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Community-based study on knowledge, attitudes and perception of rabies in Gelephu, South–Central Bhutan

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Abstract

Community knowledge, attitudes and practices are important both for prevention of human deaths due to rabies and for control of the disease in animals. This study was a cross-sectional survey investigating the level of community knowledge as well as attitudes and perceptions about rabies in Gelephu, south central Bhutan, a region endemic for rabies. A total of 615 household respondents were interviewed, of which 224 (36%) were males and 391 (64%) were females. The majority of the respondents had high level of knowledge, and attitude and perception of rabies, and has a positive attitude towards the prevention and control of rabies. Multivariable logistic regression model showed that better knowledge about rabies was predicted by gender, educational level and dog ownership status of the respondents, whilst health-seeking behaviours of animal bite injuries were predicted by dog ownership status, presence of children in the household and occupation of the respondents. The majority of the respondents believed that stray dogs are a problem in the community and felt that it was important to control the dog population in Gelephu. These findings also indicate that there exists a knowledge gap about rabies in the community that could be improved by creating an awareness education programme.

Keywords: Knowledge, Attitude, Perception, Rabies, Cross-sectional survey, Bhutan

1. Introduction

Rabies is an invariably fatal zoonotic disease, but can be prevented by avoiding contact with rabid animals and by immediate post exposure treatment. WHO guidelines on rabies post-exposure prophylaxis (PEP) recommend three important aspects of the treatment immediately following exposure to rabid animals: thorough washing of the bite wound with water and soap or detergent, or water alone; administration of rabies vaccine; and infiltration of rabies immunoglobulin into and around the wound (WHO, 1992; 2010). However, in reality people in

developing countries, particularly the poor sections of society, may not receive these life-saving treatments either because the PEP treatment is expensive and not readily available or because people may not visit the hospital for treatment owing to lack of knowledge about rabies (Kayali et al., 2003; Knobel et al., 2005; Hampson et al., 2008).

Understanding community knowledge, attitudes and perceptions of rabies is important because of their influence on post-exposure treatment seeking behavior (Matibag et al., 2008) and because community support is essential for rabies prevention and control programme (Kayali et al., 2003). Some studies have been conducted to understand knowledge, attitude and practices for rabies in India (Agarvval and Reddaiah, 2003; Singh and Choudhary, 2005; Ichhpujani et al., 2006), Sri Lanka (Matibag et al., 2007; Matibag et al., 2008; Matibag et al., 2009), and in North America (McGuill et al., 1997; Goodwin et al., 2002). These studies demonstrated a high level of people's awareness regarding rabies. A few other studies have also reported about knowledge and perception of rabies risk among travelers travelling in rabies-endemic countries (Altmann et al., 2009; Piyaphanee et al., 2010). However, these studies have also found that people apply chilli and turmeric powder, lime, kerosene oil, herbal paste or salt on the dog bite wound, or perform folk remedies at home rather than seeking conventional treatment from health facilities (Agarvval and Reddaiah, 2003; Singh and Choudhary, 2005; Ichhpujani et al., 2006; Sudarshan et al., 2006; Matibag et al., 2008).

Rabies is endemic in south Bhutan (an area that borders India) and results in sporadic human deaths (approximately 0.28 deaths per100000 population per year) following rabid dog bites (Tenzin. et al., 2011a). Although rabies PEP is given free of charge to dog bite victims, some people fail to receive PEP owing to a lack of awareness about rabies (Tenzin. et al., 2011b). To our knowledge, no detailed study has been conducted to understand the community level of knowledge, attitudes and practices for rabies prevention and treatment among the general population in Bhutan. A limited hospital-based dog bites survey in Bhutan showed that 80% of the interviewed dog bite victims had heard of rabies, whilst only 45% had washed their bite wound at home before visiting the hospitals (Tenzin et al., 2011c).

The objective of this study was to understand the knowledge, attitudes and perception of rabies and rabies control measures in the community of Gelephu, south central Bhutan. Gelephu was chosen for this study because this sub-district is endemic for rabies and has had frequent outbreaks (Tenzin et al., 2011a). There have been four human deaths due to rabies reported in Gelephu during the period from 2008 to May 2011 (Kuensel, 2009; Bhutantimes, 2011). It is expected that the information from this study will be useful for planning an awareness education program in Gelephu and elsewhere in Bhutan

2. Materials and methods

2.1. Study area

This survey was conducted in Gelephu, a small sub-district (area 53.6 km^2) located in the south central Bhutan district of Sarpang (Figure 1). Gelephu is one of the main entry points into Bhutan from India and is also one of the commercial centres in south Bhutan. Administratively the sub-district is divided into two main areas: municipal (urban) areas located close to the Indian border town of Dathgari in Assam; and semi-urban areas (Pemathang, Lekithang, Pelrithang, Dzomlingthang) located within 2−5 km of the municipal boundary (Figure 1). There were 2685 households and 11418 inhabitants in Gelephu according to the 2005 national population and housing census of Bhutan (NSB, 2005). The sub-district has one medical hospital located in the centre of the town, which can be easily accessed by the community.

