

## Preplanned Studies

## Epidemiological Characteristics of Visceral Leishmaniasis — Shanxi Province, China, 1950–2019

Yingze Zhao<sup>1</sup>; Ping Tie<sup>2</sup>; Yongfei Bai<sup>2</sup>; Liping Wang<sup>3</sup>; Yuhua Zheng<sup>2</sup>; Jiaojiao Zhang<sup>4</sup>;  
Xiao Qi<sup>3,†</sup>; Canjun Zheng<sup>3</sup>; Xiao-nong Zhou<sup>5</sup>

### Summary

#### What is already known about this topic?

Visceral leishmaniasis (VL) is the most serious form of leishmaniasis. In recent years, reported cases of VL have been gradually increasing in Shanxi Province, China.

#### What is added by this report?

The report describes the epidemiology of VL from 1950 to 2019 in Shanxi Province and the recent trend of VL reemergence.

#### What are the implications for public health practice?

Measures to prevent and control VL, such as health education, improving clinical diagnostics, strengthening epidemiological investigation capacity for VL cases, monitoring surveillance, and use of other evidence-based preventive measures, should be undertaken in Shanxi Province.

In recent years, the number of reported cases of visceral leishmaniasis (VL) has gradually been increasing in Shanxi Province, China. Using surveillance data from the Chinese Center for Disease Control and Prevention from 1950 to 2019, we analyzed and described trends and epidemiological characteristics of VL in Shanxi Province. Study results showed that the VL epidemic was reemerging, with a gradually expanding epidemic scope and evident aggregation in Shanxi Province. Among reported VL cases, 41.4% were among children under three years old and 15.7% were among adults over 60 years of age. It is necessary, therefore, to pay high attention to the reemergence of VL and take action to curb this trend in Shanxi Province.

VL data from 1950 to 2004 came from infectious disease report forms (paper version) that were delivered from agencies at each level to China CDC. These reports only provided annual summaries for each province and lacked detailed information about individual cases. Case-level data from 2005 to 2019 came from the National Notifiable Disease Reporting

System, and included detailed information such as age, gender, occupation, date of onset, and address of each case. Demographic data came from the public website of the Chinese Statistics Bureau (<https://data.stats.gov.cn/>). VL cases reported from 2005 to 2019 were diagnosed using the Criterion of Visceral Leishmaniasis Diagnosis of China (WS 258–2006) and based on clinical manifestations and rk39 test results (*1*). Early case diagnosis was based on pathogenic examination of bone marrow smears and clinical manifestations. SPSS software (version 22.0, IBM, New York, USA) was used for data processing and analysis. We estimated prevalence trends from 1950 to 2019 and analyzed season, population, and regional distribution data for 2005 to 2019.

The data showed that the prevalence of VL in Shanxi Province was very high in the 1950s, but decreased sharply after the 1960s, although there was an outbreak in 1972. From 1974 to 2004, VL was almost nonexistent in Shanxi Province, with only sporadic cases and an annual case count that never exceeded five. Since 2014, reported cases of VL had increased rapidly in Shanxi, with an annual rate of increase of 63.7%. The number of VL cases reported each year had been over 20 in the last three years, and was 47 in 2019 (*Figure 1*).

From 2005 to 2019, 140 VL cases were reported in Shanxi Province; 96 among males and 44 among females for a male:female ratio of 2.2:1. The youngest case was a 19-day infant, the oldest was 85 years old, and the median age was 21 years old. There were 58 cases under the age of 3, accounting for 41.4% of reported cases, and 22 were older than 60 years, accounting for 15.7%. Among 6 occupational groups, “children at home” had the most cases, with 43.6% of reports (*Table 1*).

Between 2005 and 2019, VL cases were reported every month of the year, with a peak reporting incidence in May and a second peak in January (*Supplementary Figure S1*, available in <https://weekly.chinacdc.cn/>).

