

# Evaluation of primary care prophylaxis post-exposure to the rabies virus

Avaliação da profilaxia no primeiro atendimento pós-exposição ao vírus da raiva

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## Keywords

Post-exposure prophylaxis; Rabies; Rabies virus/pathogenicity; Public health nursing; Nursing assessment; Nursing care

## Descritores

Profilaxia pós-exposição; Raiva; Virus da raiva/pathogenicidade; Enfermagem em saúde pública; Avaliação em enfermagem; Cuidados de enfermagem

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## Abstract

**Objective:** To evaluate primary care prophylactic post-exposure anti-rabies treatment.

**Methods:** This was a cross-sectional, descriptive and analytical study, with data from the Information System for Notification of Diseases. It analyzed 39,087 visits, excluding 1,091 (2.79%) cases of re-exposure and pre-exposure, resulting in 37,996 post-exposure visits. A logistic regression analysis was performed for adjustment of the treatment.

**Results:** A predominance of Caucasians (83.93%), male (54.58%), primary school educational level (66.13%), ages between 20-59 years (45.0%), followed by 0 to 12 years (32.88%), and residents in the urban area (91.97%) was observed. Among the visits, 15,500 (41.56%) were considered inadequate, 10,587 (28.11%) were deficient or the patient did not receive the necessary treatment, and 5,013 (13.44%) patients received more than what was necessary for rabies prophylaxis.

**Conclusion:** The post-exposure prophylaxis for rabies was considered inadequate and requires a better approach on admission, and attention in completing the notification in the data record.

## Resumo

**Objetivo:** Avaliar o tratamento profilático do primeiro atendimento anti-rábico pós-exposição.

**Métodos:** Estudo transversal, descritivo e analítico, com dados do Sistema de Informação de Agravos de Notificação. Analisados 39.087 atendimentos, excluídos 1.091 (2,79%) casos de re-exposição e pré-exposição, resultando em 37.996 atendimentos pós-exposição. Realizada análise de regressão logística para adequação de conduta.

**Resultados:** Observou-se predomínio da raça branca (83,93 %), sexo masculino (54,58 %), ensino fundamental (66,13%), idades entre 20-59 anos (45,0%), seguido por 0 a 12 anos (32,88%) e residentes na zona urbana (91,97%). Considerou-se 15.500 (41,56%) atendimentos inadequados 10.587 (28,11%) atendimentos deficitários, ou o paciente não recebeu o tratamento necessário, e 5.013 (13,44%) pacientes receberam atendimento mais do que o necessário para a profilaxia antirrábica.

**Conclusão:** A profilaxia pós-exposição da raiva foi considerada inadequada necessitando de uma melhor abordagem na admissão e atenção no preenchimento dos registros de dados.

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**Conflicts of interest:** there are no conflicts of interest to declare.

## Introduction

Human rabies transmitted by dogs is considered a neglected disease, which can be eliminated through a series of strategies such as dog vaccination, and pre- and post-exposure prophylaxis.<sup>(1)</sup> The World Health Organization reports the completion of more than 15 million cases of post-exposure prophylaxis (PEP) and the progressive increase in care over the past few years. Studies have reported an increase in economic spending for such prophylaxis, without a corresponding decrease in the number of cases of human rabies.<sup>(2-4)</sup>

Post-exposure prophylaxis (PEP) in primary care is very effective if the treatment is instituted promptly with care of the wounds, accompanied by proper vaccination. The treatment, however, is often insufficient, incomplete or delayed, and thus the occurrence of deaths continues to be reported.<sup>(5)</sup>

Despite the importance of management and funding for public health, conforming to our knowledge through the literature, there is still little published evidence about the adequate utilization of post-exposure rabies prophylaxis.