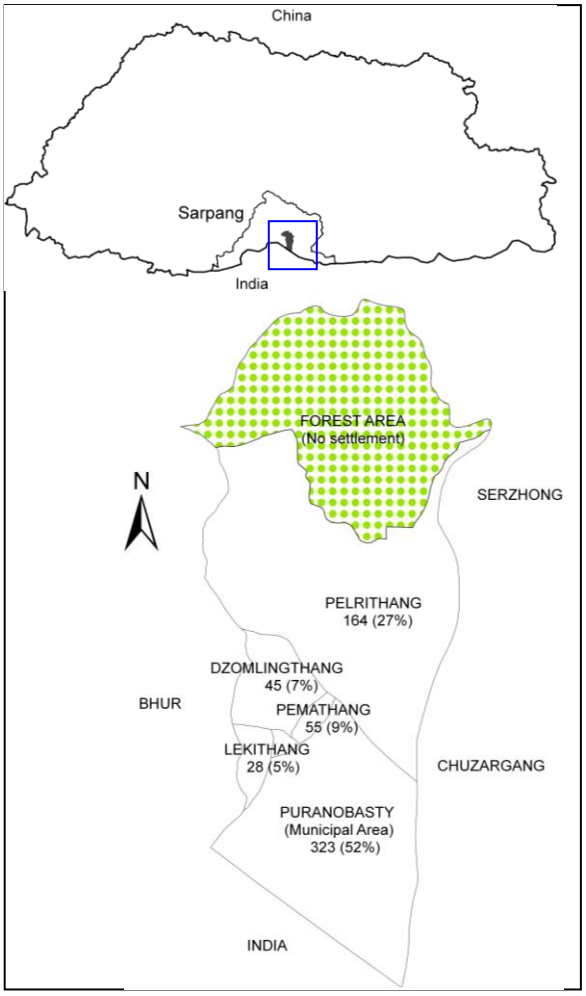

Figure.1: Bhutan map showing the administrative boundary of Sarpang District and Gelephu sub-district. The number and percentage of households interviewed are shown for each administrative area in Gelephu.

2.2. Study design

2.2.1. Sample size

Assuming approximately 3000 households in Gelephu during 2010, a target sample size of 788 was calculated to estimate the proportion of respondents of households or families who would have knowledge, attitude and perceptions of rabies with 95% confidence and a 3% error rate, assuming that the expected proportion of respondents that have knowledge of rabies was 50% (after applying finite population correction).

2.2.2. Questionnaire design

A questionnaire was designed for this study, partly adapted from similar studies conducted elsewhere (Matibag et al., 2007; Matibag et al., 2009; Bingham et al., 2010) consisting of closed and a few open questions. The questionnaire consisted of four parts: items regarding the respondent and socio-demographic information (age, sex, education level, occupation, religion, ethnicity, place of living, number of people in the household, number of children in the

household, ownership status of pets and farm animals); questions related to the knowledge and perception of rabies; questions related to attitudes and perception of rabies and its control activities; and questions on pet care practices (asked only of dog owners). The questionnaire was piloted with five people prior to the actual survey and was modified to improve clarity and interpretation.

2.2.3. Sampling procedure

Owing to the lack of a proper sampling frame, a door-to-door survey was conducted using a rolling sample method (in which the first selected household provides information about the next available household in the area or within the building) until the target number of household respondents was interviewed in the study area. However, it was ensured that a representative sample was selected from all locations (both in urban and semi-urban areas). One adult person (>18 years of age) from each selected household/family was interviewed face-to-face. The selected person was informed about the purpose of the study and that participation was voluntary and data collected were confidential. Written informed consent was obtained from the participants. The interview was carried out between February and April 2010 and was administered in local and national language, but the answers were recorded in English.

2.3. Data management and analysis

Data were entered into a database developed in Epi Info™ (V.3.5.3. http://www.cdc.gov/epiinfo) (CDC, Atlanta, Georgia, USA). Data cleaning, management and analysis were carried out using Microsoft Excel (Microsoft Corp., Redmond, Washington, USA) and SPSS software V.16 (SPSS Inc. Chicago, Illinois, USA).

2.3.1. Descriptive statistics

Descriptive statistics were calculated for each variable of interest (see Table 1). Bivariate analyses were performed using χ^2 or Fisher's exact tests to compare the responses to the questions related to the knowledge, attitude and perception of rabies between the respondents from urban and semi-urban areas as well as between dog owners and non-dog owners. A p-value <0.05 was considered statistically significant.

2.3.2. Factors associated with community knowledge and perception of rabies

Respondents were asked eight questions on knowledge and perception of rabies (see Table 11.2 and Figure 11.2), which resulted into a response of either 'yes' (have knowledge of rabies) or 'no' (do not have knowledge of rabies). The number of questions for which the respondent gave positive responses were counted and this score was then categorised based on the median (0 = score index ≤ 6 and 1 = score index > 6). A binary logistic regression model was constructed to evaluate the association of this outcome variable with demographic and socio-demographic variables (listed in Table 1). Initially, univariate logistic regression analyses were conducted to evaluate the associations between the various potential explanatory variables and the dependent variable. Those explanatory variables with a likelihood-ratio p-value <0.25 were included for further evaluation in the multivariable logistic regression models. The selected variables were tested for collinearity in pairs by calculating Spearman's rank correlation coefficient (ρ). Amongst highly correlated pairs of variables ($\rho > |0.70|$), only the variable most strongly associated with the outcome was retained for further analysis. A multivariable logistic regression model was constructed, using a manual forward stepwise selection approach.

