Spatiotemporal patterns of cutaneous leishmaniasis in the district Dera Ismail Khan, Khyber Pakhtunkhwa, Pakistan

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Introduction

Cutaneous Leishmaniasis

- ❑caused by flagellated protozoan
- ❑transmitted by Sandfly
- ❑public health burden
- ❑causes disfiguring sores
- ❑stigmatization and discrimination

- ➢ The distribution of sand fly population and its' life cycle depends on climatic and geographical variables.
- ➢ Several models have been developed to predict the hot spots for cutaneous leishmaniasis in different countries (Pakzad et al., 2017; Talmoudi et al., 2017; Shiravand et al., 2018).
- ➢ Environmental variables influencing CL endemic locations in Pakistan are not understood clearly. The current study was aimed to determine the prevalence of cutaneous leishmania and to develop risk map for predicting CL distribution in Khyber Pakhtunkhwa, Pakistan
- ➢ **Study Period:**

Study Area:

- January 2019 to March 2022
- Patients belonged to 5 tehsils of districts Dera Ismail Khan of Province KP, Pakistan

Methodology

- ➢ A tehsil-wise epidemiological data of microscopically declared CL positive patients was collected from different local hospitals and CL centers, i.e. District Headquarter Hospital D.I.Khan and Tehsil Headquarter Hospital Kohat.
- ➢ The geographical coordinates of the patients' residences were collected using the Google Earth (ver. 7.3).
- ➢ After assortment, CL cases and climatic data were analyzed through ArcGIS version 10.8.

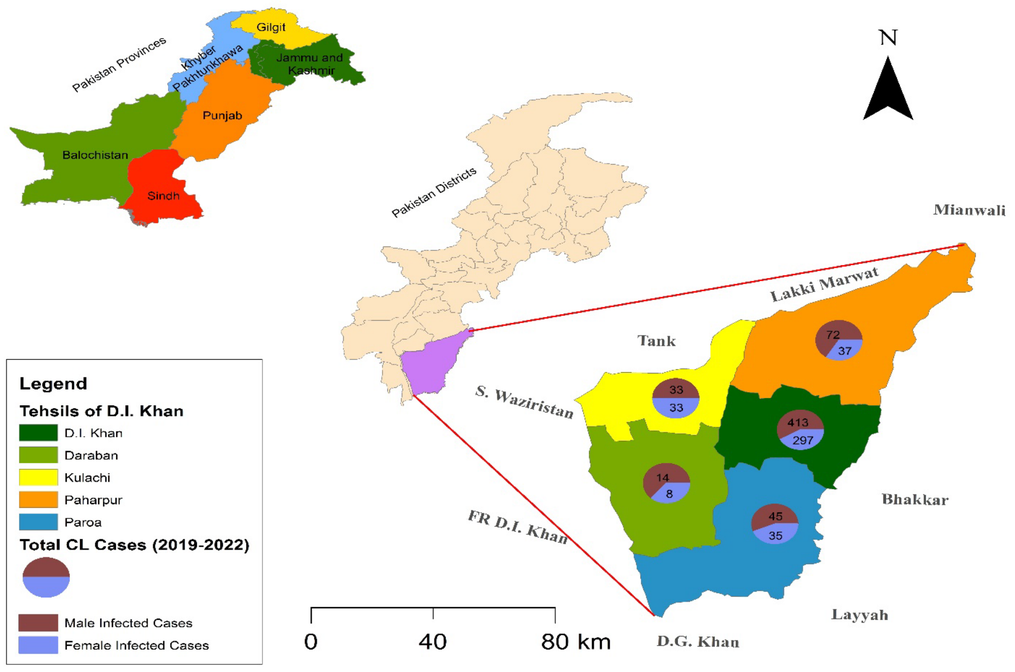


Figure 1: Map of study area indicating location of sampled villages with defined male and female ratio.

