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Knowledge, attitudes and practices regarding to rabies and its prevention and control among bite victims by suspected rabid animals in China

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ABSTRACT

Rabies is a major public health problem and the incidence of suspected rabid animal bites remains high in China. This study aimed to assess the knowledge, attitudes, and practices (KAP) about rabies of bite victims in Wuhan, China. A cross-sectional study was conducted among 1015 bite victims visiting rabies prevention clinics. We performed a face-to-face interview to investigate the rabies KAP of these victims using a self-designed questionnaire. Factors associated with the KAP were evaluated using logistic regression models. Only 56.85% of respondents knew that rabies is infectious. More than 20% of respondents thought that it is not necessary to vaccinate dogs and cats against rabies usually. About 70% of participants stated that they never need to be reminded to vaccinate when they were bitten. Lower education level (odds ratio [OR] = 3.77, 95% confidence interval [CI]: 2.65–5.38 for secondary school or less and OR = 1.74, 95% CI: 1.28–2.38 for high school or vocational school, p-trend<0.0001) was independently associated with poor knowledge of rabies. Respondents who had experienced two or more times of animal bites (OR = 0.62, 95% CI: 0.39–0.97) were inclined to have appropriate attitudes about rabies prevention and control. Older respondents were more likely to show proper behaviors towards rabies prevention and control (OR = 0.44, 95% CI: 0.33–0.58 for age group 31–60 and OR = 0.34, 95% CI: 0.21–0.54 for age group >60, p-trend <0.0001). The level of rabies KAP among bite victims in China was suboptimal. It is necessary to conduct interventions focusing on improving public awareness of rabies and ameliorating behaviors of rabies post-exposure prophylaxis.

1. Introduction

Rabies is a fatal zoonotic disease that causes severe paralysis of the central nervous system. The disease is widespread throughout the world. More than 59,000 people die of rabies each year [1], and about 95% of the deaths occur in Asia and Africa [2]. China has the second-highest number of human rabies deaths, following India [3]. Although the annual number of human rabies cases has decreased in recent years, the epidemic situation remains serious in China. A total of 516 cases were reported in 2017 [4], and new cases appeared in previously rabies-free and low-incidence provinces such as Qinghai, Gansu, and Tibet [5,6]. The situation of rabies prevention and control in China is pressing.

It is well known that dogs play a pivotal role in rabies transmission and most rabies deaths in people are caused by bites from rabid dogs in China [7]. Controlling the dog population size and mass vaccination of dogs are key strategies to reduce human deaths from canine rabies [1,8]. However, vaccination coverage of dogs is generally low in rural China, mainly owing to insufficient knowledge of rabies and poor economic status [7]. Moreover, allowing dogs to roam freely would increase the likelihood of rabies transmission among the animal population and would make rabies a continual threat to humans. More seriously, some people exposed to a suspected rabid bite fail to receive post-exposure prophylaxis (PEP) immediately which further increases the risk for developing rabies [9].

Basic knowledge of rabies is crucial for the prevention and control of the disease, and personal attitudes towards rabies and animals as well as related behaviors are also considered to be the contributing factors. Previous knowledge, attitudes, and practices (KAP) assessments had been performed in rabies endemic areas such as Tanzania [10], Sri Lanka [11], Nigeria [12], and Nepal [13] and in areas of the United

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States that experienced rabies outbreaks in wildlife [14,15]. These studies demonstrated a high level of people's awareness regarding rabies, but a further understanding of the disease may be insufficient. Currently, the existing KAP research of rabies is limited in China. Several studies were conducted among the general population [16–19], but similar research among bite victims was scarce.

Given that more than 40 million people were bitten or scratched annually in China [20], and that rabies is invariably fatal once the clinical symptoms are manifested, improving awareness of rabies prevention and control and ameliorating behaviors of rabies PEP among bite victims is imperative. This study aimed to investigate rabies KAP status among bite victims and analyze the influencing factors. To our knowledge, no detailed study has been carried out to explore the associated factors for KAP among bite victims in China. The findings of the current investigation may be useful for planning future rabies control strategies in China.