Variables with $P<0.05$ were considered significant. The fit of each model was assessed using the Hosmer-Lemeshow goodness-of-fit test.

2.3.3. Factors associated with the community attitude of reporting animal bite injuries to the hospital for treatment

A perception index (similar to that described above) was created based on the seven questions asked of the respondents about their attitude and perception of reporting animal bite injuries to the hospital for treatment (see Table 3 and Figure 3). The number of positive responses were counted and this score categorized into a binary variable with score index value ≤ 6 coded as 0 and score index value > 6 coded as 1 (outcome variable). Then, binary logistic regression (both univariable and multivariable) models were constructed using the same explanatory variables (demographic and socio-demographic variables (listed in Table 1) as described above. The fit of the model was assessed using the Hosmer-Lemeshow goodness-of-fit test.

3. Result

3.1. Respondent demographic and sociodemographic characteristics

A total of 615 respondents (one per household) were interviewed in the survey. Table 1 shows the demographic and socio-demographic characteristics of the respondents. The median age of the respondents was 33 years (mean 35.8 years; range 18–85 years).

Table 1: Characteristics of household respondents in a study of knowledge, attitude and perception of rabies in Gelephu, south−central Bhutan, during 2010 (n=615).

Variable/category	n (%)	Variable/category	n (%)
Gender		Location	
Female	391 (64)	Municipal (urban)	323 (53)
Male	224 (36)	Pelrithang (semi-urban)	164 (27)
Age (years)		Lekithang (semi-urban)	28 (5)
18−29	202 (33)	Pemathang (semi-urban)	55 (9)
30−41	242 (39)	Dzomlingthang (semi-urban)	45 (7)
≥42	171 (28)	Dog ownership	
Educational level		Yes	146 (24)
No education	338 (57)	No	469 (76)
Primary	105 (18)	Cat ownership	
High school	107 (18)	Yes	118 (19)
Secondary	29 (5)	No	489 (81)
University	16 (3)	Missing data	8
Missing data	20	Cattle ownership	
Occupation		Yes	180 (30)
Farmer	172 (28)	No	427 (70)
Dependent/housewife	214 (35)	Missing data	8
Businessman	83 (13)	Goat ownership	
Student	22 (4)	Yes	98 (16)
Employee	124 (20)	No	509 (84)
Religion		Missing data	8
Buddhist	406 (66)	Horse ownership	
Hindu	199 (32)	Yes	17 (3)

Other	10 (2)	No	587 (97)
Variable/category	**n (%)**	**Variable/category**	**n (%)**
Ethnicity [a]		Missing data	11
Lhotsham	224 (36)	Pig ownership	
Kheng/Bumthap	110 (18)	Yes	55 (9)
Sharchop	237 (39)	No	549 (91)
Ngalong	44 (7)	Missing data	11
No. of persons in household		Poultry ownership	
1	5 (1)	Yes	150 (25)
2	45 (7)	No	457 (75)
3	61 (10)	Missing data	8
4	133 (22)		
5	140 (23)		
6	106 (17)		
≥7	125 (20)		
No. of children in household			
0	89 (15)		
1	76 (13)		
2	145 (24)		
3	151 (25)		
≥4	142 (23)		
Missing data	12		

[a] People from different parts of Bhutan who were permanently or temporarily settled in Gelephu during the time of survey in 2010.

3.2. Community knowledge and perception of rabies

Table 2 includes bivariate analyses of the respondents' knowledge and perception of rabies and rabies control measures in Gelephu. In total, 89.6% of the respondents had heard of rabies. Of those respondents who had heard of rabies, the majority believed that rabies is a dangerous and fatal disease; that rabies can be transmitted by dogs and cats, that it could be prevented by regular vaccination of dogs and believed that there are no locally available methods of treatment for bite wounds and rabies. Only 55.6% (229/412) of the respondents believed that rabies can be confirmed by a laboratory test. The majority of respondents were also aware that animal bite wounds should be washed with soap and water (Table 2).

There were significant differences between dog owners and non-dog owners with respect to the awareness of rabies (P=0.026), knowledge that rabies can be transmitted by dogs (P=0.044), and that there are no locally available methods of treatment for dog bites and rabies (P=0.001). Similarly, there was a significant difference (P=0.019) between the response of the participants from urban and semi-urban areas with respect to the belief that rabies can be confirmed by laboratory tests (Table 2). Figure 2 summarizes the percentage of respondents that have knowledge and perception of rabies in Gelephu.

