

## Vital Surveillances

## Integrated Rabies Surveillance — Hunan Province, China, 2020

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## ABSTRACT

**Introduction:** The objective of this paper was to assess the epidemiology of rabies in Hunan Province, analyze the associated factors, understand the status of prevention and treatment after rabies exposure, evaluate the effectiveness of prevention and treatment, and provide a scientific basis for formulating effective prevention and control measures.

**Methods:** The surveillance data of rabies in Hunan Province in 2020 were collected and analyzed by descriptive epidemiological method.

**Results:** In 2020, a total of 59 cases of rabies were reported in Hunan Province, with an incidence rate of 0.09/100,000. Overall, 42 cases (71.19%) were due to animal bites and 43 cases (72.88%) were of grade III. The proportion of hand and combined injury of hand was the highest (40.68%). A total of 603,261 cases of rabies exposure were reported from the rabies post-exposure prophylaxis (PEP) clinic in Hunan Province. Dogs were the main animal causing injuries, accounting for 74.21%. Only 83,418 (13.84%) of the animals had a clear immune history, and a total of 11 dog attacks were reported in Hunan Province. The average immunity rate of dogs in the whole province was 30.98%. In 2020, 554 dogs were sampled in the whole province; 20 of them were positive for a positivity rate of 3.61%.

**Conclusions:** Rabies in Hunan Province in 2020 had a relatively low prevalence. Failure to treat wounds, immunoglobulin injections, and vaccination after exposure were the main causes of rabies. Therefore, post-exposure management of rabies should be further strengthened to reduce the risk of rabies for high-risk populations.

Rabies is an acute human and animal infectious disease mainly caused by rabies virus infection of the central nervous system. Human rabies is usually transmitted by the bite of an animal carrying the rabies

virus. There is no treatment method yet, and the case fatality rate is almost 100% (1–2). Since 1998, the incidence of rabies in China began to slowly increase, and after reaching the peak in 2007, the incidence generally decreased (3). Hunan Province had one of the highest incidences of rabies in China (4). In order to assess the epidemic situation and epidemic factors and provide a scientific basis for formulating effective prevention and control measures, the characteristics and trends of rabies in Hunan Province in 2020 were analyzed.

## METHODS

The following aspects comprise the integrated rabies surveillance system: case surveillance, surveillance of prevention and treatment of rabies after exposure, surveillance of host animals, and laboratory testing methods.

**Case surveillance:** medical institutions at all levels and of various types diagnose rabies cases in accordance with the “Rabies Diagnostic Standards” (WS 281–2008). After receiving the rabies case report, each county and city’s CDC will conduct an epidemiological investigation of the case, fill in the “Rabies Case Investigation Form,” and collect specimens of the deceased for the provincial and municipal CDC for rabies virus testing.

**Surveillance of prevention and treatment of rabies after exposure:** all rabies post-exposure prophylaxis (PEP) clinics in Hunan are required to collect information about PEP services for all rabies exposure patients, including the PEP service seekers, exposure category, wound treatment, vaccination, and rabies immunoglobulin (RIG) use, by filling in the “Rabies PEP Clinic Registration Form,” which is reported to the Provincial CDC every month.

**Surveillance of host animals:** 14 sentinel counties were set up, and each county was required to collect 20 wounded dog brain tissue specimens throughout the year. If stray dogs or unlicensed dogs were killed in an epidemic focus (within a five-kilometer radius of the

case occurrence site) in the counties and urban areas where rabies cases had occurred, at least five canine brain specimens were collected. If one dog bit multiple people, then the brain specimens of that dog were collected as much as possible. All canine brain specimens were sent to the provincial CDC for rabies virus detection. The county-level CDC was required to collect, investigate, and understand the information of dogs and other host animals in the areas under its jurisdiction, including the number, density, and reported immunization numbers of dogs and cats, with the collaboration of relevant departments such as the local animal husbandry, veterinary, and public security sectors.