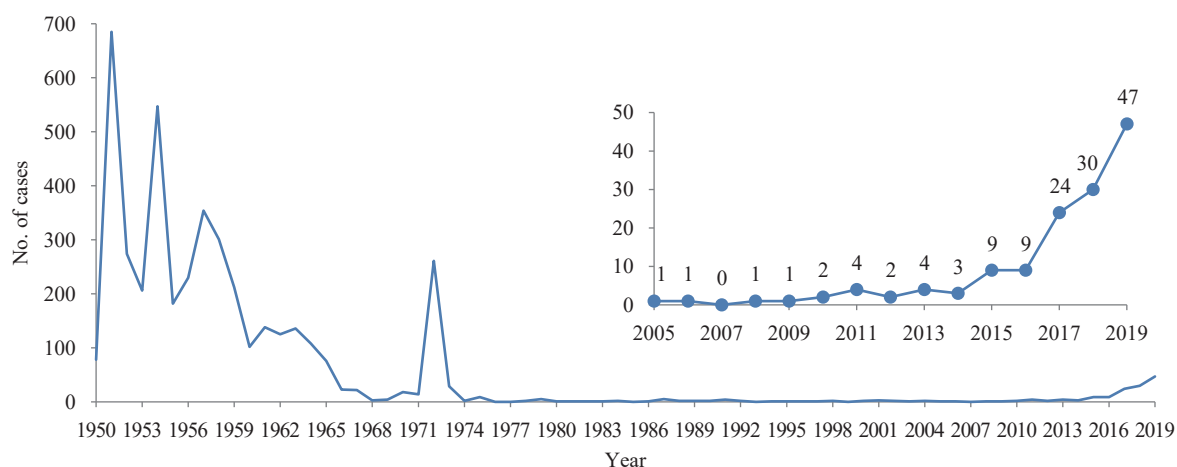


FIGURE 1. Prevalence trend of visceral leishmaniasis in Shanxi Province, 1950–2019.

TABLE 1. The reported visceral leishmaniasis cases by age and occupation in Shanxi Province, 2005–2019.

Item	Group	No. of male	No. of female	Total	Proportion (%)
Age (years)	0–2	31	27	58	41.4
	3–9	6	2	8	5.7
	10–19	3	1	4	2.9
	20–59	38	10	48	34.3
	60–	18	4	22	15.7
Occupation	Children at home	33	28	61	43.6
	Farmers	29	9	38	27.1
	Houseworkers	10	3	13	9.3
	Workers	8	0	8	5.7
	Students	6	2	8	5.7
	Others	10	2	12	8.5

There are 11 prefectures, 117 counties, and 1,390 townships in Shanxi Province. From 2005 to 2019, reported cases were seen in all 11 prefectures and in 29 counties and 67 townships. The number of townships, counties, and prefectures where cases were reported increased each year (Figure 2). Cases were aggregated. At the prefecture level, 89.9% of cases were distributed in Yangquan Prefecture (73 cases, 52.1%), Changzhi Prefecture (29 cases, 20.7%), and Linfen Prefecture (24 cases, 17.1%). At the county level, 57.1% of cases were distributed in 4 counties, including Suburb District of Yangquan (32 cases), Pingding County of Yangquan (19 cases), Wuxiang County of Changzhi (17 cases), and Urban District of Yangquan (12 cases). However, on a smaller scale, there was a sporadic trend. Of the 67 townships with reported cases during 2005–2019, the number of cases in each township varied from 1–5, with an average of 1.3 cases per township. Only 15 townships reported 2 or more cases

in the same year.

## DISCUSSION

Our study showed a VL resurgence in Shanxi Province. Historically, Shanxi Province was an epidemic area of zoonotic type VL, which is mainly transmitted from dogs to humans through sandfly bites — a common occurrence in infants and young children (2). VL prevalence is related to local distribution of sandflies and animal hosts in endemic areas. Changes in the natural and social environment often lead to outbreaks or reemergences of VL. Because large-scale actions such as controlling dogs, spraying insecticides, promoting the use of mosquito nets, and conducting health education were adopted in the 1970s, VL was almost eliminated in Shanxi Province (3). However, in recent years, the number of family dogs in Shanxi Province has been increasing (4). Since

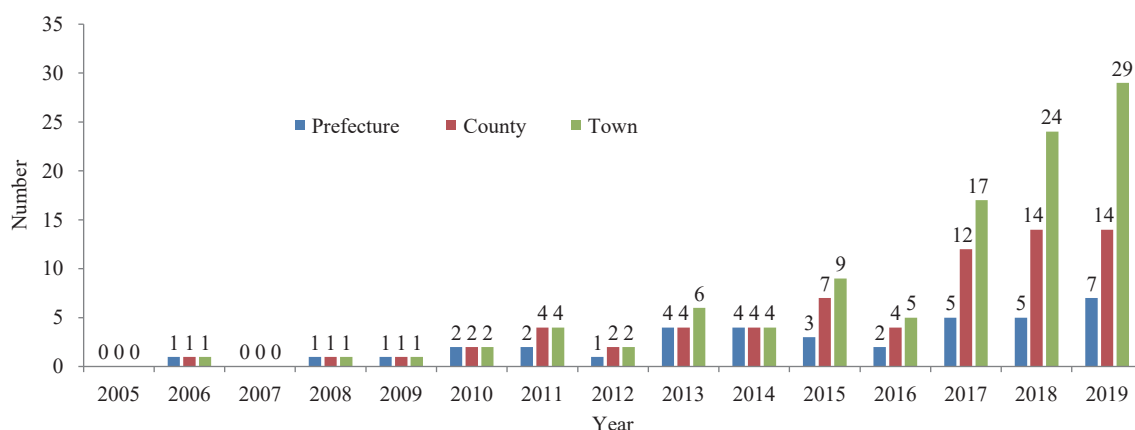


FIGURE 2. Changes of the number of towns, counties, and prefectures reported visceral leishmaniasis in Shanxi Province, 2005–2019.

