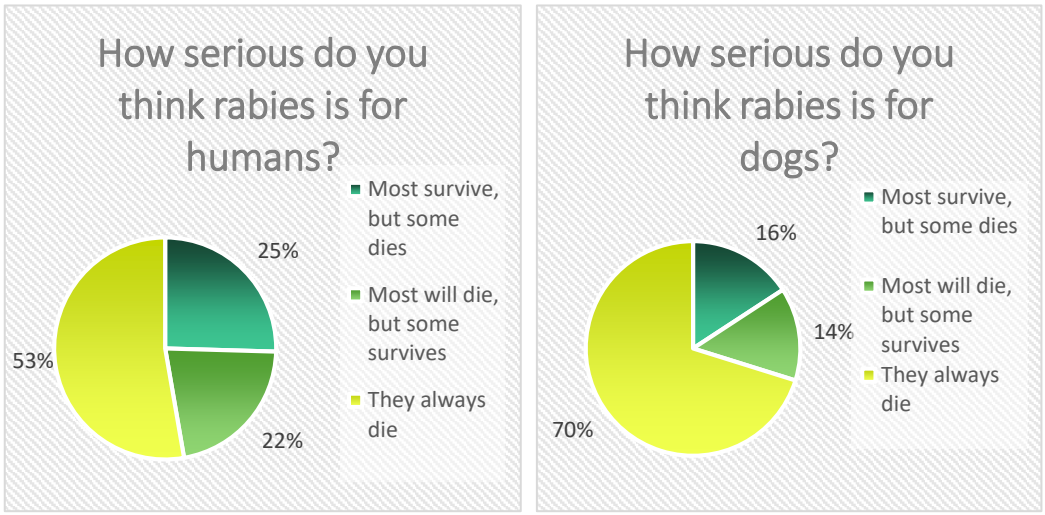

Figure 2. Circle diagrams describing how serious people in Cambodia thought rabies is for humans and dogs.

As seen in both table 7 and figure 2, many people did not know that rabies has a 100% mortality rate for both humans and dogs, and people generally thought that the disease is more deadly for dogs than it is for humans. 25% thought that it is more common for humans to survive rabies than to die because of the disease. In Takeo, no one answered “They always die” on the question about rabies mortality in humans.

For the question about symptoms in dogs, people got a correct answer for answering “aggressiveness”, “salivation” or both. In total, 66% answered correctly, but the results differed quite a lot between the provinces with only 47% correct answers in Kampong Speu and 69% and 74% in Takeo and Kampong Chhnang respectively. This question was a multiple-choice question with the alternatives “aggressiveness”, “salivation”, “fever”, “staggering”, “vomiting/diarrhoea”, “difficulty breathing”, “fatigue”, “don’t know”, and “other” with the possibility to give another answer than the ones already mentioned.

Regarding symptoms of rabies in humans, 37.29 % answered “Don’t know”, with almost 50 % (46.67 %) of the dog owners in Kampong Speu not knowing the symptoms of rabies in humans, and 36.67 % in Kampong Chhnang and 28.57 % in Takeo, respectively. This question was a multiple-choice question with the same

possible answers as the question about rabies symptoms in dogs. 47.46 % answered "salivation", 38.98 % answered "aggressiveness", and 35.59 % answered "fever". The other choices got 22.03 % (difficulty breathing), 10.7 % (staggering), 3.39 % (fatigue) and 1.69 % (vomiting/diarrhoea). No one answered "abortion", "skin lesions", "weight loss" or "other". Multiple alternatives were allowed.

The conclusion from this question is that few people know about the symptoms of rabies in humans, and even those who think they know, might not know for sure.

Since the symptoms in humans are a bit different than in dogs, and, hence, harder to classify some alternatives as correct and analyse those in a table, this question is not a part of table 7 and therefore also not a part of the "knowledge points".

The knowledge regarding if rabies vaccines exist for both people and dogs was low in all the provinces, with not one province reaching 10%. This was the lowest score on all the questions about rabies knowledge. However, it was much more common that people knew that it exists rabies vaccines for humans (see table 8).

Table 8. Table describing knowledge about rabies vaccines in the provinces.

Do you know if rabies vaccines exist?	**Kampong Chhnang**		**Kampong Speu**		**Takeo**		**Total**	
Yes, for humans	7	22.58%	1	6.67%	6	42.86%	14	23.33%
Yes, for dogs	2	6.45%	1	6.67%		0.00%	3	5.00%
Yes, for both dogs and humans	4	12.90%	1	6.67%	3	21.43%	8	13.33%
No	3	9.68%	2	13.33%	3	21.43%	8	13.33%
Don't know	15	48.39%	10	66.67%	2	14.29%	27	45.00%
Number of answers	**31**	**51.67%**	**15**	**25.00%**	**14**	**23.33%**	**60**	**100.00%**

The question on what to do if you suspect rabies in a human got the highest correct score of all the questions, with 76% answering that the person would be taken to a hospital or to get vaccinations, and in Kampong Speu, 100% answered that (see table 7). However, in Takeo, only just below 60% answered the same. One of the interviewed dog owners said that they would also use traditional medicine. 20% of the interviewed dog owners answered something else than to take the victim to a hospital/to get vaccinations, divided almost equally between "stay away from

person"/isolate/quarantine the person in question or report to authority/village leader. One person answered that the victim would be held under observation.