2. Methods

2.1. Ethics statement

This study was approved by the Ethics Committee of Huazhong University of Science and Technology, Wuhan, China. All participants read the purpose statement of the investigation and each provided written informed consent.

2.2. Study setting

A cross-sectional study was conducted in the city of Wuhan, which is one of the five largest pet cities in China, with more than 130,000 domestic animals [21,22]. The Wuhan Centers for Disease Prevention and Control reported that dogs injured more than 60,000 people yearly, and the annual consumption of human rabies vaccine was more than 100,000 regimens.

2.3. Questionnaire and construction of KAP scores

The questionnaire was designed by reviewing similar literature [23–26] and consulting with experts. A preliminary test was conducted to ensure that the questions were clear and understandable. The acceptability of the survey and the time required to complete it were also examined.

The questionnaire consisted of four parts: the first part was designed to obtain demographic characteristics including age, gender, educational level, monthly household income (RMB), times of animal bites, rabies vaccination history, and time spent to the rabies prevention clinics (RPCs).

The second part investigated the knowledge of rabies which included seven questions: 1) is rabies an infectious disease, 2) is rabies preventable, 3) should the rabies vaccine be vaccinated on schedule, 4) how long is the incubation period of rabies usually, 5) the severity of rabies, 6) transmission routes of rabies, and 7) which animals can spread rabies. Of the seven questions, the first six had a single correct answer, and respondents received one point for each correct answer. The last question had three correct answers, and the respondent received one point for each correct choice and zero for an incorrect choice. The total correct responses were calculated to show the scores of overall knowledge, ranging from 0 to 9.

In the third part, attitudes assessment towards rabies and its prevention and control involved nine questions: 1) rabies is a risk to human health, 2) elimination of dog-mediated and cat-mediated rabies is vital, 3) vaccinating susceptible dogs and cats can prevent the transmission of rabies, 4) it is not necessary to vaccinate dogs and cats against rabies usually, 5) injecting rabies vaccine as soon as possible after being bitten by suspected rabid animals, 6) completing the full courses of vaccination after being bitten by suspected rabid animals, 7) testing the level of antibody after vaccinated, 8) willing to learn the knowledge of rabies, and 9) it is necessary to promote rabies knowledge in the community. Each appropriate attitude item was scored on a five-point Likert scale ranging from ‘strongly agree’ to ‘strongly disagree’ coded with values from 5 to 1. Conversely, scores of 1 to 5 were assigned for each inappropriate attitude item, with the same response options. The maximum score of attitudes is 45 points, and a minimum score is 9 points.

The fourth part assessed the practices related to rabies prevention and control by six questions: 1) taking the rabies vaccine on schedule, 2) needing someone to remind you to get vaccinated when you were bitten, 3) discontinuing the rabies regimen if the wound is not serious, 4) advising bite victims to be vaccinated after a suspected rabid bite, 5) playing with pets, and 6) keeping away from aggressive animals. Response options included ‘always,’ ‘often,’ ‘sometimes,’ and ‘never’, and scores of 4, 3, 2, and 1 were assigned for each proper practices item. Conversely, scores of 1, 2, 3, and 4 were assigned for each improper practices item. The maximum score of practices is 24 points, and a minimum score is 6 points.

2.4. Sampling and data collection

A multistage sampling technique was used to recruit participants. The city of Wuhan was divided into 15 districts, and we randomly selected three. In each district, two RPCs were selected by simple random sampling. The investigators who have received unified training surveyed bite victims consulting the RPCs between March and May 2016. Data were double-entered into Epidata 3.0 separately by two individuals. A total of 1080 bite victims were interviewed, but 65 refused to answer all questions. Finally, 1015 questionnaires were included in the analysis.