In the period between 2000 to 2009, approximately 425,400 people per year, in Brazil, sought care due to exposure and, of these, 64% received some type of prophylactic treatment,<sup>(6)</sup> while in Latin America, 25.4% of the individuals receiving care in health services received anti-rabies treatment.<sup>(1)</sup>

In the history of anti-rabies treatment in Paraná, an increase of 29,361 visits in 2002 was identified, and 38,477 cases were reported for anti-rabies treatment in 2008.<sup>(7)</sup> On the other hand, of the cases of rabies reported in Brazil, 66.0% did not receive post-exposure prophylaxis (PEP) because of ignoring the need for prophylaxis or difficulty in accessing health services, and 10.5% of cases who received PEP died because of inadequate treatment.<sup>(6)</sup>

According to the World Health Organization, about 50% of overseas tourists do not make on-site treatment, waiting to return to their country to initiate PEP, exposing themselves to the risk of developing the disease, and therefore they are considered as having had incomplete or inadequate care.<sup>(8)</sup>

The post-exposure prophylaxis for rabies in some cases may not be necessary, depending on a risk assessment performed by a health professional, for making a more judicious treatment of post-exposure prophylaxis, of not vaccinating patients when observation of the animal attacker by the owner or veterinarian is possible, as verified in a study conducted in Marseille, France from 1994 to 2005, representing a savings of 177,600 Euros.<sup>(9)</sup>

Due to the above, the objective of this study was to evaluate the appropriateness of prophylactic anti-rabies treatment in the first post-exposure care visit, occurring in the year of 2010, in the State of Paraná, in southern Brazil.

## Methods

A cross-sectional study using univariate analysis and a logistic regression model was performed, to assess the suitability of post-exposure rabies prophylaxis.

Data were extracted from the *Sistema de Informação de Agravos de Notificação* (Information System for Notification of Diseases - Sinan) with records of cases of diseases and disorders of compulsory notification.<sup>(10)</sup> We collected 37,996 records from the Sinan database regarding post-exposure anti-rabies visits, reported in the State of Paraná, in the period from January 1, 2010 to December 31, 2010.

All the data from the first anti-rabies care visit and the treatment adopted were analyzed, excluding the records of subsequent visits. The outcome variable was the adequacy of treatment adopted in anti-rabies primary care. The appropriateness of treatment is the result of the sum of the variables: degree of injury, single or multiple injuries, superficial, deep and lacerating injury, type of exposure (bite, scratch, licking, indirect contact), location of injury (mucous, head, hands, thorax, upper and lower limbs) and the condition of the animal (healthy, suspect, angry, dead or disappeared at the time of service).<sup>(5)</sup> The treatment was considered adequate when the analysis of all variables was in accordance with the treatment determined

## Results

by the Technical Standards, otherwise it would be considered inadequate.

It is noteworthy that for Inadequate Treatment, a categorization was developed for cases in which more than the necessary procedures were performed (Excessive Treatment) and for cases that lacked the performance of procedures (Deficient Treatment), according to the protocol of the Ministry Health.

Data were collected by the TabWin® program, stored in the Excel® program, and subsequently analyzed in the Statistic Program 8.0®. Descriptive analyses were performed using simple frequencies, and to test the associations of interest the univariate Pearson’s chi-square test was used, and subsequently a multivariate analysis with a confidence interval of 95% and a significance level of <0.05.

The study followed the developed national and international standards of ethics in research involving humans.

We analyzed 39,087 visits, excluding 1,091 (2.79%) cases of re-exposure and pre-exposure care, resulting in 37,996 post-exposure anti-rabies visits; of these, 41.56% (15,500) presented inadequate treatment when compared to the prophylactic anti-rabies treatment proposed by the Ministry of Health.

The population was predominantly Caucasian (83.93%), male (54.58%), had a low educational level with only primary education (66.13%), predominant age between 20-59 years (45.0%), followed by 0-12 years (32.88%), and were residents in the urban area (91.97%).

The single injury was the most prevalent (57.02%), followed by multiple injuries (40.07%), with the majority being biting (82.36%), with the lower limbs as the most common location (29.50%), with a superficial injury (51.22%). Some patients may have had more than one type of exposure and location of injury (Table 1).