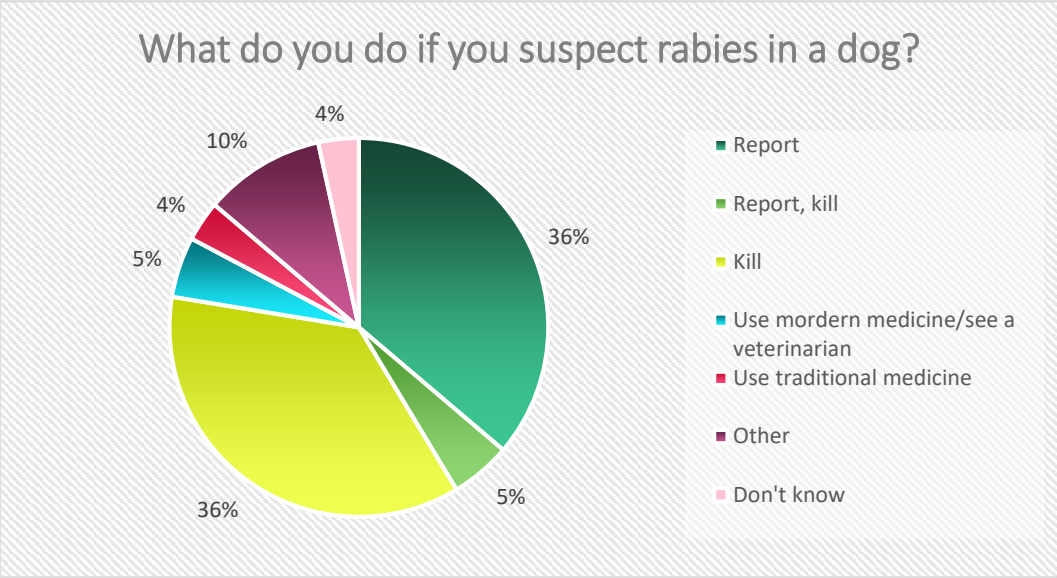

Figure 3. Cambodian dog owners' response to what would be done to a dog if suspected infected with rabies.

In the questionnaire, there was also a question about what would be done with a dog if it was suspected ill with rabies (see figure 3). Most people answered that the dog would be killed or that they would report the dog to either the village leader (19/21 answers) or to the commune's medical centre (1/21 answers). One person answered that they would report the dog but did not specify where.

The answers grouped together as "other" included four people that answered "stay far away", one "tell kid to stay far away" and one "chase away the dog".

Only two people answered that they would use traditional medicine on a dog with suspected rabies. They both lived in Kampong Chhnang, in the same district and commune, but in different villages. They described almost the same procedure, which was that they would cut one of the dog's ears and draw some blood, and one of them would also give the dog something sweet to drink.

Almost everyone (above 90%) of the interviewed people said that they would want to vaccinate their dogs against rabies, with the highest percentage in Kampong Chhnang (100%) and lowest in Kampong Speu (71%). However, when asked whether they would be willing to pay for the vaccine, 100% in Kampong Speu answered "yes" and about 2/3 in Takeo (see table 9).

Of the five people that did not want to vaccinate their dogs, four still said that they would be willing to pay for the vaccine.

Table 9. Table describing how many are positive to vaccinate their dog against rabies, and if they would be willing to pay for the vaccine.

	Kampong Chhnang		Kampong Speu		Takeo		Total	
Would want to vaccinate their dog against rabies	31	100.00%	10	71.43%	13	92.86%	54	91.53%
Would be willing to pay for the vaccine	28	96.55%	14	100.00%	9	69.23%	51	91.07%
Number of answers	**31**	**52.54%**	**14**	**23.73%**	**14**	**23.73%**	**59**	**100.00%**

A total of four people (8%) wanted to vaccinate their dogs against rabies but would not be willing to/would not be able to pay for the vaccine.

The price people were willing to pay for rabies vaccination for their dog ranged between $0.25-25, with more than 50% willing to pay between $1-2.5 and approximately 20% willing to pay below $1 (see table 10). The interviewed dog owners in Takeo were generally willing to pay more for vaccination than the dog owners in the other provinces, with the biggest difference compared to Kampong Chhnang. One person claimed to be willing to pay $25, with the comment “I love my dogs, they are part of the family”.

Table 10. Description of what people are willing to pay for rabies vaccination.

Price range	Kampong Chhnang		Kampong Speu		Takeo		Total	
Below $1	9	33.33%	1	7.14%	1	9.09%	11	21.15%
$1–2.5	14	51.85%	9	64.29%	4	36.36%	27	51.92%
$3–5	3	11.11%	3	21.43%	3	27.27%	9	17.31%
$7 or above	1	3.70%	1	7.14%	3	27.27%	5	9.62%
Number of answers	**27**	**51.92%**	**14**	**26.92%**	**11**	**21.15%**	**52**	**100.00%**

4.2.2 Key Informant Interviews

Nine key informant interviews were done in separate villages: two in Takeo, two in Kampong Speu and five in Kampong Chhnang. One of the key informants in Takeo

was the district veterinarian and not the village leader since he was not approachable at the time.

All the key informants were positive to rabies vaccination campaigns, and said that they thought the campaigns worked, although there had never been any rabies vaccination campaigns in their villages. Two of the key informants, one in Takeo and one in Kampong Speu, said that it would be preferable if the vaccinations were free. The above-mentioned key informant in Takeo (the district veterinarian) said that it will only work if the vaccination campaign was free for the dog owners.

All but two of the key informants thought that there was not a problem with aggressive or wild dogs in their village. One of the village leaders in Kampong Chhnang mentioned that last year they had a dog in the village with hypersalivation that bit a child that got PEP at IPC, and one village leader in Kampong Speu said that they used to have a strange dog that bit people many years ago. One village leader in Kampong Chhnang said that the dog owner to the dog that has bitten someone need to pay money to the victim.

If there is a dog that is aggressive and bites people, it seems that the villages handle things differently among them. One village leader in Kampong Speu said that they report the incident to a rabies related hospital and inform the victim about PEP. According to two village leaders, the dog is killed if it is aggressive and bites people. Three village leaders in Kampong Chhnang said that the dog owner is told to take better care of the dog and in one of these villages, the dog is also tied up. One of these leaders also said that the dog is only killed if it is very aggressive. Two village leaders said that the dog is given to the victim's family to do whatever they want with it. This usually means that the dog is either killed or slaughtered for meat.

One key informant in Takeo, the village leader, said that they tell the owner to take the dog away (did not specify more).