2.5. Data analysis

All analyses were performed using the Statistical Analysis System (SAS) 9.4 for Windows (SAS Institute Inc., Cary, NC, USA). Continuous variables were described by mean and standard deviation (SD), and categorical data were described using frequency and percentage. Analyses of variance and *t*-test were conducted to compare different groups' scores on knowledge, attitudes, and practices of rabies. Three separate multivariable logistic regression models were performed to explore the association of various factors with the socio-demographic characteristics of the victims. The cumulative score obtained for questions based on the three response criteria (knowledge, attitudes, and practices towards rabies, respectively) was converted into binomial outcomes by categorizing the respondents as having scored $\leq$ or $>$ the average score of each response criterion. A test for linear trend was conducted with the use of rank variables such as age, educational level, and time spent to the RPCs as continuous variables by assigning the rank values of the categories to the variable. All comparisons were two-tailed, and *p*-values less than 0.05 were considered statistically significant.

3. Results

3.1. Sociodemographic characteristics of animal bite victims

Table 1 presents the sociodemographic characteristics of animal bite victims. The study participants had a mean age of 39.72 years old (SD = 15.93), and 57.24% were older than 30. More than half of respondents (55.67%) were females, and approximately one-third of respondents (37.64%) were bitten by suspected rabid animals twice or more. Most of the bite victims (66.11%) could visit the RPC within 30 min, and 33.30% had been vaccinated against rabies before participating in the survey.

3.2. Knowledge

Table 2 shows the rabies knowledge of participants. Only 56.85% of

Table 1
Characteristics of the 1015 bite victims visiting rabies prevention clinics.

Characteristics	N	%
Gender		
Male	450	44.33
Female	565	55.67
Age		
≤30	434	42.76
31–60	469	46.21
>60	112	11.03
Educational level		
Secondary school or less	255	25.12
High school or vocational school	296	29.16
Bachelor degree or above	464	45.72
Monthly household income (RMB)		
<5000	524	51.63
≥5000	491	48.37
Times of animal bites		
Once	633	62.36
Twice or more	382	37.64
History of rabies vaccination		
Yes	338	33.30
No	677	66.70
Time spent to the RPCs [a]		
≤half hour	671	66.11
1/2–1 h	278	27.39
≥1 h	66	6.50

[a] RPCs, rabies prevention clinics.

Table 2
Knowledge about rabies among respondents.

Knowledge parameter	N (%)
Is rabies an infectious disease?	
Yes	577 (56.85)
No	277 (27.29)
Don't know	161 (15.86)
Is rabies preventable?	
Yes	839 (82.66)
No	61 (6.01)
Don't know	115 (11.33)
Should the rabies vaccine be vaccinated on schedule?	
Yes	958 (94.38)
No	19 (1.87)
Don't know	38 (3.75)
How long is the incubation period of rabies usually?	
<14 days	67 (6.60)
1–3 months	144 (14.19)
>1 year	494 (48.67)
Don't know	310 (30.54)
The severity of rabies	
Nonlethal/ Low mortality	30 (2.96)
High mortality	229 (22.56)
Always fatal	596 (58.72)
Don't know	160 (15.76)
Transmission routes of rabies	
Bite or scratch	942 (92.80)
Inhaling aerosols containing viral particles	2 (0.20)
Organ transplant	1 (0.10)
Don't know	70 (6.90)
Which animals can spread rabies?	
Dog	939 (92.51)
Cat	875 (86.21)
Wildlife	589 (58.03)
Fowl	145 (14.29)
Don't know	60 (5.91)

respondents knew that rabies is infectious, and 82.66% were aware that rabies is preventable. 94.38% of respondents knew that the rabies vaccine should be taken on schedule. A majority of respondents knew that dogs and cats were capable of transmitting rabies virus, and approximately three-fifths (58.03%) recognized that wildlife could also transmit rabies virus. More than 90% of respondents were aware that rabies was transmitted by the bite or lick from rabid animals. More than 50% of respondents knew that rabies is fatal, while only 14.19% were knowledgeable of the incubation period of rabies.

3.3. Attitudes

Participant attitudes towards rabies and its prevention and control are shown in Table 3. Most respondents believed that rabies is a risk to human health (93.79%) and that the elimination of dog-mediated and cat-mediated rabies is vital (95.37%). 92.21% of respondents thought that vaccination of susceptible dogs and cats can prevent the transmission of rabies, while about one-fifth (21.18%) of respondents thought that it is not necessary to vaccinate dogs and cats against rabies usually. About 90% of respondents were willing to learn the knowledge of rabies, and 94.29% thought that the propaganda of rabies knowledge in the community is necessary.