**Laboratory test methods:** Reverse transcription-polymerase chain reaction (RT-PCR) was used to detect rabies virus nucleic acid in case samples, and immunofluorescence and RT-PCR were used to detect canine brain samples. The direct immunofluorescence assay (DFA) was used to examine the dog brain.

## RESULTS

A total of 59 rabies cases were reported in Hunan Province in 2020, an increase of 4 cases from 2019, and the reported incidence was 0.09/100,000 population, including 24 confirmed laboratory cases. In 2020, a total of 32 cases were sampled and tested in the province. The case detection rate was 54.24% (32/59), of which 21 cases were positive and the positive rate was 65.63% (21/32). In 2020, 25 counties (cities, districts) reported rabies cases. All 59 cases reported died in 2020.

Of the 59 cases, 51 (86.44%) did not treat wounds by themselves or attend medical institutions for wound treatment after exposure and did not receive vaccination or use RIG. Only eight went to medical institutions for wound treatment, three had their wounds squeezed and bled, five had their wounds cleaned and disinfected, and only four cases received RIG but not the complete rabies vaccine (Table 1).

In 2020, a total of 11 incidents of multi-victims

TABLE 1. Characteristics of exposure history and post-exposure prophylaxis, Hunan Province, 2020.

Contents	Number of cases	Constituent ratio (%)
Wound site		
Hand and combined injury of hand	24	40.68
Lower limb below knee	12	20.34
Arm	6	10.17
Head and face combined injury	5	8.47
Lower limbs above knee	6	10.17
Unknown	6	10.17
Exposure mode		
Bite	42	71.19
Scratch	7	11.86
Others	10	16.95
Exposure level		
Degree I	2	3.39
Degree II	14	23.73
Degree III	43	72.88
Wounding animals		
Dogs	56	94.92
Cats	2	3.39
Others	1	1.69
Category of wounding dog		
Self-raised	22	39.29
Neighbor raised	17	30.36
Stray dog	17	30.36

bitten by a single dog (i.e., one dog injuring three or more people) were detected. Overall, 8 of the 11 incidents occurred in rural areas and 3 in urban areas. Almost all months had such incidents reported except January, April, July, and December, and there were 2 incidents in March, August, and October. The incidents took place in 5 cities, including Yueyang (3 incidents), Yongzhou (3 incidents), Loudi (2 incidents), Changsha (2 incidents), and Changde (1 incident).

A total of 11 dogs were involved in the 11 incidents, of which 7 were stray dogs (63.64%) and 4 were domestic dogs; none of the domestic dogs had a history of animal rabies vaccination. Brain specimens of 10 dogs were collected for DFA detection, and the detection results were 100% positive.

A total of 67 persons were exposed in 11 incidents, with one incident involving as high as 10 persons, and the rest less than 10. Among all the exposed persons, 61 were classified as level III and 6 as level II. All victims were given standardized PEP according to the national guidelines and none developed rabies.

A total of 603,261 outpatients were reported in rabies PEP clinics in Hunan, accounting for 0.86% of the total population of Hunan (70.5 million). Of all reported outpatients, the male-female sex ratio was 1.04:1; exposure grades I, II, and III accounted for 3.46%, 49.73%, and 46.81%, respectively. Injured animals were mainly dogs (447,316, 74.21%). Only 83,418 (13.84%) of attacking animals had a clear immune history.

From the surveillance data reported in Hunan, 44.96% of all outpatients treated the wounds in time after exposure; 87.45% received wound treatment in various preventive clinics; 96.84% were fully vaccinated after exposure; and 139,414 exposures received antiserum or immunoglobulin, accounting for 49.41% (139,414/282,173) of all graded exposure.

Rabies host animal surveillance data were reported in 14 sentinel cities in Hunan Province. According to the data reported, the density of dogs varied greatly in

Hunan Province, with a range of 1.48–8.43/100 people and an average of 4.51/100 people. The immunization rates of the dogs also varied greatly among different cities, ranging from 11.82% to 68.24%, with an average of 30.98%.