4.2.3 Focus Group Discussions

When asked "what would be done with a dog if it is aggressive and has bitten people?", the groups answered a bit differently. The FGD in Takeo said that they kill the dog and send the head for rabies analysis. One FGD in Kampong Speu said that the dog is simply killed and did not mention rabies diagnostics. The other FGD in Kampong Speu said that it depends on whether the dog is only aggressive or if it actually has bitten people. If only aggressive, people will inform the owner so that the dog is kept of the roads. If the dog bites, the dog is killed, and the head is sent for lab diagnostics. What kind of diagnostics did not get specified.

In Kampong Chhnang, the answers differed a bit from the other provinces. 4/5 of the FGDs in Kampong Chhnang said that if the dog bites, it is given to the victim or the victim's family to do what they want. This could either be to kill it, slaughter it for meat or to sell it to a third party, usually in exchange for MSG (Monosodium Glutamate), a pot or money. Three of these four villages said that the dog is tied up until decided what will be done with it. The 1/5 that did not answer the same as the other 4/5 villages earlier mentioned, said "In this village, we usually tie the dog up and follow the progress of the symptoms, but sometimes the dog is killed for meat".

Four out of five villages here also said that the dog owner pays for at least part of the victim's PEP and/or help to transport the victim to the hospital. One of the villages in Kampong Chhnang said that the people that are bitten cover the wound with leftover rice and did not mention PEP or hospital.

4.3 Oral Rabies Vaccination

4.3.1 Dog Owner Interviews

As seen in figure 5 and table 11, the vast majority of the interviewed dog owners in all the provinces would prefer if the dogs were given rabies vaccine through pieces of food. More than 75% of the interviewed people thought that it was a "very good idea" to give ORV to the dogs (see figure 5). No people answered "Not a good idea at all" in Takeo, 3% in Kampong Chhnang (one person) and about 25% in Kampong Speu (four people). All but one answered "Very good idea" in Takeo. The only one that did not answer that it was a very good idea answered "not sure".

Table 11. Information about whether people prefer dog vaccinations by injections or with ORV.

What do you prefer?	**Kampong Chhnang**		**Kampong Speu**		**Takeo**		**Total**	
Give vaccine in food	21	67.74%	9	64.29%	10	76.92%	40	68.97%
Injection	10	32.26%	5	35.71%	2	15.38%	17	29.31%
Injection, optional to give in food		0.00%		0.00%	1	7.69%	1	1.72%
Number of answers	**31**	**53.45%**	**14**	**24.14%**	**13**	**22.41%**	**58**	**100.00%**

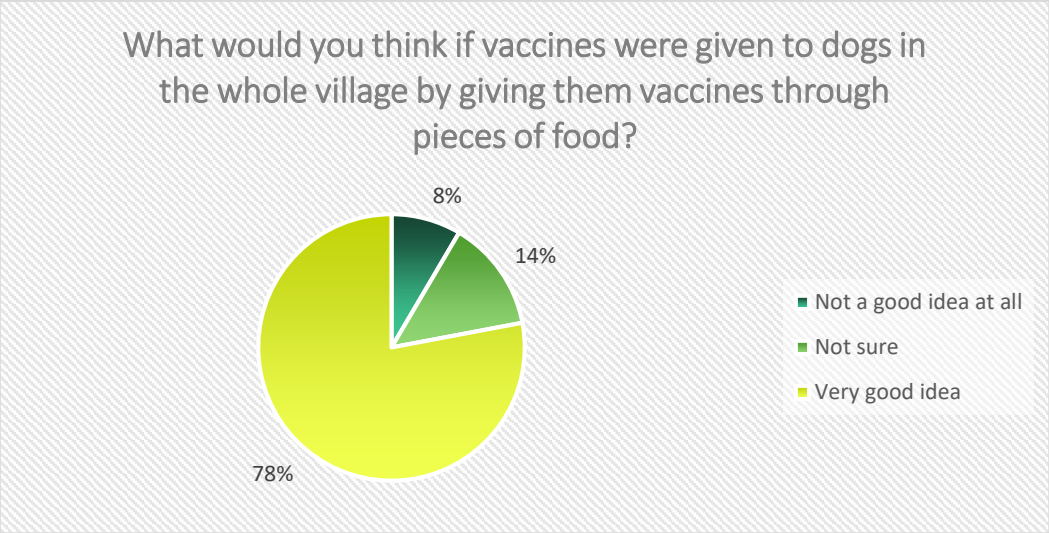

Figure 4. Cambodian dog owners' opinions regarding oral rabies vaccination.

4.3.2 Key informant interviews

All the key informants were positive to oral vaccination campaigns against rabies. Only one had a concern regarding the vaccine, and that is what will happen to the quality of the vaccine if it is not eaten and left in the sun. Otherwise, no concerns were raised by the key informants.

One key informant said that oral vaccination "is the best [way to prevent rabies among] the villages dogs, because it is easy to feed to the dog", and, that if there was a campaign, "me and my villagers will be joining".

Another key informant said that "I'm very happy to join [an ORV campaign] with my villagers" and that he thought that ORV is "very good because it is easy to feed to the dogs".

Other comments from key informants were for example: "easier with ORV", "never heard about ORV before", "no concerns", "good idea".

4.3.3 Focus Group Discussions

Eight focus group discussions were held: one in Takeo, two in Kampong Speu and six in Kampong Chhnang. The gender distribution and total amount of answers per province is shown in table 12.

Table 12. Participants in the FGDs divided by gender and province.

Gender of participants	Kampong Chhnang		Kampong Speu		Takeo		Total	
Male	21	55.26%	7	40.00%	8	72.72%	36	55.38%
Female	17	44.74%	9	60.00%	3	27.28%	29	44.62%
Total	**38**	**58.46%**	**16**	**24.61%**	**11**	**16.92%**	**65**	**100.00%**

All the FGD's were overall very positive to ORV. The most recurring answer was that it is a good way to administer vaccines since it is easier to give baits to the dogs than to catch the dog and give injections. During the discussions, some comments were said multiple times: "easier to give [ORV] than [vaccine] with injection" and "good"/"very good". One person said that this is "a good way to give vaccinations, since even my own dog that I take care of every day try to scratch me when I try to catch it to inject medicine".