China started implementing a policy of returning farmland to forests in 2000, Shanxi Province had returned 1.82 million hectares of farmland to forests by 2018 (5). This change may provide suitable conditions for an increase in density of wild animal hosts and growth in population of the main vector, the sandfly. The reemergence in recent years is likely related to these changes.

In our study, the infection rate in males was higher than in females, which is consistent with the epidemic characteristics in endemic areas in Gansu Province and Xinjiang Uygur Autonomous Region in China (6). It is generally believed that because males have more field activities, they have a higher exposure risk to sandflies, which leads to a higher incidence. Children under 3 years old accounted for a large proportion (41.4%) of cases. This is consistent with the characteristics of zoonotic VL caused by *Leishmania infantum*, which was historically epidemic in Shanxi Province. However, half of the cases were more than 20 years old, and 15.7% were among individuals over 60 years of age, which is significantly different from endemic areas in Gansu and Xinjiang (7–8). This phenomenon may be related to lack of immunity and high susceptibility to VL in adults, or to changes of VL type, infectious sources, routes of transmission, and vector habitats in those areas. The epidemiological history of these adult cases should be further investigated, including occupations, outdoor working conditions, and dog breeding activities.

VL cases reported from 2005 to 2019 were concentrated in a few prefectures in Shanxi Province, such as Yangquan, Linfen, and Changzhi prefectures. These three prefectures were previously severely endemic areas based on records in the 1950s. Sporadic VL cases had been reported every year since the 1980s,

indicating the existence of VL circulation in the local mountainous wild environments (9). Although the incidence in Shanxi Province has increased rapidly in recent years, a sporadic pattern of local VL at the community level has been seen in the last three years. This indicates that the VL epidemic is still at an early stage. The density of vector sandflies and the number of infection sources have not yet accumulated to the point of causing large-scale epidemics. A retrospective investigation and analysis of VL cases in Yangquan City in 2021 showed that eliminating sandflies, preventing sandfly bites, managing sick dogs, and strengthening clinical diagnostic abilities are the main measures to control *Leishmania infection* (10). It is necessary to take effective measures as soon as possible to curb the epidemic trend.

This study had several limitations. Available data lacked detailed laboratory and epidemiological information related to cases, including VL typing, occupational characteristics, and living habits. We were unable to evaluate the ecological relationship between natural or social environmental changes and VL incidence. Therefore, this study cannot provide related prevention and control suggestions.

In summary, VL control and prevention should be paid attention to in Shanxi Province. Health education on VL prevention and control knowledge for clinicians, patients, and high-risk populations should be strengthened. Detection, diagnosis, and epidemiological investigation capacity of medical staff should be improved. VL vector and host monitoring should be strengthened. Finally, proven preventive measures, such as use of mosquito nets, spraying insecticide against sandflies, and management of sick dogs should be used to curb the expansion of reemergence of VL in Shanxi Province.

**Conflicts of interest:** No conflicts of interest reported.

**Funding:** Supported by grants from the China Mega-Project on Infectious Disease Prevention (No. 2018ZX10713001).

doi: 10.46234/ccdcw2022.121

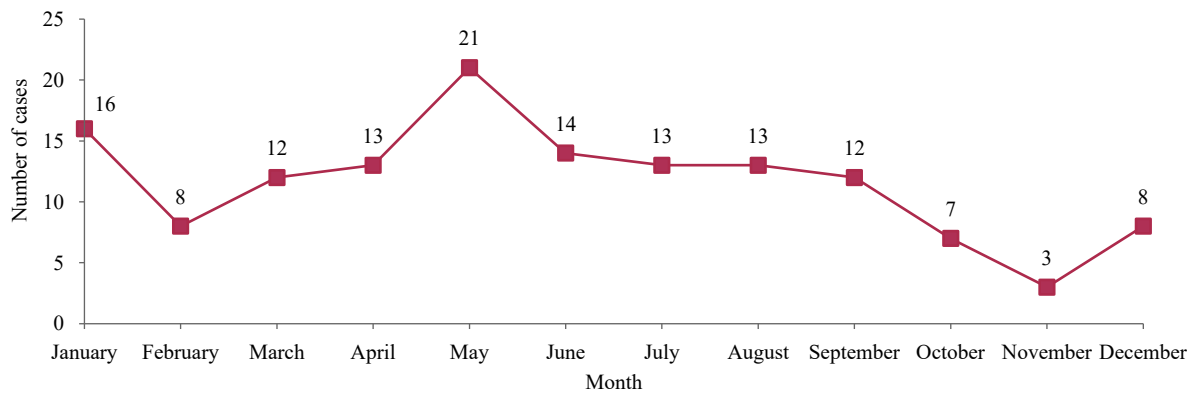
\* Corresponding author: Xiao Qi, qixiao@chinacdc.cn.