3.4. Practices

Participant practices related to rabies prevention and control are shown in Table 4. Most of the respondents reported that they always take the rabies vaccine on schedule (83.84%) and that they always advise bite victims to be vaccinated after a suspected rabid bite (80.59%). About 70% of respondents stated that they never need to be reminded to vaccinate when they were bitten. Only 74.38% reported that they always complete the rabies regimen even if the wound is not serious. About 40% of the respondents reported that they always play with pets, and 76.55% stated that they always keep away from aggressive animals.

3.5. Univariate analyses

Table 5 shows KAP scores based on respondents' characteristics and the results of univariate analyses. The mean score of rabies knowledge was 6.36 (SD = 1.63) from a maximum of 9. Males and younger respondents had higher scores compared to females and the elderly ($p = 0.0357$ and $p < 0.0001$, respectively). Participants who had less education ($p < 0.0001$), who reported poor economic status ($p < 0.0001$), and who spent more time to the RPCs ($p = 0.0008$) had lower knowledge scores.

The average score of attitudes towards rabies and its prevention and control was 38.81 (SD = 4.06) from a maximum of 45. Participants who were younger ($p < 0.0001$), who received better education ($p < 0.0001$), and who reported good economic status ($p = 0.0004$) were more likely to have higher scores of attitudes.

The mean score of practices about rabies prevention and control was 20.21 (SD = 2.75) from a maximum of 24. Participants who were younger ($p < 0.0001$), who reported good economic status ($p = 0.0492$), who had experienced two or more times of animal bites ($p < 0.0001$), and who had a history of rabies vaccination ($p < 0.0001$) had lower scores of practices.

3.6. Determinants of knowledge, attitudes, and practices

Table 6 presents the results of the multivariate logistic regression analysis, where the dependent variables were the level of knowledge, attitudes, and practices. Lower educational level (OR = 3.77, 95%CI: 2.65–5.38 for secondary school or less and OR = 1.74, 95%CI: 1.28–2.38 for high school or vocational school, *p-trend* < 0.0001) was independently associated with poor knowledge of rabies.

For inappropriate attitudes towards rabies and its prevention and control, the relevant factors were lower educational levels (OR = 1.98, 95%CI: 1.41–2.79 for secondary school or less and OR = 1.66, 95%CI: 1.22–2.26 for high school or vocational school, *p*-trend<0.0001) and times of animal bites (OR = 0.62, 95%CI: 0.39–0.97 for twice or more).

Improper practices regarding rabies prevention and control were associated with times of animal bites (OR = 2.44, 95%CI: 1.54–3.86 for

Table 3
Attitudes towards rabies and its prevention and control among respondents.

Attitude parameter	N (%)
Rabies is a risk to human health.	
Strongly agree	593 (58.42)
Agree	359 (35.37)
Neutral	37 (3.64)
Disagree	23 (2.27)
Strongly disagree	3 (0.30)
Elimination of dog-mediated and cat-mediated rabies is vital.	
Strongly agree	609 (60.00)
Agree	359 (35.37)
Neutral	30 (2.95)
Disagree	15 (1.48)
Strongly disagree	2 (0.20)
Vaccinating susceptible dogs and cats can prevent the transmission of rabies.	
Strongly agree	559 (55.07)
Agree	377 (37.14)
Neutral	57 (5.62)
Disagree	18 (1.78)
Strongly disagree	4 (0.39)
It is not necessary to vaccinate dogs and cats against rabies usually.	
Strongly agree	62 (6.11)
Agree	79 (7.78)
Neutral	74 (7.29)
Disagree	470 (46.31)
Strongly disagree	330 (32.51)
Injecting rabies vaccine as soon as possible after being bitten by suspected rabid animals.	
Strongly agree	634 (62.46)
Agree	359 (35.37)
Neutral	11 (1.08)
Disagree	8 (0.79)
Strongly disagree	3 (0.30)
Completing the full courses of vaccination after being bitten by suspected rabid animals.	
Strongly agree	618 (60.89)
Agree	370 (36.45)
Neutral	15 (1.48)
Disagree	11 (1.08)
Strongly disagree	1 (0.10)
Testing the level of antibody after vaccinated.	
Strongly agree	206 (20.30)
Agree	266 (26.21)
Neutral	400 (39.41)
Disagree	112 (11.03)
Strongly disagree	31 (3.05)
Willing to learn the knowledge of rabies.	
Strongly agree	483 (47.59)
Agree	450 (44.33)
Neutral	29 (2.86)
Disagree	47 (4.63)
Strongly disagree	6 (0.59)
It is necessary to promote rabies knowledge in the community.	
Strongly agree	525 (51.73)
Agree	432 (42.56)
Neutral	27 (2.66)
Disagree	26 (2.56)
Strongly disagree	5 (0.49)