Every FGD agreed that they were okay if ORV were to be given to their dogs. The most important concern that were discussed was the price. All the FGDs agreed that they would be willing to pay for the vaccine, but all except one mentioned that the price of the vaccine can be an issue. The FGDs that were concerned about the price said that it would be optimal if ORV would be free of charge, or within the price range of $0.75–$3.

Two other concerns that arose were about the efficacy of the vaccines since they pass the gastrointestinal tract, and the risk of environmental plastic pollution if the baits are not eaten because of the plastic satchels that contain the vaccine inside the baits. There were also questions about how many doses the dog needs to get fully vaccinated and how often the dog needs to get revaccinated.

People were overall not worried about baits being left on the ground for wild dogs to eat (except for one FGD that were worried about plastic environmental pollution, as mentioned before). 6/8 FGDs even said that it would be good if baits were left on the ground so wild dogs and other wild animals potentially could be vaccinated against rabies as well. All FGDs said that they don't have any problems with wild dogs, and 5/8 specifically said that they don't have any wild dogs at all in the village. Every group also said that they don't have any problems with aggressive dogs in their village. Every FGD, except two, said that all the dogs in the village are owned by someone. One of the two that said otherwise said that "most of the dogs are owned", and the other simply said "no" when asked if there were many dogs that no one owns.

When asked “if there was a campaign in your village using oral vaccination, what would you think about that? Do you have any concerns?”, most of the groups said that it would be great with an ORV campaign and that they had no concerns except for the ones earlier mentioned, but two groups were worried that the people that did not participate in the group discussions, and hence don’t know as much about as rabies as the people that did participate, would not know the severity of rabies and therefore not understand the importance of vaccinating the dogs against the disease. This could make them less prone to take part in an ORV campaign, according to the people in these two FGDs.

5. Discussion

This study finds that the majority of both the dog owner interviews, the focus group discussions and key informant interviews were positive or very positive to ORV, and most dog owners even preferred ORV to injections. Hopefully, this pilot study will shine more light on ORV and help to implement ORV also in Cambodia. In Thailand, an ORV campaign was implemented in 2020 in five municipalities with great success (WHO 2021). Almost 2000 free-roaming dogs were given ORV and they managed to get a 65% vaccination coverage in the population of free-roaming dogs in the areas with the ORV campaign. Since the oral vaccination campaign, no rabies outbreaks have been reported in these municipalities. Since the programme was so successful, Thailand planned to scale up the ORV vaccinations in free-roaming dog populations to complement rabies vaccine injections under 2021 (WHO 2021).

The most important concern about ORV that were raised were about the price of the vaccination. The price that the dog owners said that they were willing to pay differed slightly from what that the focus group discussions stated. More than half of the interviewed dog owners would be willing to pay $1–2.5 and just above 20% below $1. However, the focus group discussions said that it would be optimal if the ORV were free of charge or at least did not cost more than $3. Because of the economic situation in rural Cambodia, the FGD's price appreciation is probably more correct than the individual interviewees and corresponds well with other studies done in Cambodia (Ung 2021; Ung *et al.* 2021).

Another important concern that arose during the focus group discussions were how to get the people in the villages that have not taken part in the focus group discussion to join the potential ORV campaign. They generally do not know as much about rabies as the ones that did take part, and therefore do not know why it is so important to vaccinate their dogs against rabies. Several studies made in different African countries have found that households with a higher mean knowledge about rabies, more often chose to vaccinate their dogs against rabies than households that had lower knowledge about rabies (Mucheru *et al.* 2014; Awuni *et al.* 2019; Dahourou *et al.* 2021; Savadogo *et al.* 2021), which correlates well to a study done by Ung *et al.* (2021) in Cambodia. To accomplish this, rabies knowledge campaigns should be combined with rabies vaccination campaigns.

Regarding the level of rabies knowledge, it seems as if the general knowledge is lower in provinces Kampong Chhnang, Kampong Speu and Takeo than in other studied provinces in Cambodia. This study found that 60% knew about rabies (36% in Takeo, 47% in Kampong Speu and 77% in Kampong Chhnang), compared to 99.4% in the provinces Kandal and Prey Veng (Ung 2021), and 96.0% in Phnom Penh province (Lunney *et al.* 2012).

Alarmingly, no one in Takeo province answered that rabies is 100% fatal for humans, and only 61% in Kampong Chhnang and 80% in Kampong Speu. This is low compared to a study done in unvaccinated and vaccinated villages in Kandal and Prey Vey provinces, where they found that 89.6% in unvaccinated villages and 98.5% in vaccinated villages in these provinces knew that rabies is a fatal disease (Ung *et al.* 2021). However, it corresponds better to a study done in Siem Reap province were 66% knew that rabies is fatal (Sor *et al.* 2018) and a study made in Phnom Penh where 65.6% answered that rabies is fatal to humans (Lunney *et al.* 2012).

Regarding the overall rabies knowledge in the provinces compared to level of education, Kampong Speu had the highest mean level of education but was not the province with the highest knowledge about rabies, and Kampong Chhnang had the highest level of rabies knowledge but not the highest mean level of education. However, Takeo had the lowest mean level of education and the lowest level of rabies knowledge. Because of this, it is hard to conclude that higher of level of education necessarily leads to higher rabies knowledge. Yet, other studies in Cambodia have found that there is a significant correlation between higher level of education and higher knowledge of rabies (Sor *et al.* 2018; Ung *et al.* 2021).

However, there were some incongruences in the answers. For example, 26% of the people that answered “no” when asked if they know what rabies is, still answered “yes” when asked if they know about diseases that can spread from dogs to humans, and answered “rabies” when asked what zoonotic diseases they know about (see table 8). Similarly, 48% of the persons that answered “no” when asked if they know what rabies is, still answered “bites” or another correct answer when asked how rabies is transmitted. Two of these people even answered “no” when asked if they know what rabies is and also answered “no” when asked if they know how rabies is transmitted but answered correctly that rabies is transmitted through bites.