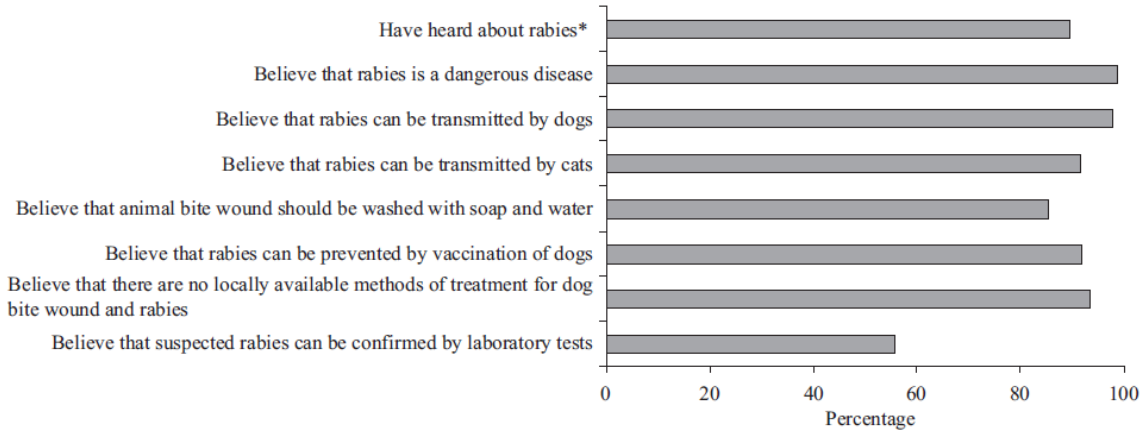

Figure 2: Community knowledge and perception of rabies in Gelephu, during 2010. * The response of the first question, 'Have you heard of rabies? – (yes/no)', was based on responses from 615 participants, whilst the percentage of responses to the remaining seven questions (except the washing of bite wound question) were based on those who answered 'yes' to the first question.

Table 2: Descriptive and bivariate χ^2 analyses of responses to questions related to the knowledge and perception of rabies, comparing dog owners with non-dog owners as well as respondents living in urban and semi-urban areas in Gelephu, Bhutan during 2010.

Variable/category	n(%)[a]	Dog ownership status [n (%)]		*P*-value	Respondent's area of living [n (%)]		*P*-value
		Yes	No		Urban	Semi-urban	
Have heard of rabies				0.026			0.154
Yes	551 (89.6)	138 (94.5)	413 (88.1)		284 (87.9)	267 (91.5)	
No	64 (10.4)	8 (5.5)	56 (11.9)		39 (12.1)	25 (8.5)	
Believe that rabies is a fatal disease				0.499			0.777
Yes	526 (98.7)	134 (99.3)	392 (98.5)		272 (98.9)	254 (98.4)	
No	7 (1.3)	1 (0.7)	6 (1.5)		3 (1.1)	4 (1.6)	
Believe that rabies can be transmitted by dogs				0.044*			0.265
Yes	508 (97.7)	129 (100)	379 (96.9)		256 (96.9)	252 (98.4)	
No	12 (2.3)	0 (0)	12 (3.1)		8 (3.1)	4 (1.6)	
Believe that rabies can be transmitted by cats				0.703			0.966
Yes	380 (91.6)	98 (92.4)	282 (91.3)		186 (91.6)	194 (91.5)	
No	35 (8.4)	8 (7.6)	27 (8.7)		17 (8.4)	18 (8.5)	
							0.993

Believe that bite wound should be washed with soap and water							
Yes	493 (85.4)	120 (82.2)	373 (86.5)	0.198	258 (85.4)	235 (85.5)	
No	84 (14.6)	26 (17.8)	58 (13.5)		44 (14.6)	40 (14.5)	
Believe that rabies outbreaks can be prevented by vaccination of dogs				0.257			0.125
Yes	458 (91.8)	127 (94.1)	331 (90.9)		236 (93.6)	222 (89.8)	
No	41 (8.2)	8 (5.9)	33 (9.1)		16 (6.4)	25 (10.1)	
Believe that suspected rabies can be confirmed by laboratory tests				0.106			0.019
Yes	229 (55.6)	69 (50.0)	160 (58.4)		96 (49.5)	133 (61.0)	
No	183 (44.4)	69 (50.0)	114 (41.6)		98 (50.5)	85 (39.0)	
Believe that there are no locally available methods of treatment for dog bite and rabies				0.001			0.077
Yes	461 (93.3)	99 (86.1)	362 (95.5)		241 (95.3)	220 (91.3)	
No	33 (6.7)	16 (13.9)	17 (4.5)		12 (4.7)	21 (8.7)	

[a] The response to the first question 'Have you heard of rabies? − (yes/no)' was based on the responses from 615 participants, whilst responses to the remaining seven questions (except the question about animal bite wound washing) were based on those who answered 'yes' to the first question (owing to missing data, the total numbers do not sum exactly). * Fisher's exact test.

2.3.2. Factors associated with knowledge and perception of rabies

Shortlisted demographic and socio-demographic variables associated with community knowledge and perception of rabies based on univariable analyses (P<0.25) are shown in Table 3. When adjusted for other variables in the final multivariable model, male respondents (OR= 1.47; 95% CI: 1.02–2.12), the respondents with some education (up to high school level) (OR= 1.74; 95% CI: 1.10–2.74) and dog owners had high level of knowledge and perception of rabies (OR= 1.48; 95% CI: 1.01–2.18) (Table 4). The model fit the data adequately (Hosmer-Lemeshow goodness-of-fit test P=0.520).

Table 3: Univariable analyses of the demographic and socio-demographic characteristics of the respondents associated with the community knowledge and perception of rabies in Gelephu, Bhutan during 2010.