**Table 1.** Multivariate analysis of characteristics of the injury and the animal attacker

	Treatment adequacy		OR	CI	p-value
	Adequate n(%)	Inadequate n(%)			
Injury (37,996)					
Single (21,667)	12,576(58.04)	9091(41.96)			NS
Multiple (15,227)	9,099(59.80)	6128(40.20)	1		
Without injuries (270)	55(20.40)	215(79.60)	4.14	3.02 – 5.68	<0.0001
No information (832)					
Type of exposure (40,743)*					
Bite (33,557)	20,063(59.75)	13,494(40.25)	1.72	1.57 – 1.89	<0.001
Scratch (5,351)	2,965(55.41)	2,386(44.59)	0.90	0.84 – 0.98	0.0125
Licking (1,148)	633(55.14)	515(44.86)			NS
Indirect contact (478)	13(2.72)	465(97.28)	51.87	29.88 – 90.04	<0.001
Other injuries (209)	117(55.98)	92(44.02)			NS
Injury location (49,793)*					
Hands/feet (12733)	8,033(63.09)	4,700(36.91)	1.28	1.19 – 1.38	<0.0001
Lower limbs (14,691)	7,817(53.21)	6,874(46.79)	1.23	1.14 – 1.32	<0.0001
Upper limbs (6,796)	3,896(57.33)	2,900(42.67)			NS
Head/neck (3,457)	2,452(70.93)	1,005(29.07)	1.81	1.64 – 1.99	<0.0001
Thorax (2,219)	1,210(54.53)	1,009(45.47)	1.18	1.07 – 1.30	0.0008
Mucous (897)	573(63.88)	324(36.12)			NS

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Continuation

	Treatment adequacy		OR	CI	p-value
	Adequate n(%)	Inadequate n(%)			
Depth (38,460)*					
Superficial (19,703)	10,656(54.08)	9,047(45.92)	1		
Deep (15,992)	10,326(64.57)	5,596(35.43)	0.64	0.61-0.67	0.0002
Lacerating (2,765)	1,747(63.18)	1,018(36.82)	0.82	0.76-0.89	<0.0001
Type of animal (37,996)					
Canine (34,796)	20,529(59.00)	14,267(41.00)			NS
Feline (1,730)	1,026(59.30)	704(40.70)	1		
Others (689)	191(27.72)	498(72.28)	2.27	1.84 – 2.80	<0.0001
Bat (91)	48(52.75)	43(47.25)			NS
No information (690)					
Animal condition (37,996)					
Healthy (30,266)	20,108(66.43)	10,158(33.57)	1		
Dead/disappeared (3069)	1,120(36.49)	1,949(63.51)	3.42	3.16 – 3.70	<0.0001
Suspect (3,766)	532(14.13)	3,234(85.87)	12.11	11.01– 13.32	<0.0001
Rabid (194)	34(17.52)	160(82.48)	7.67	5.20 – 11.32	<0.0001
S/Informação (701)					
Type of treatment (37,307)					
Observation and vaccine	16,607(79.99)	4,156(20.01)	1		
Animal observation	3,751(41.85)	5,213(58.15)	5.55	5.26-5.86	<0.0001
Anti-rabies serum and vaccine	861(76.61)	263(23.39)	1.23	1.07-1.41	<0.0001
Vaccine	558(10.46)	4,775(89.54)	34.54	31.43-37.96	<0.0001
Exemption of treatment	21(1.88)	1,093(98.12)	207.88	134.80-320.56	<0.0001

Legend: OR – Odds Ratio; CI – Confidence Interval; p-value – level of significance; NS – not significant;\* some patients can be represented in more than one category

In this study, all variables that were associated with the outcome were retained in the multivariate regression model. The model was divided into blocks, according to the characteristics of the variable due to the large number of visits, and so one model was created with information regarding the injury and another referring to the animal attacker.

The variables that were significantly correlated in multivariate analysis (Table 1) adjusted for sex, age, educational level, race and area of residence, with the outcome variable of adequacy of treatment, were considered factors that contributed to and enhanced the occurrence of the event. Thus, in relation to the characteristics of the injury, 41.96%

(9,091) of individuals with single injuries received inadequate treatment, noting that the event without injury showed an OR = 4.14 (CI 3.02-5.68), four times higher chance of inadequate treatment, compared to individuals with multiple injuries.

The most common exposure type was the bite, however indirect contact was the type of exposure that had the highest percentage of inadequacy, with a risk factor of OR = 51.87.

Injuries located in the lower limbs showed a higher number of incidents and inadequate treatment, however injuries located in the head/neck were at higher risk for inadequate treatment with a 1.81 times greater chance when compared to in-

dividuals who had not suffered aggression to the head/neck. The variables “mucous” and “upper limbs” lost significance after multivariate analysis, suggesting that they were confounding factors.

Regarding the depth of the injury, it was observed that in 19,703 (51.22%) of the visits, superficial injuries were found; and deep and lacerating injuries were considered protective factors for inadequate treatment.