This means that only 26% of the people that answered “no” to the question “Do you know what rabies is?” did not answer any correct answers when asked one of the above-mentioned questions. The incongruences in the answers were particularly high in Takeo, but also quite high in Kampong Speu. Kampong Chhnang had no contradictory answers to these questions, however.

When reading the results, one need to keep in mind that all the villages were deliberately chosen to be unvaccinated since this study was done together with another study that needed blood samples from dogs that were not vaccinated against rabies. As other studies have shown, unvaccinated villages generally have lower mean knowledge about rabies (Ung *et al.* 2021). The results therefore need to be interpreted for unvaccinated villages in the provinces, and not as a general result.

5.1 Limitations to the study

In the multiple-choice question about symptoms of rabies in humans in the dog owner questionnaire, the choices were the same as the question about symptoms in dogs. This might have been negative for the study's results, since the rabies symptoms that humans experience differ slightly from the clinical signs that are seen in dogs. After the prodromal period, with nonspecific symptoms, people are generally not experiencing "aggressiveness" but instead a general anxiety, confusion, abnormal behaviour, and hyperactivity or paralysis (depending on whether it is furious or dumb rabies) (Rupprecht 1996; CDC 2022). It is also common to experience numbness, pain or itching around the area of exposure (1177 Vårdguiden 2022). Seizures could also have been on the list of symptoms, both for dogs and humans (Rupprecht 1996; SVA 2021). The choices for symptoms of rabies in humans might have been slightly misleading, and this can possibly have made people confused or make them not choose correctly. The results are also harder to interpret, and it is harder to draw conclusions about this question because of this. However, it is still possible to draw the conclusion that the overall knowledge about symptoms of rabies in people in these provinces is low.

Regarding the age of the dog owners, more dog owners in Takeo answered on paper-based questionnaires with a multiple-choice answer regarding age than in the other provinces. On the paper-based questionnaires, the highest alternative answer for the dog owners age was "36 and above". This might be the answer to why Takeo seems to have lower mean age than the other provinces.

Another limitation to the study is the fact that the recordings of the focus group discussions were deleted before transcriptions could be made. The results from the focus group discussions are therefore based on the short comments and summaries written down by the interpreter during the discussions.

The study is quite small, with only 9 villages included and 60 dog owners interviewed. When the study was planned, more villages in Takeo and Kampong Speu were planned to be visited. Unfortunately, because of circumstances, this could not be done.

5.2 Sources of error

Sources of error in the study might have been issues with translation of the questionnaires from English to Khmer and the translations of the answers from Khmer to English. This could possibly have led to misunderstood questions and answers.

5.3 Conclusion

This study found that social acceptance of oral rabies vaccination in rural Takeo, Kampong Speu and Kampong Chhnang was very good. People were generally very positive to vaccinating their dogs with oral vaccination, as long as it is free or not too expensive.

The overall rabies knowledge in these villages were low, compared to other studies. But even though the rabies knowledge was quite low, the will to vaccinate their dogs against rabies was high with a mean of 91.5%.

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Popular science summary

Rabies är en virussjukdom som kan drabba alla däggdjur och dödar ca 60 000 människor varje år. 9/10 rabiesfall på människa beror på smitta från en rabiessmittad hund. Sjukdomen smittas via saliv som kommer i kontakt med slemhinnor eller skadad hud, och orsakar en hjärninflammation hos individen som i princip alltid slutar med döden. Enbart 14 fall av överlevnad av rabies hos människa finns dokumenterade globalt. Det finns inga botemedel mot rabies när symtom väl har utvecklats, utan det enda sättet att förhindra sjukdom är att förhindra att bli smittad eller förhindra att sjukdomen bryter ut. Detta kan man göra antingen via att man vaccinerar sig innan man riskerar att exponeras för rabies, eller att man vid misstänkt exponering tillämpar så kallad postexpositionsprofylax, PEP.

Kambodja är ett av de hundtätaste länderna i världen och även ett av de rabiestätaste länderna i världen, med 3,5 fler fall per invånare än Indien (som annars är det landet i världen där flest människor dör i rabies). Det beräknas att ca 800 människor dör varje år i Kambodja i rabies, men siffran är förmodligen kraftigt underskattad. Ungefär 95 % av alla hundbett i Kambodja behandlas inte med PEP trots den höga rabiesprevalensen i landet. Till följd av detta är rabies ett mycket allvarligt hot mot den Kambodjanska befolkningen.

Eftersom människor som får rabies i fler än 9/10 fall har blivit smittade av en hund, är det viktigaste och mest ekonomiska sättet att förhindra human rabies att förhindra att hundar blir smittade. Detta görs enklast via vaccinationer av hundarna. För att uppnå så kallad flockimmunitet, dvs. då tillräckligt många djur har vaccinerats för att ge hela populationen ett skydd, så behöver mellan 60–70 % av hundarna vara vaccinerade. Traditionellt sätt har hundar vaccinerats mot rabies med injektioner, men i Europa har man vaccinerat vilda rovdjur med vaccinpreparerade beten, så kallade orala rabiesvaccin (ORV), sedan 1980-talet med stor framgång. Då majoriteten av hundarna i Kambodja är lösgående, många inte är speciellt mycket hanterade och har heller aldrig varit hos en veterinär, så är det svårt att komma upp i 70 % vaccinationstäckning.

Här kan ORV vara ett mycket bra alternativ och/eller komplement till vanliga rabiesvaccinationer för att få upp vaccinationstäckningen. Eftersom hundarna inte behöver fångas in för att vaccineras kan man därmed komma åt att vaccinera även

hundar som inte kan hanteras, och på så sätt få upp vaccinationsgraden i populationen. Det är också billigare med ORV då man inte behöver professionellt tränad personal för att vaccinera med ORV, det går snabbare att vaccinera många hundar och det är säkrare för de som vaccinerar då de inte behöver fånga in och hantera potentiellt rabiessmittade hundar.