Variable/category	***b***	***SE***	***P-value***	**OR (95% CI)**
Location				
Semi-urban	0	-	-	1
Urban	0.200	0.162	0.216	1.22 (0.89–1.68)
Gender				
Female	0	-	-	1
Male	0.564	0.169	0.001	1.76 (1.26–2.45)
No. persons in the household				
≤ 5	0	-	-	1
> 5	0.382	0.167	0.022	1.46 (1.05–2.03)
Education level			0.007*	
No education	0	0	0	1
Primary	0.541	0.225	0.016	1.72 (1.11–2.67)
High school	0.652	0.224	0.004	1.92 (1.24–2.98)
Above secondary	0.002	0.324	0.994	1.00 (0.53–1.89)
Occupation			0.022*	
Farmers	0	-	-	1
Dependants/housewife	-0.566	0.208	0.006	0.57 (0.38–0.85)
Businessman	-0.288	0.268	0.284	0.75 (0.44–1.27)
Student	0.490	0.469	0.296	1.63 (0.65–4.09)
Employee	-0.070	0.236	0.767	0.93 (0.59–1.48)
Dog ownership status				
No	0	-	-	1
Yes	0.426	0.190	0.025	1.53 (1.05–2.22)

Variable/category	***b***	***SE***	***P-value***	**OR (95 % CI)**
Cat ownership status				
No	0	-	-	1
Yes	0.498	0.207	0.016	1.64 (1.09–2.46)

Cattle ownership status				
No	0	-	-	1
Yes	0.475	0.179	0.008	1.61 (1.13–2.28)
Goat ownership status				
No	0	-	-	1
Yes	0.340	0.221	0.125	1.40 (0.91–2.16)
Pig ownership status				
No	0	-	-	1
Yes	0.629	0.288	0.029	1.87 (1.06–3.29)
Poultry ownership status				
No	0	-	-	1
Yes	0.349	0.189	0.065	1.42 (0.98–2.05)

* Log likelihood ratio test p value.

Table 4: Final multivariable logistic regression model of factors associated with community knowledge and perception of rabies in Gelephu, Bhutan during 2010

Variable	***b***	***SE***	***P*-value**	**OR (95 % CI)**
Constant	-0.590	0.126	-	-
Gender				
Female	0	-	-	1
Male	0.386	0.186	0.038	1.47 (1.02–2.12)
Education level			0.042*	
No education	0	-	-	1
Primary	0.394	0.233	0.090	1.48 (0.94–2.34)
High school	0.553	0.232	0.017	1.74 (1.10–2.74)
Above secondary	-0.159	0.332	0.632	0.85 (0.44–1.64)
Dog ownership status				
No	0	-	-	1
Yes	0.389	0.199	0.050	1.48 (1.01–2.18)

Likelihood ratio χ^2 test = 4.49; *P*<0.001; Hosmer-Lemeshow goodness-of-fit test = 5.19; P=0.520;
* Likelihood ratio test p-value.

2.3.3. Community attitudes and perception of rabies

Table 5 includes the bivariate analyses of the respondents' attitude and perceptions of rabies and rabies control programme in Gelephu. The majority (range: 84−92%) of the respondents reported that they would report to the hospital for treatment if bitten by stray dogs, owned dogs, stray cats, owned cats, wild animals, were scratched by stray dogs, or were bitten by dogs in other countries (see Table 5 and Figure 3). Moreover, 98.8% of the respondents mentioned that they would report to the authorities if there is a suspected outbreak of rabies in the community and 61.0% of the respondents believed that stray dogs are a problem in the community. Almost all of the respondents believed that it was important to control both the dog population (99.7%) and also would support a dog rabies control programme (99.5%) in Gelephu. There were significant differences between the dog owners and non-owners as well as the responses of the respondents from urban and semi-urban areas with respect to their attitude and perception of rabies (Table 5).

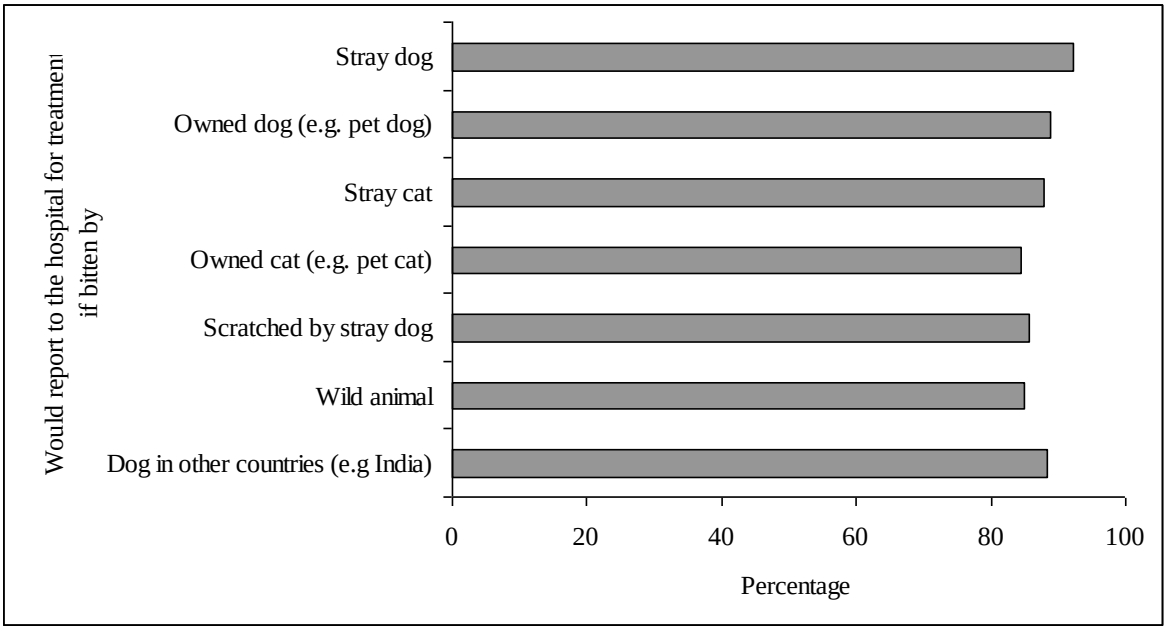

Figure 3: Community attitude and perception of reporting animal bite injuries to the hospital for treatment in Gelephu, Bhutan, during 2010.