In 2020, 554 dogs' brain tissue was collected in Hunan Province, and 20 dogs tested positive with a positivity rate of 3.61%. The positive detection of different kinds of dogs is shown in [Table 2](#).

## DISCUSSION

In 2020, there was a slight decrease in the number of reported cases in counties and districts, but there was a small rebound in the number of human cases (59 cases), compared to that of 2019 (55 cases). Rabies in Hunan Province continued to show a low epidemic level. This study also indicated that the risk of rabies was still high, and PEP was still not standardized, which was the main cause of death.

The canine surveillance of the disease control system in our province showed that the infection rate of dogs in our province increased significantly in the past 3 years (3.48% in 2017, 15.55% in 2018, and 10.02% in 2019). The infection rate decreased to 3.61% in 2020, which may be related to COVID-19 as animals moved less outside, reducing the risk of infection among animals (5).

The main factor of rabies risk was the country dogs that were kept in free range; the country dogs have a low immunity rate, free range, and come into contact with stray dogs and even wild animals (6–8).

In 2020, the majority of cases in Hunan Province were from farmers and students. The cases occurred in all months of the year, mainly in the population aged 55–65. Of the 59 cases, 51 (86.44%) did not receive any treatment for the wounds or go to a medical institution after exposure without vaccinations and passive immunizations. The number of cases in Shaoyang and Yongzhou accounted for 81.36% of the total number of cases, which may be due to the

TABLE 2. Results of dog rabies virus detection from different sources in Hunan Province in 2020.

Source of dogs	Number of dogs	Number of positive cases	Positive rate (%)
Generally hurt dogs*	265	2	0.75
Dogs in epidemic source areas†	258	0	0.00
Hurt multiple dogs‡	31	18	58.06
Total	554	20	3.61

\* A dog that only hurts one person.

† The dogs raised in areas within 5 kilometers of the location of the human rabies case.

‡ Three or more people were injured by one dog.

underdeveloped economy and low level of urbanization. It is suggested that Hunan Province should strengthen its rabies prevention and control work in Shaoyang and Yongzhou. In addition, we will strengthen medical insurance reimbursement for middle-aged and elderly people after rabies exposure, and urge them to vaccinate after exposure. Simultaneously, publicity and health education should be increased to reduce the risk of disease (9–11).

Rabies prevention and control needs to establish and improve the rabies joint prevention and control mechanism with the participation of public security, urban management, agriculture and rural areas, health, and other departments. Actions include establishing and improving dog management methods, removing stray dogs, and carrying out the work of exterminating dogs in epidemic areas (12–14). At the same time, it is also necessary to strengthen the construction of standardized rabies prevention and treatment in outpatient clinics, carry out the planning and training of outpatient staff in key areas, and improve the success rate of prevention and treatment after rabies exposure to reduce the number of cases (15).