Syftet med den här studien var att undersöka den sociala acceptansen för ORV på landsbygden i byar i tre provinser i Kambodja där hundarna är ovaccinerade mot rabies, samt kunskapsnivåerna gällande rabies i dessa byar. Detta gjordes genom enkätundersökningar med enskilda hundägare samt nyckelpersoner och genom gruppdiskussioner.

Studien visade att den sociala acceptansen för ORV är mycket god i alla tre provinser och nästan alla var positivt inställda till ORV. Viljan till att vaccinera sina hundar är hög, förutsatt att vaccinet är gratis eller åtminstone kostar under $3. Kunskapsnivåerna om rabies var dock relativt låga jämfört med studier som gjorts i andra provinser i Kambodja, och det var många som svarade att de till exempel inte visste vad rabies var och att sjukdomen är 100 % dödlig för människor. Tidigare studier från bland annat flera afrikanska länder samt en annan provins i Kambodja har visat att ovaccinerade byar har lägre kunskapsnivåer om rabies jämfört med vaccinerade byar. Detta kan vara en orsak till att kunskapsnivåerna är lägre i de byar som är inkluderade i den här studien än vad andra studier i Kambodja har visat.

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Appendix 1

Questionnaire for dog owners:

លេខកូដ បញ្ជីសំនួរ/ Questionnaire code and number of the dog:

Do we have permission to store and handle your personal information? It will only be used for research related to this survey. Yes/No

ឈ្មោះអ្នកចូលរួម Name of participant:

លេខទូរស័ព្ទ Phone number:

1. ទីតាំង Location:

1.1 Which district do you live in:

1.2 ១.១ តើស្រុក និង ខេត្តណាមួយដែលអ្នករស់នៅ? **/Which province do you live in:**

២. ពត៌មានអំពីម្ចាស់សត្វឆ្កែ **Information about the dog owner and dog:**

2.1 ភេទ/Gender	ស្រី/Female ប្រុស/Male
2.2 អាយុ (ឆ្នាំ)/Age (years)	0-15 16-25 26-35 36 and above

2.3 កម្រិតវប្បធម៌/**Education level**	មិនមានការអប់រំ/No education កម្រិតបឋម/Primary ថ្នាក់ទី ៥ ដល់ទី១០/Class 5-10 កម្រិតមធ្យមសិក្សា/Higher secondary បញ្ចប់ការសិក្សា និងលើសពីនេះ/Graduation and above
២.៤ តើអ្នកជាម្ចាស់សត្វឆ្កែនេះមែនទេ?/ **Are you the owner of the dog?**	បាទ/ចាស/Yes ទេ/No ប្រសិនបើ ទេ, តើនេះជាឆ្កែរបស់អ្នកណា?/If no, whose dog is it?
៥.១ អាយុសត្វឆ្កែ/ **Age of the dog**	
ការប្រើប្រាស់ចម្បងរបស់សត្វឆ្កែ/ **The dogs' main use**	យាម/Guard កំដរ/Company សាច់/Meat ផ្សេងៗ, សូមពន្យល់/Other, explain:
អ្នកមើលថែចម្បង/**Main caregiver**	មនុស្សពេញវ័យនៅក្នុងគ្រួសារ/Adult in family ក្មេងនៅក្នុងគ្រួសារ/Ch

	ild in family ផ្សេងៗ, សូមពន្យល់/Other, explain:
ស្ថានភាពរស់នៅ/ **Living situation**	នៅតែខាងក្រៅដោយសេរី/Only outside loose នៅតែខាងក្រៅដោយជាប់ចំណង/Only outside in a leash នៅតែខាងក្រៅដោយសេរី ប៉ុន្តែក្នុងតំបន់មានរបង/Only outside loose but in a fenced area នៅតែក្នុងផ្ទះ/Only indoor ទាំងក្នុង និងក្រៅ, ពេលនៅក្រៅមានចំណង/Both indoor and outside, when outside in a leash ទាំងក្នុង និងក្រៅ, ពេលនៅក្រៅក៍សេរី/Both indoor and outside, when outside loose រស់នៅជាមួយគ្រួសារ/Lives with family
តើអ្នកបានឆ្កែមកចិញ្ចឹមដោយរបៀបណា?/ **How did you come to own the dog?**	ទិញ/Bought ការដូរ/A gift ជាកូនឆ្កែដែលបានមកពីឆ្កែមុនៗ/A puppy from previous dog ផ្សេងៗ, សូមពន្យល់/Other, explain:
តើអ្នកដែលយកឆ្កែរបស់អ្នកទៅជួបពេទ្យសត្វ ឬអ្នកជំនាញពេទ្យសត្វដែរឬទេ?/ **Have your dog ever visited a veterinarian or veterinary technician?**	ទេ/No បាទ/ចាស/Yes ប្រសិនបើធ្លាប់, តើយកទៅដើម្បីអ្វី?/If yes, what for:
តើសត្វឆ្កែនេះធ្លាប់ទទួលបានវ៉ាក់សាំងដែរឬទេ?/ **Has the dog ever been vaccinated?**	បាទ,ចាស/Yes ទេ/No **មិនដឹងទេ**/Don’t know
តើប្រឆាំងនឹងជម្ងឺអ្វីដែរ?/ **Against which illnesses?**	
តើញឹកញាប់ប៉ុណ្ណាដែលសត្វឆ្កែនេះទទួលបានវ៉ាក់សាំង?/ **How many times has the dog been vaccinated?**	ម្តងគត់/One time ម្តង/១ឆ្នាំ 1 time / year ម្តង/៣ឆ្នាំ 1 time / 3 years ផ្សេងៗ/Other: មិនដឹងទេ/Don’t know