Table 4
Practices of respondents towards rabies prevention and control.

Practice parameter	N (%)
Taking the rabies vaccine on schedule.	
Always	851 (83.84)
Often	67 (6.60)
Sometimes	62 (6.11)
Never	35 (3.45)
Needing someone to remind you to get vaccinated when you were bitten.	
Always	125 (12.32)
Often	65 (6.40)
Sometimes	117 (11.53)
Never	708 (69.75)
Discontinuing the rabies regimen if the wound is not serious.	
Always	80 (7.88)
Often	53 (5.22)
Sometimes	127 (12.52)
Never	755 (74.38)
Advising bite victims to be vaccinated after a suspected rabid bite.	
Always	818 (80.59)
Often	123 (12.12)
Sometimes	40 (3.94)
Never	34 (3.35)
Playing with pets.	
Always	427 (42.07)
Often	149 (14.68)
Sometimes	169 (16.65)
Never	270 (26.60)
Keeping away from aggressive animals.	
Always	777 (76.55)
Often	118 (11.63)
Sometimes	79 (7.78)
Never	41 (4.04)

twice or more). Older respondents were more likely to show proper behaviors (OR = 0.44, 95%CI: 0.33–0.58 for age group 31–60 and OR = 0.34, 95%CI: 0.21–0.54 for age group >60, p-trend <0.0001).

4. Discussion

The present study showed that the majority of respondents were aware that dogs and cats can spread rabies and that the disease can be transmitted via bites or licks from rabid animals. This is consistent with previous reports from Ethiopia [24,27], Sri Lanka [11], and Indian [28]. Notably, we found some important knowledge gaps. For instance, only 14.19% of respondents knew that the incubation period of rabies in most cases is one to three months. A similar finding was reported by Agarwal (2003) [29]. Previous observations indicated that the incubation period of rabies in humans ranges from as few as 10 days to several years according to the severity of the wound, the location of the bite, and the

Table 5
Knowledge, attitudes, and practices scores of the bites victims.

Characteristics	Knowledge score(out of 9)		Attitudes score(out of 45)		Practices score(out of 24)	
	Mean (SD)[b]	*P*-value	Mean (SD)	*P*-value	Mean (SD)	*P*-value
All respondents	6.36 (1.63)		38.81 (4.06)		20.21 (2.75)	
Gender						
Male	6.48 (1.56)	0.0357	38.69 (4.11)	0.4425	20.14 (2.70)	0.4685
Female	6.26 (1.68)		38.89 (4.02)		20.27 (2.79)	
Age						
≤30	6.54 (1.52)	<0.0001	39.40 (3.94)	<0.0001	19.38 (2.76)	<0.0001
31–60	6.35 (1.67)		38.53 (4.11)		20.78 (2.56)	
>60	5.68 (1.72)		37.66 (3.97)		21.07 (2.62)	
Educational level						
Secondary school or less	5.40 (1.83)	<0.0001	37.69 (4.28)	<0.0001	20.43 (2.93)	0.1123
High school or vocational school	6.25 (1.58)		38.45 (3.72)		20.33 (2.84)	
Bachelor degree or above	6.94 (1.25)		39.63 (3.96)		20.02 (2.57)	
Monthly household income (RMB)						
<5000	6.16 (1.69)	<0.0001	38.37 (4.11)	0.0004	20.37 (2.89)	0.0492
≥5000	6.57 (1.55)		39.27 (3.95)		20.04 (2.58)	
Times of animal bites						
Once	6.30 (1.66)	0.1452	38.65 (4.07)	0.1134	20.64 (2.62)	<0.0001
Twice or more	6.45 (1.59)		39.07 (4.02)		19.50 (2.81)	
History of rabies vaccination						
Yes	6.49 (1.55)	0.0701	39.01 (3.98)	0.2603	19.70 (2.70)	<0.0001
No	6.29 (1.67)		38.70 (4.10)		20.47 (2.73)	
Time spent to the RPCs [a]						
≤half hour	6.40 (1.60)	0.0008	38.84 (4.02)	0.7782	20.17 (2.77)	0.6642
1/2–1 h	6.41 (1.57)		38.80 (4.15)		20.26 (2.69)	
≥1 h	5.62 (2.02)		38.47 (4.07)		20.47 (2.79)	