Table 5: Descriptive and bivariate χ^2 analyses of responses to questions related to the community attitude and perception of rabies, comparing responses between dog owner and non-dog owner as well as respondents' area of living (urban and semi-urban areas) in Gelephu, Bhutan during 2010.

Variable/category		**Dog ownership status of respondents [n (%)]**		***P*-value**	**Respondent,s area of living [n (%)]**		***P*-value**
	n(%)[a]	**Yes**	**No**		**Urban**	**Semi-urban**	
Would report to hospital for treatment if bitten by stray dog				0.049			0.001
Yes	565 (92.2)	129 (88.4)	436 (93.4)		307 (95.6)	258 (88.4)	
No	48 (7.8)	17 (11.6)	31 (6.6)		14 (4.4)	34 (11.6)	
Would report to hospital for treatment if bitten by owned dog (e.g. pet dog)				< 0.001			<0.001
Yes	537 (88.9)	116 (79.4)	421 (91.9)		296 (94.0)	241 (83.4)	
No	67 (11.1)	30 (20.6)	37 (8.1)		19 (6.0)	48 (16.6)	
Would report to hospital for treatment if bitten by stray cat				0.001			<0.001
Yes	525 (87.9)	110 (79.7)	415 (90.4)		294 (93.6)	231 (81.6)	
No	72 (12.1)	28 (20.3)	44 (9.6)		20 (6.4)	52 (18.4)	
Would report to hospital for treatment if bitten by owned cat (e.g. pet cat)				< 0.001			0.001
Yes	507 (84.4)	103 (73.0)	404 (87.8)		284 (89.0)	223 (79.0)	
No	94 (15.6)	38 (27.0)	56 (12.2)		35 (11.0)	59 (21.0)	

Would report to hospital for treatment if scratched by stray dog				<0.001		<0.001
Yes	517 (85.7)	102 (72.9)	415 (89.6)		291 (91.8)	226(79.0)
No	86 (14.3)	38 (27.1)	48 (10.4)		26 (8.2)	60 (21.0)
Would report to hospital for treatment if bitten by wild animal				< 0.001		<0.001
Yes	496 (84.9)	96 (72.2)	400 (88.7)		280 (90.6)	216 (78.5)
No	88 (15.1)	37 (27.8)	51 (11.3)		29 (9.4)	59 (21.5)
Would report to hospital for treatment if bitten by dogs in other countries (e.g. India)				0.002		0.001
Yes	533 (88.4)	117 (81.3)	416 (90.6)		293 (92.4)	240 (83.9)
No	70 (11.6)	27 (18.7)	43 (9.4)		24 (7.6)	46 (16.1)
Would report to authorities if there is suspected rabies outbreak in the community				0.36*		0.055*
Yes	561 (98.8)	129 (100)	432 (98.4)		300 (99.7)	261 (97.7)
No	7 (1.2)	0 (0)	7 (1.6)		1 (0.3)	6 (2.3)
Would kill stray dog if rabies is suspected				0.002		0.851
Yes	227 (42.8)	72 (54.1)	155 (39.0)		115 (42.4)	112 (43.2)
No	303 (57.2)	61 (45.9)	242 (61.0)		156 (57.6)	147 (56.8)

Is stray dog a problem in your community?				0.048		0.477
Yes	364 (61.0)	96 (68.1)	268 (58.8)		186 (59.6)	178 (62.5)
No	233 (39.0)	45 (31.9)	188 (41.2)		126 (40.4)	107 (37.5)
Believe it is important to control dog population in Gelephu				0.100*		0.500*
Yes	601 (99.7)	140 (100)	461 (99.6)		315 (99.4)	286 (100)
No	2 (0.3)	0 (0)	2 (0.4)		2 (0.6)	0 (0)
Do you support rabies control campaign?				0.100*		0.250*
Yes	600 (99.5)	140 (100)	460 (99.3)		313 (99.0)	287 (100)
No	3 (0.5)	0 (0)	3 (0.7)		3 (1.0)	0 (0)
What methods do you believe is appropriate to control dog population				0.221		0.334
Sterilization	333 (54.1)	87 (59.6)	246 (52.4)		183 (56.6)	150 (51.1)
Impounding	82 (13.3)	14 (9.6)	68 (14.5)		38 (11.8)	44 (15.1)
Sterilization & impounding	167 (27.2)	40 (27.4)	127 (27.1)		88 (27.2)	79 (27.2)
Killing	33 (5.4)	5 (3.4)	28 (6.0)		14 (4.4)	19 (6.6)

[a] Owing to missing data, the total numbers do not sum exactly. * Fisher's exact test.