តើឆ្កែរបស់អ្នកដែលមានរបួសដោយសារខាំក្នុងរយៈពេល៦ខែមុនដែរឬទេ?/**Did your dog have any bite wounds the last six month?**	បាទ,ចាស/Yes ទេ/No
តើឆ្កែរបស់មានសញ្ញានៃការឆេវឆាវដែរឬទេ?/**Has your dog ever shown signs of aggression?**	បាទ,ចាស/Yes ទេ/No ប្រសិនបើមាន, តើវាសំដៅទៅមនុស្ស ឬសត្វផ្សេងៗ?ឬទាំងពីរ/If yes, towards humans or other animals or both?
ប្រវត្តិនៃជម្ងឺរបស់សត្វឆ្កែ (អាចរើសបានជម្រើសលើសពីមួយ)/ **History of illness of the dog (More than one option can be selected)**	របួសដោយសារខាំ/Bite wounds ក្អួត/រាគVomiting/diarrhoea ប៉ារ៉ាសិត/Parasites ពិការភាព (ខ្វិន)/Lameness ផ្សេងៗ, សូមពន្យល់/Other, explain:

៣. សំនួរទូទៅ/General questions

៣.១ តើអ្នកដឹងថាសត្វឆ្កែអាចចម្លងជម្ងឺដល់មនុស្សដែរទេ? **Do you know if dogs can transmit diseases to humans?**	បាទ/ចាស/Yes ទេ/ No
៣.២ ប្រសិនបើបាទ/ចាស, តើជម្ងឺអ្វីដែលអ្នកដឹងថាសត្វឆ្កែអាចនឹងចម្លងដល់មនុស្ស?/ **If yes, which diseases do you know of that dogs could transmit to humans?**	
តើអ្នកដឹងថា	បាទ/ចាស/Yes

មានវ៉ាក់សាំងសម្រាប់សត្វឆ្កែ?/**Do you know there are vaccines for dogs?**	ទេ/No
ប្រសិនបើអ្នកដឹង, តើជម្ងឺណាមួយដែលអ្នកដឹងថាអាចចាក់វ៉ាក់សាំងប្រឆាំងបាន?/**If yes, which diseases do you know it is possible to vaccinate against?**	

4. ជម្ងឺឆ្កែឆ្កួត/**Rabies**

៤.១ តើអ្នកដឹងថាជម្ងឺឆ្កែឆ្កួតជាអ្វីដែរទេ?/ **Do you know what Rabies is?**	បាទ/ចាស/Yes ទេ/No
៤.២ តើធ្កដឹងថាជម្ងឺឆ្កែឆ្កួតឆ្លងដោយរបៀបណាដែរទេ?/**Do you know how rabies is transmitted?**	បាទ/ចាស/Yes ទេ/No
៤.៣ ប្រសិនបើអ្នកដឹង, តើជម្ងឺឆ្កែឆ្កួតឆ្លងដោយរបៀបណា? (អនុញ្ញាតឲ្យរើសជម្រើស **If yes, how is Rabies transmitted?** Multiple options allowed:	មូស/Mosquitoes លាមក/Faeces ខាំ/Bites ប៉ះពាល់ឈាម/Blood contact ប៉ះពាល់ជាមួយទឹកមាត់ឆ្កែ/Contact with dog saliva អាហារ/Food ផ្សេងៗ/Other, explain:

៤.៤ តើអ្នកណាដែលអាចឆ្លងជម្ងឺឆ្កែឆ្កួត? (អាចជ្រើសរើសជម្រើសលើសពី១)/ **Who can get Rabies? (More than one option can be selected)**	មនុស្ស/Humans ឆ្កែ/Dogs ឆ្មា/Cats សត្វពាហនៈ/Cattle បក្សី/Birds ទាំអស់/All ផ្សេងៗ/Other, explain: ខ្ញុំមិនដឹងទេ/Don't know
៤.៥ អាការៈជម្ងឺឆ្កែឆ្កួតនៅក្នុងមនុស្ស (អាចរើសជម្រើសលើសពីមួយ)/ **Symptoms of rabies in humans (More than one option can be selected)**	ក្តៅខ្លួន/Fever ក្អួត/រាគ/Vomiting / Diarrhoea ឆេវឆាវមិនអាចគ្រប់គ្រង/Aggressiveness ហៀរទឹកមាត់/Salivation រលូតកូន/Abortion រន្ធត់ខ្លាំង/Staggering ពិបាកដកដង្ហើម/Difficulty breathing ស្រកទម្ងន់/Weightloss អស់កម្លាំង/Fatigue ដំបៅស្បែក/Skin lesions មិនដឹងទេ/Don't know ផ្សេងៗ, សូមពន្យល់/Other, explain:
4.5 អាការៈជម្ងឺឆ្កែឆ្កួត	ក្តៅខ្លួន/Fever

នៅក្នុងសត្វឆ្កែ(អាចរើសជម្រើសលើសពីមួយ)/ **b Symptoms of rabies in dogs (More than one option can be selected)**	ក្អួត/រាគ/Vomiting / Diarrhoea ឆេវឆាវមិនអាចគ្រប់គ្រង/Aggressiveness ហៀរទឹកមាត់/Salivation រលូតកូន/Abortion រន្ធត់ខ្លាំង/Staggering ពិបាកដកដង្ហើម/Difficulty breathing ស្រកទម្ងន់/Weightloss អស់កម្លាំង/Fatigue ដំបៅស្បែក/Skin lesions មិនដឹងទេ/Don't know ផ្សេងៗ, សូមពន្យល់/Other, explain:
៤.៦ តើអ្នកគិតថាជម្ងឺឆ្កែឆ្កួតធ្ងន់ធ្ងរប៉ុណ្ណាសម្រាប់មនុស្ស?/**How serious do you think rabies is for humans?**	ភាគច្រើនរស់, ប៉ុន្តែខ្លះងាប់/Most survive, but some dies ភាគច្រើនងាប់ ប៉ុន្តែខ្លះរស់/Most will die, but some survives ឆ្កែទាំងនោះតែងតែងាប់/They always die
៤.៦ តើអ្នកគិតថាជម្ងឺឆ្កែឆ្កួតធ្ងន់ធ្ងរប៉ុណ្ណាសម្រាប់សត្វឆ្កែ?/**How serious do you think rabies is for dogs?**	ភាគច្រើនរស់ ប៉ុន្តែខ្លះស្លាប់/Most survive, but some dies ភាគច្រើនស្លាប់