<sup>1</sup> National Institute for Viral Disease Control and Prevention, Chinese Center for Disease Control and Prevention, Beijing, China; <sup>2</sup> Shanxi Provincial Center for Disease Control and Prevention, Taiyuan City, Shanxi Province, China; <sup>3</sup> Chinese Center for Disease Control and Prevention, Beijing, China; <sup>4</sup> Beijing Center for Disease Control and Prevention, Beijing, China; <sup>5</sup> National Institute of Parasitic Diseases of Chinese Center for Disease Control and Prevention, Shanghai, China.

Submitted: May 03, 2022; Accepted: May 29, 2022

## REFERENCES

1. Wang JY, Gao CH. Interpretation of diagnostic criteria for Kala-azar. *Chin J Schisto Control* 2017;29(5):541 – 3. <http://dx.doi.org/10.16250/j.32.1374.2017109>. (In Chinese).
2. Zhang P, Shen ZY, Zhang YP, Han XL, Liu ZJ. Research progress of clinical epidemiology, prevention and treatment on visceral leishmaniasis. *Med J Natl Defend Forces Northwest China* 2019;40(11):703 – 8. <http://dx.doi.org/10.16021/j.cnki.1007-8622.2019.11.010>. (In Chinese).
3. Zheng CJ, Wang LY, Xu X, Zhu XH, Wu WP. Visceral leishmaniasis in China during 2004-2007. *Chin J Parasitol Parasit Dis* 2009; 27(4):344-6. <http://www.jsczz.cn/CN/Y2009/V27/I4/12>. (In Chinese).
4. Dong YY. The current situation, existing problems and development countermeasures of canine industry in China. *Mod Anim Husband* 2010(4):45 – 8. <http://dx.doi.org/10.14070/j.cnki.15-1150.2010.04.041>. (In Chinese).
5. Zheng F. Problems and countermeasures in the construction of converting cropland to forest project in Shanxi Province. *For Shanxi* 2019(1):4 – 5. <http://dx.doi.org/10.3969/j.issn.1005-4707.2019.01.001>. (In Chinese).
6. Zheng CJ, Xue CZ, Wu WP, Zhou XN. Epidemiological characteristics of Kala-azar disease in China, during 2005-2015. *Chin J Epidemiol* 2017;38(4):431 – 4. <http://dx.doi.org/10.3760/cma.j.issn.0254-6450.2017.04.004>. (In Chinese).
7. Maimaitiyming Y, Zhang HT, Zhang S, Zhumahong R, Abuduwayiti S. Epidemic analysis of Kala-azar in Xinjiang Uygur autonomous region from 2004 to 2014. *Bull Dis Control Prev* 2015;30(3):5 – 8,17. <http://dx.doi.org/10.13215/j.cnki.jbyfkztb.1501057>. (In Chinese).
8. Liu LL, Guan ZP, Li F, Yu DW. Retrospective analysis of epidemic feature of visceral leishmaniasis in Wen county of Gansu province from 2009 to 2017. *Bull Dis Control Prev* 2019;34(1):29 – 31,57. <http://dx.doi.org/10.13215/j.cnki.jbyfkztb.1808006>. (In Chinese).
9. Xiong GH, Jin CF. The impact of sandflies and leishmaniasis research on the development of western China. *Chin J Parasitol Parasit Dis* 2003;21(2):119 – 22. <http://dx.doi.org/10.3969/j.issn.1000-7423.2003.02.017>. (In Chinese).
10. Duan XH. Retrospective investigation and analysis of 82 cases of Kala azar in Yangquan City, Shanxi Province. *Shanxi Med J* 2021;50 (13):2019-20. <https://d.wanfangdata.com.cn/periodical/ChlQZXJpb2RpY2FsQ0hJTmV3UzIwMjIwNDE1Eg9zeHl5enoyMDIxMTMwMD EaCDExcGg1c3Uz>. (In Chinese).



SUPPLEMENTARY FIGURE S1. Seasonal distribution of reported visceral leishmaniasis in Shanxi Province, 2005–2019.