3.5. Factors associated with the community attitude and perception of reporting animal bite injuries to the hospital

Various demographic and sociodemographic variables were found to be significantly (P<0.25) associated with the community attitude and perception of reporting animal bite injuries to the hospital for treatment in univariable analyses (see Table 6). When adjusted for other variables in the final multivariable model, respondents who owned dogs were less likely (OR = 0.51; 95% CI: 0.33–0.78) to report animal bite injuries to the hospital than those who did not own dogs. Respondents who had children in their house (OR = 2.27; 95% CI: 1.36–3.78), respondents who were dependent or housewives (OR = 7.08; 95% CI: 3.83–13.09); businessman (OR = 1.95; 95% CI: 1.07–3.55) and employee in the government or private organization (OR = 1.95; 95% CI: 1.15–3.30) were more likely to report animal bite injuries to the hospital for treatment (see Table 7). The model fitted the data well (Hosmer-Lemeshow goodness-of-fit test P=0.950).

Table 6: Univariable analyses of demographic and sociodemographic variables associated with community attitude and perception of reporting animal bite injuries to the hospital for treatment in Gelephu, Bhutan during 2010.

Variable/category	***b***	***SE***	***P*-value**	**OR (95% CI)**
Location				
Semi-urban	0	-	-	1
Urban	-0.701	0.191	<0.001	0.496 (0.34–0.72)
Gender				
Female	0	-	-	1
Male	-0.828	0.191	<0.001	0.437 (0.30–0.63)
Age class			<0.001	
18–29	0	-	-	1
30–41	0.224	0.240	0.351	1.252 (0.78–2.00)
> 42	-0.843	0.233	<0.001	0.430 (0.27–0.68)
Occupation			<0.001	
Farmers	0	-	-	1
Dependant/housewives	2.211	0.302	<0.001	9.125 (5.05–16.50)
Businessman	0.715	0.293	0.015	2.045 (1.15–3.63)
Student	-0.122	0.455	0.788	0.885 (0.36–2.16)
Employee	0.794	0.258	0.002	2.212 (1.33–3.67)
Religion				
Buddhism	0	-	-	1
Hinduism	-0.960	0.195	<0.001	0.383 (0.26–0.56)

Variable/category	***b***	***SE***	***P*-value**	**OR (95% CI)**
Ethnicity			<0.001	
Lhotsham	0	-	-	1
Kheng/Bumthap	0.604	0.264	0.022	1.830 (1.09–3.07)
Sharchop	1.218	0.232	<0.001	3.382 (2.15–5.33)
Ngalong	0.530	0.375	0.157	1.699 (0.81–3.54)
Presence of children in the household				
No	0	-	-	1
Yes	0.868	0.241	<0.001	2.383 (1.49–3.82)

No. persons in the household				
≤ 5	0	-	-	1
> 5	-0.687	0.190	<0.001	0.503 (0.35–0.73)
Dog ownership status				
No	0	-	-	1
Yes	-1.092	0.204	<0.001	0.335 (0.22–0.50)
Cat ownership status				
No	0	-	-	1
Yes	-0.946	0.219	<0.001	0.388 (0.25–0.59)
Cattle ownership status				
No	0	-	-	1
Yes	-1.580	0.202	<0.001	0.206 (0.14–0.31)

Table 7: Final logistic regression model of factors associated with community attitude and perception of reporting animal bite injury to the hospital for treatment in Gelephu, Bhutan during 2010.

Variable/category	***b***	***SE***	***P*-value**	**OR (95% CI)**
Constant	-0.090	0.278		
Dog ownership status				
No	0	-	-	1
Yes	-0.679	0.224	0.002	0.51 (0.33–0.78)
Presence of children in the household				
No	0	-	-	1
Yes	0.820	0.261	0.002	2.27 (1.36–3.78)
Occupation			0.001*	
Farmers	0	-	-	1
Dependent/housewives	1.958	0.314	0.000	7.08 (3.83–13.09)
Businessman	0.669	0.305	0.028	1.95 (1.07–3.55)
Student	-0.211	0.467	0.652	0.81 (0.32–2.02)
Employee	0.669	0.268	0.012	1.95 (1.15–3.30)

Likelihood ratio test, P<0.001, Hosmer-Lemeshow goodness-of-fit test = 2.175; P=0.95
* Likelihood ratio test p value

4. Discussion

This cross-sectional study was conducted to understand the community knowledge, attitudes and perception of rabies and to investigate factors influencing their knowledge and perceptions about rabies. This is the first study conducted to understand the public health hazard of rabies in Gelephu, which is endemic for canine rabies. It provided valuable information on which to build a rabies awareness education programme.

It is important to note that like any other observational study, the study design used had some limitations. First, the required sample size could not be achieved due to logistical reasons and time constraints, so that the precision of our estimates might have been reduced. However, the sample size was estimated assuming 50% prevalence of knowledge/perceptions (worst-case scenario), but in fact about 80% of the sample had correct knowledge and perceptions about rabies. This means that the effective precision of our estimates is likely better than what we

planned for because a sample size of only 556 is required to estimate a proportion of 80% with 3% precision. Second, households were not randomly selected due to lack of a proper sampling frame. However, it was ensured that a representative sample of households was selected and interviewed from all locations both within urban and semi-urban areas. Third, the sample of people interviewed from the household was those found at home during the visit. Since women (particularly dependents/housewives) are more commonly present at home than men, the number of female respondents in this survey was more than that of males (64% vs 36%). Finally, only adults were interviewed: those younger than 18 years of age were excluded due to ethical issues. We acknowledge that those who were not interviewed may have different knowledge, attitude and perception of rabies. In view of the above issues, the study results should be interpreted with a degree of caution.