	ប៉ុន្តែខ្លះរស់/Most will die, but some survives ពួកគេតែងតែស្លាប់/They always die
៤.៩ តើអ្នកធ្វើយ៉ាងដូចម្តេច ប្រសិនបើអ្នកសង្ស័យជម្ងឺឆ្កែឆ្កួតមាននៅក្នុងមនុស្ស? **/ What do you do if you suspect rabies in a human?**	
៤.៨ តើអ្នកធ្វើយ៉ាងដូចម្តេច ប្រសិនបើអ្នកសង្ស័យជម្ងឺឆ្កែឆ្កួតមាននៅក្នុងសត្វឆ្កែ?/ **What do you do if you suspect rabies in a dog?**	
តើមាននរណាម្នាក់នៅក្នុងតំបន់នេះមានជម្ងឺឆ្កែឆ្កួតដែរឬទេ?/ **Has any person in the area had rabies (that you know of)?**	បាទ/ចាស មាន/Yes មិនមានទេ/No
៤.១០ តើនៅក្នុងតំបន់នេះមានសត្វឆ្កែមានជម្ងឺឆ្កែឆ្កួតដែរឬទេ? **/Have any dogs in the area had rabies (that you know of)?**	បាទ/ចាស មាន/Yes មិនមានទេ/No
តើអ្នកជឹងថាមានវ៉ាក់សាំង	ទេ/No

ប្រឆាំងនឹងជម្ងឺឆ្កែឆ្កួតដែរឬទេ? **/Do you know if there is a vaccine against rabies?**	មិនដឹងទេ/Don't know បាទ/ចាសមាន, សម្រាប់ឆ្កែ/Yes, for dogs បាទ/ចាសមាន, សម្រាប់មនុស្ស/Yes, for humans បាទ/ចាសមាន, សម្រាប់ទាំងមនុស្ស និងសត្វឆ្កែ/Yes, for both dogs and humans
តើអ្នកចង់ចាក់វ៉ាក់សាំងដល់ឆ្កែរបស់អ្នកសម្រាប់ជម្ងឺឆ្កែឆ្កួតដែរឬទេ? **/Would you want to vaccinate your dog for rabies?**	ទេ**/No** ប្រសិនទេ,ហេតុអ្វី?**If no, why not?** បាទ/ចាស**/Yes** ប្រសិនបើអ្នកចង់, តើអ្នកនឹងព្រមបង់ថ្លៃសម្រាប់វ៉ាក់ដែរទេ?**/If yes, would you be willing to pay for the vaccine?** តើថ្លៃប៉ុន្មាន?**/How much:**
ប្រសិនបើអ្នកនឹងចាក់វ៉ាក់សាំងឆ្កែរបស់អ្នកប្រឆាំងនឹងជម្ងឺឆ្កែឆ្កួត, តើអ្នកចូលចិត្តមួយណាជាង? **/If you were going to vaccinate you dog against rabies, what would you prefer**	ការចាក់**/Injection** ផ្តល់វ៉ាក់សាំងនៅក្នុងអាហារ**/Give vaccine in food**

តើអ្នកគិតយ៉ាងដូចម្តេច ប្រសិនបើវ៉ាក់សាំងនឹងត្រូវបានផ្តល់ឲ្យសត្វឆ្កែនៅក្នុងភូមិទាំងមូលដោយការផ្តល់វ៉ាក់សាំងតាមរយៈដុំអាហារ? **/What would you think if vaccines were given to dogs in the whole village by given them vaccines through pieces of food?**	មិនមែនជាគំនិតល្អទាល់តែសោះ/**Not a good idea at all** មិនប្រាកដ/**Not sure** ពិតជាគំនិតល្អខ្លាំងណាស់/**Very good idea**

Questions about dog meat consumption:

២.៥ តើអ្នកធ្លាប់បរិភោគសាច់ឆ្កែដែរឬទេ? **/Do you ever consume dog meat**	បាទ/ចាស/Yes ទេ/No
២.៦ ប្រសិនបើធ្លាប់, តើញឹកញាប់ប៉ុណ្ណា? **/If yes, how often?**	រាល់ថ្ងៃ/Every day ម្តងក្នុង១សប្តាហ៍/Once a week ម្តងក្នុង១ខែ/Once a month មិនញឹកញាប់ទេ/Less often
២.៧ ប្រសិនបើទេ, ហេតុអ្វី? **/If no, why not?**	

Appendix 2

Questions for the Focus Group Discussions:

1. What do you think about giving vaccines this way?
2. Would you feel ok if it was given to your dog? If not, why?
3. Is there anything you would be worried about?
4. If there was a campaign in your village using oral vaccination, what would you think about that? Do you have any concerns?
5. Would you think it was ok if baits were left on the ground for wild dogs to eat? Would you worry about that?
6. What is important to you for you to want to vaccinate your dog?
7. Would people in your village be willing to pay for vaccination of the dogs?
8. How many dogs approximately are in your village?
9. Do any dogs ever come from other countries?
10. Is it common with people eating dogs?
11. Are there many dogs that no one owns?
12. Is there a problem with aggressive dogs or wild dogs?
13. What would be done with a dog if it is aggressive and has bitten people?

Appendix 3

Questions for Key Informant Interviews:

1. Do you know if there have ever been any vaccination campaigns for rabies in your villages? In that case, how did it happen, and when was it?
2. What do you think about rabies vaccine campaigns? Do you think they work?
3. How many dogs approximately are in your village? Is it common with people eating dogs?
4. Are there many dogs that no one owns?
5. Is there a problem with aggressive dogs or wild dogs?
6. What would be done with a dog if it is aggressive and has bitten people?
7. If there was a campaign using oral vaccination, what would you think about that? Do you have any concerns?
8. Are there any markets selling live animals in your village?
9. Which animals are sold at these markets? Are there any wild animals sold?
10. Are you concerned about any disease risks at these markets?

Appendix 4

Presentation of ORV:

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