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## REFERENCES

1. Wang XK, Song MH, Chen ZH. Progress in anti-viral treatment of rabies. *Chin J Exp Clin Virol* 2020;34(2):221–4. <http://dx.doi.org/10.3760/cma.j.cn112866-20190506-0063>. (In Chinese).
2. Liu X, Zhu WY. Research progress on rabies treatment methods and application of antiviral drugs. *Chin J Zoonoses* 2021;37(5):444–9. <https://d.wanfangdata.com.cn/periodical/ChlQZXJpb2RpY2FsQ0hJTmV3UzlwMjJwMzlyEhJ6Z3JzZ2hienoyMDIxMDUwMTMaCGM3OXA5aTVl>. (In Chinese).
3. Liu JJ, Duo L, Tao XY, Zhu WY. Epidemiological characteristics of human rabies in China, 2016–2018. *Chin J Epidemiol* 2021;42(1):131–6. <http://dx.doi.org/10.3760/cma.j.cn112338-20200116-00037>. (In Chinese).
4. Yang H, Deng ZH, Sun QL, Zhang HJ, Zhao SL, Zhang SY, et al. Analysis on the events of multi-victims bit by single dog in Hunan province from 2013 to 2017. *J Trop Dis Parasitol* 2018;16(2):86–9. <http://dx.doi.org/10.3969/j.issn.1672-2302.2018.02.007>. (In Chinese).
5. Lyu S, Gao F. Investigation of outpatients exposed to rabies on knowledge of rabies in Huangpu District, Shanghai. *Shanghai J Prev Med* 2021;33(8):708–13. <http://dx.doi.org/10.19428/j.cnki.sjpm.2021.20099>. (In Chinese).
6. Wu DH. Prevention and treatment measures of major zoonosis in Guangde. *Chin J Anim Husb Vet Med* 2020(6):64. <http://dx.doi.org/10.3969/j.issn.1671-6027.2020.06.046>. (In Chinese).
7. Wang B, Yan MH, Wei DP, Li S, Tang HM. Value analysis of health education in prevention and control of rabies. *J Snake* 2021;33(1):80–1. <http://dx.doi.org/10.3969/j.issn.1001-5639.2021.01.023>. (In Chinese).
8. Chen Y. Analysis on prevention and treatment of rabies exposed patients in dog trauma clinic of Ninth Hospital of Xi'an in 2019. *Clin Res Pract* 2021;6(23):23–6. <http://dx.doi.org/10.19347/j.cnki.2096-1413.202123008>. (In Chinese).
9. Mao DJ. Rabies epidemic and prevention and control. *Graziery Vet Sci Electron Version*, 2019(17):45–6. <https://d.wanfangdata.com.cn/periodical/ChlQZXJpb2RpY2FsQ0hJTmV3UzlwMjJwMzlyEhdRS0MyMDE5MjAxOTEyMTcwMDA1MzY2MRoIb3RneGVscWV0%3D>. (In Chinese).
10. Tian BJ, Wu D, Yang F, Ning QE, Li YT, Chen D, et al. Comprehensive treatment and effect evaluation of a dog injury to multiple people. *Clin Res Pract* 2020;5(12):4–5,8. <http://dx.doi.org/10.19347/j.cnki.2096-1413.202012002>. (In Chinese).
11. Wen SY. Investigation and analysis of 11 cases of multiple people injured by one dog in Yudu County. *Med Forum* 2021;25(20):2932–3. <http://dx.doi.org/10.19435/j.1672-1721.2021.20.066>. (In Chinese).
12. Yin XR. Difficulties and solutions of grass-roots rabies prevention and control. *Vet Orientat* 2021(7):61–2. <https://kns.cnki.net/kcms/detail/detail.aspx?dbcode=CJFD&dbname=CJFDLAST2021&filename=DWBJ202107047&uniplatform=NZKPT&v=DJFeXBF5FPWhSNrtx87kGQiPpIF52mMzNFkACuLnYnSWeu-Sk7tHZgX4lplcuuWm>. (In Chinese).
13. Cao LZ, He J, Liu B, Song FG, Liu F, Liu QH, et al. Problems and countermeasures of dog management in Hengshui City. *Chin Livest Poult Breed* 2021;17(3):80–1. <http://dx.doi.org/10.3969/j.issn.1673-4556.2021.03.042>. (In Chinese).
14. He J. Rabies prevention and control measures. *Mod Anim Husb Technol* 2021(9):84–5. <http://dx.doi.org/10.19369/j.cnki.2095-9737.2021.09.045>. (In Chinese).
15. Zhang B, Liu QB, Li ZJ, Guo JL, Zhou GL. Thoughts on rabies prevention and control in Beijing. *Contemp Anim Husb* 2017(1):66–8. <https://kns.cnki.net/kcms/detail/detail.aspx?dbcode=CJFD&dbname=CJFDLAST2017&filename=DDXM201703033&uniplatform=NZKPT&v=5OeRQSS6uia2nC68qOKs1PT2QGzobKbN5K7D16yiNXp4Pie8s5avABxgsPd-4HU>. (In Chinese).