[a] RPC, rabies prevention clinics; [b] SD, standard deviation.

Table 6
Multivariate logistic regression analysis of factors associated with poor knowledge, attitudes, and practices towards rabies.

Characteristics	Knowledge score (≤ 6.36 vs. > 6.36)			Attitudes score (≤ 38.81 vs. > 38.81)			Practices score (≤ 20.21 vs. > 20.21)		
	OR [b]	95% CI [c]	*P*-value	OR	95% CI	*P*-value	OR	95% CI	*P*-value
Gender (Ref [a]: Male)									
Female	1.26	0.97–1.64	0.0801	0.97	0.75–1.25	0.7993	1.00	0.77–1.29	0.9672
Age (Ref: ≤30)									
31–60	0.85	0.64–1.12	0.2488	1.11	0.84–1.46	0.4713	0.44	0.33–0.58	<0.0001
>60	1.21	0.76–1.93	0.4223	1.42	0.91–2.23	0.1247	0.34	0.21–0.54	<0.0001
P-trend		0.9675			0.1446			<0.0001	
Educational level									
(Ref: Bachelor degree or above)									
Secondary school or less	3.77	2.65–5.38	<0.0001	1.98	1.41–2.79	<0.0001	1.31	0.92–1.86	0.1338
High school or vocational school	1.74	1.28–2.38	0.0005	1.66	1.22–2.26	0.0012	1.12	0.82–1.54	0.4839
P-trend		<0.0001			<0.0001			0.1352	
Monthly household income (RMB) (Ref: ≥5000)									
<5000	1.10	0.84–1.44	0.5067	1.18	0.91–1.54	0.2179	0.82	0.62–1.07	0.1407
Times of animal bites									
(ref: Once)									
Twice or more	1.05	0.66–1.65	0.8493	0.62	0.39–0.97	0.0368	2.44	1.54–3.86	0.0002
Rabies vaccination history									
(ref: Yes)									
No	1.04	0.65–1.67	0.8608	0.71	0.45–1.13	0.1484	1.30	0.81–2.09	0.2814
Time spent to the RPCs [d]									
(ref: ≤half hour)									
1/2–1 h	0.99	0.74–1.33	0.9493	0.89	0.67–1.19	0.4303	1.00	0.74–1.34	0.9891
≥1 h	1.55	0.90–2.66	0.1147	0.95	0.56–1.60	0.8462	0.76	0.45–1.30	0.3192
P- trend		0.8608			0.1484			0.2814	

[a] Ref, reference; [b] OR, odds ratio; [c] CI, confidence interval; [d] RPCs, rabies prevention clinics.

amount of rabies virus in the wound. Clinical symptoms appear after one to three months in most cases [24,30]. Besides, similar to other studies conducted in the USA [15] and New Mexico [31], more than 40% of respondents did not know that rabies is invariably fatal once the clinical signs are manifested in the present study. Given that insufficient knowledge of rabies might be a main reason for improper PEP [9], educational programs should be conducted to help the public have a comprehensive understanding of rabies.