Findings of this study indicate that rabies is an important public health problem in Gelephu and the community awareness, knowledge and perception of rabies was high among the respondents. Respondents who owned dog(s) were more likely to have knowledge of rabies, but no significant difference in knowledge was observed between respondents from urban and semi-urban areas. The high level of awareness among the respondents may be due to endemicity of rabies and frequent reports of rabies outbreaks in Gelephu combined with an annual rabies control campaign, and from the news media about rabies outbreaks. Findings from this study are consistent with those from other studies in the neighbouring countries in south Asia that demonstrated a high level of knowledge of rabies and its transmission (Agarvval and Reddaiah, 2003; Sharma, 2005; Ichhpujani et al., 2006; Matibag et al., 2008; Matibag et al., 2009). However, the current study also identified some knowledge gaps: some respondents had not heard of rabies and its transmission (Figure 2; Table 2), indicating that rabies awareness education is necessary in Gelephu.

Understanding the community attitude and perceptions of treatment-seeking behaviours is important for rabies prevention in humans (Matibag et al., 2008). Immediate PEP is required to neutralize the rabies virus in the wound before it spreads into the central nervous system and brain (Warrell and Warrell, 2004; WHO, 2010). This study showed good treatment-seeking behaviours as a majority of the respondents would report to the hospital for animal bite wound treatment (Table 5, Figure 3). However, the odds of reporting animal bite wounds to the hospital were higher for owners of dogs, in households with children and in dependent/housewives, businessmen or employees (Table 7). These findings are comparable with previous studies reporting that a large number of people visited the hospitals for rabies PEP following dogs bites, touching/feeding of rabid animals and ingestion of meat and dairy products derived from rabid animals in Bhutan (Tenzin. et al., 2011b). Similarly, treatment records from the hospital also revealed that during the period 2000–2010, more than 3000 people visited the Gelephu hospital following dog bites and contact with rabid animals to receive PEP vaccine (Bhutantimes, 2011; Tenzin. et al., 2011b). This evidence supports the current finding that the people in Gelephu have good health-seeking behaviours. However, it is to be noted that human deaths due to rabies have occurred in Gelephu and in the south Bhutan region, especially in children (Kuensel, 2009, 2010, 2011). Of the 12 reported human rabies deaths in Bhutan between 2006 and June 2011, 9(75%) occurred in children (<15 years of age) who did not receive post exposure prophylaxis. It is possible that children would often interact with dogs resulting in dog bite injuries, but probably do not report the incident to their parents or to the hospital owing to lack of awareness of rabies (Dodet et al., 2010). Furthermore, studies in other countries have shown that children are more often bitten on the head and neck, which carries a much higher risk than bites to other parts of the body (Pancharoen et al., 2001; Cleaveland et al., 2002; Knobel et al., 2005). Further studies should be conducted to confirm this proposition, and if found to be correct, awareness education should be planned targeting children.

The study results shows that male respondents have better knowledge about rabies but they are less likely to report animal bite cases to the hospital. This is not surprising because it is well documented that compared to women, men in general have limited contacts with physicians and seek less healthcare services (Mansfield et al., 2003; Galdas et al., 2005; Smith et al., 2006). It is assumed that several factors might be involved in men's decisions, including masculine ideologies regarding seeking help when faced with illness or problems (Galdas et al., 2005; Smith et al., 2006). This is comparable to field observations that of the 12 human rabies deaths in Bhutan (from January 2006–April 2011), 11 (92%) were males but most (75%) were children under 15 years of age.

The current results also indicate that the attitudes of the respondents were positive: the majority mentioned that they would report suspected rabies outbreaks in the community to the appropriate authorities for investigation. The majority of respondents also believed that stray dogs are a public health problem in the community and would support a dog population control programme. Community support of, and participation in a rabies control programme is important in order to achieve good coverage of vaccination (>70 %). This is necessary to break the chain of infection and to prevent the maintenance of rabies in the dog population (WHO, 1992; Coleman and Dye, 1996).

In conclusion, this study has shown that the community level of knowledge, attitude and perception of rabies is high in Gelephu and that people have positive attitudes towards the prevention and control programmes. However, there are some knowledge gaps in the community regarding rabies: some respondents had not heard of rabies and the risk of transmission from all warm-blooded animals (see Figure and Table 2), whilst some would not report animal bites injuries to the hospital for treatment (see Figure 3 and Table 5). Therefore, rabies awareness education within the community is necessary on the following areas: the danger of rabies and mode of transmission to humans; the importance and usefulness of washing the animal bite wound with plenty of soap and water; the importance of seeking health facilities following animal bites injuries or exposures to suspected/rabid animals; and providing community support and participation for dog rabies control programme.

Authors' contributions

All authors contributed to the concept and design of the study; BDR, C, ST, KT, PU and KS implemented the field survey; T, NKD and MPW analysed the data, all authors interpreted the analysed data, T drafted the manuscript. All authors contributed critically to revising the manuscript and read and approved the final version. T is guarantor of the paper.

Conflicts of interest: None declared

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