With respect to the animal attackers, the dog was the main attacker with 93.27% (34,796) of the total visits, and consequently showed the highest number of inadequate cases of treatment with 41.00% (14,267). People who were attacked by other types of animals had a greater risk of receiving inadequate treatment, with a 2.27 times greater chance compared to those who were attacked by felines, and among other types of animals including: primates, domestic herbivore, fox, skunk, capybara, coati, turtle, pig, bovine, rat, horse, duck, rabbit, spider, lizard, hamster, armadillo, horses, alpaca, squirrel, giant otter, river otter, mule, wild boar and sheep.

The condition of a healthy animal was more prevalent, with 81.31% (30,266) of the total, as well as inadequate treatment, with 33.58% (10,158); the condition of a suspect animal showed higher risk, that is, individuals who were

attacked by suspect animals showed 12.11 times greater chance of having inadequate treatment compared to individuals who were attacked by healthy animals.

The treatment that showed the highest risk of inadequate treatment was that of dispensing with treatment, that is, individuals who were discharged from treatment presented a 207.88 times greater chance of having inadequate treatment when compared to those who received vaccine and indication of observation of the animal for 10 days, as shown in table 1.

The comparative analysis of the adopted treatment by health services with those established by the Brazilian Ministry of Health identified that observation and vaccination were the most prevalent, with 20,763 (55.66%) visits and in 79.99% of the cases, this treatment was correctly indicated. The dispensation of treatment was less prevalent, with 1,114 (2.98%) visits and it presented a lower percentage of correct indication of treatment, with 1.88%, as shown in table 2.

Of the total of 15,500 inadequate visits, 10,587 (28.11%) had deficient care, that is, the patient did not receive the necessary treatment, and in 5,013 (13.44%) visits, the patient received treatment beyond what was necessary, as shown in table 3.

**Table 2.** Treatment adopted by the health service

Treatment adopted by the health service	Treatment established by the Ministry of Health					Total
	Dispensing with treatment n(%)	Animal observation n(%)	Observation and vaccine n(%)	Vaccine n(%)	Serum and vaccine n(%)	
Dispensing with treatment	21(1.88)	386(34.65)	524(47.04)	42(3.77)	141(12.66)	1,114(2.98)
Animal observation	100(1.11)	3,751(41.85)	4,857(54.19)	10(0.11)	246(2.74)	8,964(24.03)
Animal observation and vaccine	178(0.85)	2,162(10.42)	16,607(79.99)	72(0.34)	1,744(8.40)	20,763(55.66)
Vaccine	165(3.09)	406(7.61)	1,739(32.61)	558(10.46)	2,465(46.23)	5,333(14.29)
Serum and vaccine	43(3.82)	7(0.62)	187(16.64)	26(2.31)	861(76.61)	1,124(3.04)
Total	507(1.36)	6,712(18.00)	23,914(64.12)	708(1.89)	5,457(14.63)	37,298*

Legend: \* 698 cases had no information about treatment

**Table 3.** Visits according to treatment indication as excessive, adequate and deficient

Indication of treatment	Excessive n(%)	Adequate n(%)	Deficient n(%)	Total n
Dispensing with treatment	486 (96.86)	21 (3.14)	-	507
Animal observation	2,575 (38.36)	3,751 (55.88)	386 (5.76)	6,712
Vaccine	26 (3.67)	558 (78.82)	124 (17.51)	708
Animal observation and vaccine	1,926 (8.05)	16,607 (69.45)	5,381 (22.50)	23,914
Serum and vaccine	-	861 (15.78)	4,596 (84.22)	5,457
Total	5,013 (13.44)	21,798 (58.45)	10,487 (28.11)	37,298

## Discussion

The studies conducted in Brazil related to the inadequacy of anti-rabies treatment showed rates ranging from 3.8%<sup>(11)</sup> to 24.7%.<sup>(12)</sup> A study in the city of Porto Alegre, also in the southern region of Brazil, observed that 96.20% of the visits were adequate,<sup>(13)</sup> demonstrating a reduced percentage of inadequate treatment, as advocated by the Technical Standards for the Prevention of Human Rabies. In contrast, this study found that 41.56% of anti-rabies visits were inadequate, with 13.44% having excessive treatment and 28.11% deficient treatment, and the principal excessive treatment was animal observation (51.36%), while for deficient treatment, animal observation and dispensing with vaccination (51.31%) were the most frequent. These results are similar to those found in the United States that showed inadequate and deficient treatment for those who were discharged.<sup>(14)</sup>

In the present study, it was verified that 4,596 (43.82%) deficient visits should have received serum and vaccine. Inadequate treatment can favor the development of the disease, because many individuals with rabies received inadequate treatment using the vaccination scheme and administration of the serum.<sup>(15)</sup> Another important fact was the number of visits of 5,013 (13.44%) of excessive

treatment that occurred when the patient did not require treatment. This result led us to reflect on the increase in public expenditure with the administration of serums and vaccines, and the human resources for this health area.