More than 90% of the respondents believed that the rabies vaccine should be injected as soon as possible after a suspected rabid bite. This favorable attitude is in line with the World Health Organization guidelines on rabies that people should seek medical attention immediately when they are bitten by a suspected rabid animal [32]. Most respondents believed that vaccinating susceptible dogs and cats can prevent the transmission of rabies. Similar results were reported in Haiti [25]. This favorable attitude may encourage pet owners to vaccinate their dogs or cats, which would decrease the chance of each bite being rabid, and benefit rabies elimination efforts [8]. In fact, low vaccination coverage of dogs was reported in many countries, ranging from 0.8% to 51.6% [13,25,26,33–35], and several factors may be responsible. The limited

number of veterinarians would make it unlikely for many pet owners to access animal rabies vaccination [25]. Moreover, poor family income or the high cost of vaccines may hinder individuals from vaccinating their pets or themselves despite awareness of the benefits of rabies vaccination [7].

Avoiding animal bites or scratches is an effective measure for rabies prevention. However, this may be poorly practiced among individuals who like dogs and cats. In the present study, most bite victims stated that they play with pets, even a minority of respondents reported that they seldom keep away from aggressive pets. These behaviors may increase the risk of exposure to rabies. About one-fourth of the victims reported that they would discontinue the rabies regimen if the wound is not serious, which to some extent reflected inadequate knowledge of rabies PEP among these bite victims. This may suggest that future rabies education should emphasize the necessity of completing full courses of rabies PEP.

Previous studies showed that educational level was a major determinant of the level of rabies knowledge [10,23,36,37]. A similar result was found in our study that the knowledge score increased with the educational level. This may be because people with a better education had more learning opportunities and a better ability to acquire rabies knowledge. Therefore, we should pay more attention to these people with lower educational levels and regard them as the key intervention population in improving the knowledge of rabies.

In the present study, younger respondents were more likely to show improper practices towards rabies prevention and control compared with older people. One possible explanation is that young people prefer to play with animals resulting in more contact opportunities with rabid animals [38], and their sense of self-protection is generally weak. Thus it would be meaningful to enhance the propaganda of rabies PEP in the general population, especially in the young population. The study also revealed that people who experienced two or more times of animal bites had worse practices about rabies prevention and control. It may suggest that the experience of being bitten by suspected rabid animals does not make the victims more careful, although people would theoretically learn from their own experience and become more cautious after being bitten, as the Chinese idiom goes, “once bitten by a snake, ten years in fear of a well rope.” It may be reasonable to consider that the probability of being bitten again is still high if a bite victim does not pay attention to his behavior when getting along with pets.

Rabies prevention and control is an arduous task that requires the collaboration of various governmental and non-governmental agencies. Following the One Health approach, short and long-term strategies could be deployed in Wuhan. For example, health education and awareness-raising programs should be further improved. There is a need to strengthen coordination and communication between health and education sectors and educate people about the severity of rabies, preventive measures, the necessity of completing PEP treatment, etc. especially among young people, victims with lower educational levels, and those who experienced two or more times of animal bites. Besides, the Public Security Bureau and the Urban Management and Law -Enforcement Bureau could work together to strengthen dog population management. Regularly organize veterinary stations and relevant sectors to vaccinate dogs against rabies.

Several limitations need to be acknowledged. First, the level of knowledge about rabies might be overestimated among bite victims in China, for participants were recruited in RPCs, and these people usually have a higher awareness of rabies prophylaxis compared with those not seeking medical assistance after a suspected rabies bite. Second, the study site is mainly in an urban area, the results of this study may not reflect the level of rabies KAP among bite victims in rural areas.

5. Conclusion

In conclusion, this clinic-based study showed that the level of rabies KAP among bite victims in China was suboptimal. A majority of respondents had poor knowledge of the incubation period as well as the severity of rabies. Most of the respondents had positive attitudes towards the prevention and control of rabies, but their actual practices might be insufficient. Participants who were young, who had a lower level of education, and who had experienced two or more times of animal bites should be the key population when we implement intervention programs to improve public awareness of rabies prevention and control and meliorate behaviors of rabies PEP.

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Declaration of Competing Interest

None.

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