Regarding injury characteristics, the type of exposure without injury showed a risk of 4.14 for inadequate treatment. This fact can be explained because generally in these cases there is no need for prophylactic treatment, and the indicated treatment is to dispense with the treatment, however, the health services, possibly, due to insecurity, performed the rabies prophylaxis. This situation is demonstrated in other literature, in which results showed excesses of unnecessary procedures.<sup>(11,16,17)</sup>

The insecurity of treatment indication can possibly be the cause of the high risk of indirect contact as exposure type, which showed a 51.87 times higher chance for inadequate treatment. The type of treatment indicated for these cases is to wash the location with soap and water, and the individual is exempted from treatment, regardless of the type and condition of the animal attacker.

Lacerating and deep injuries were considered protective factors. The individuals who presented these types of injuries showed a decrease of 82% and 64%, respectively, in the risk of inadequate treatment, indicating good results, because the risk of developing the disease was higher in these cases.

With regard to the condition of the animal attacker, the suspect animal had a higher risk of inadequate treatment. This increased risk suggests that health professionals did not consider the condition of the animal attacker when the prophylactic was indicated, as noted in a study conducted in southeastern Brazil, where, in most of the cases examined, the utilization of the post-exposure prophylaxis was based only on the characteristics of the injuries.<sup>(18)</sup>

Although the dog was the principal animal attacker, other types of animals presented a risk for inadequate treatment, and this can be explained because some of the mentioned animals are not potential transmitters of rabies, such as in the case of

the rabbit and hamster, and do not require prophylactic treatment.<sup>(6,14)</sup>

The most frequently recommended treatment by health services in primary care was animal observation and vaccine, possibly because the injuries were more frequently of the mild type and it was possible to observe the animal attacker. This category of treatment also showed the highest number of cases of inadequate treatment, this treatment being indicated only for healthy dogs and cats that were possible to observe for ten days. The treatment with a higher risk of inadequacy was the dispensation of treatment, with an almost 208 times greater chance, if compared to individuals who presented with the treatment of animal observation and vaccine. These results are consistent with the observation made in the analysis of cases of indirect contact and cases without injury. In these situations, generally the treatment is to dispense with treatment or animal observation, and there is no need to perform the vaccination schedule, suggesting the existence of cases in which anti-rabies prophylaxis was initiated without necessity, as observed in a study in the region of São Paulo where 78.75% received the vaccine unnecessarily, as the animal attacker was healthy and subject to observation and after observation, the animal remained healthy.<sup>(11)</sup>

The failure to complete the data in the database of the national computerized system is a problem for research.<sup>(11,12)</sup> The surveillance system is faulty and there is a need to fix it, so that the information regarding the outcome of cases is conclusive. There is also a need to standardize the locations of records of indication and application of the prophylactic vaccine, because with the fragmentation of these locations, information regarding treatment is lost. This initiative would provide improved quality of records and information, reducing the risk of abandonment of treatment.<sup>(12)</sup> Even so, the computerized system, Sinan, presents reliability of information contained in the Anti-rabies Attendance Sheets for the performance of data analysis.<sup>(17)</sup>

The results of this study allowed us to reflect on the need for training of health professionals, in or-

der to improve the correct treatment indicated in primary care and a reduction in unnecessary prescriptions, avoiding adverse reactions and public spending on vaccines and anti-rabies serums.

## Conclusion

Prophylactic treatment of the first visit for post-exposure anti-rabies was inadequate in 41.56% of the prophylactic treatments.

## Collaborations

Moriwaki AM; Masukawa MLT; Uchimura NS; Santana RG and Uchimura TT declare that they contributed to the design and development of the research, analysis and interpretation of data, drafting the article, critically revising it related to intellectual content, and providing final approval of the version to be published.

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