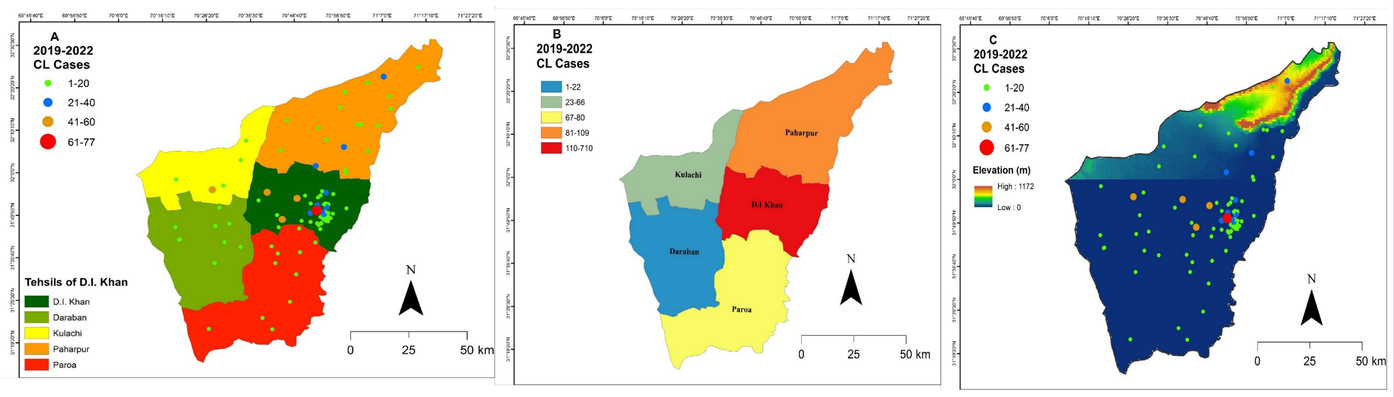
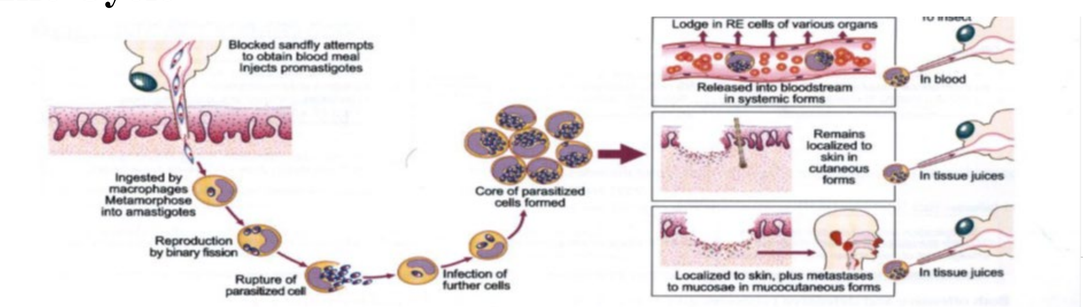


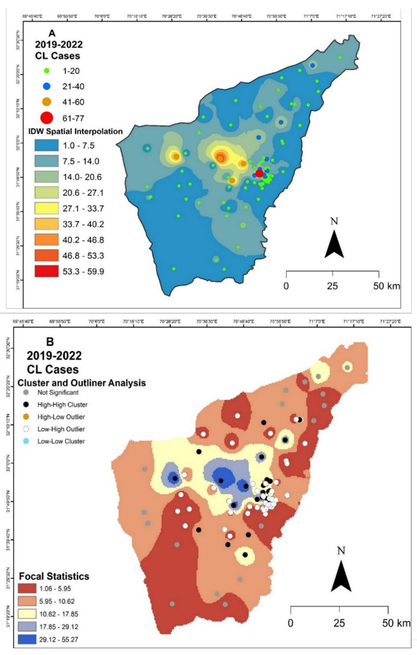
Figure 2. (**A**) Cutaneous leishmaniasis (CL) cases in each tehsil, showing the highest and lowest incidences across the district; (**B**) a choropleth map showing district-based CL cases; (**C**) a digital elevation model (DEM) map illustrating the occurrence of CL at different altitudes.

Life Cycle



Results

- ➢ During the last four consecutive years, a total of 1135 microscopically confirmed CL positive cases were reported in the Dera Ismail Khan District (Fig. 1). The incidence of CL has been sharply decreased from 2019 (n= 423, 37.3%) to 2022 (n=78, 6.9%). CL cases were more prevalent in D.I.K tehsil (n= 712, 62.7%) and adjacent areas of district (n=146, 12.6%) followed by Paharpur (n=109, 9.6%), Paroa (n=80, 7%), Kulachi (n=66, 5.8%) and Daraban (n=22, 1.95). Gender-based annual distribution of CL cases followed a decreasing pattern of infection in both males (700, 61.7%) and females (435, 38.3%), while age-wise highest annual incidence of CL was recorded in 1–20-year age groups (n= 734, 64.7%) and a decrease has been observed in older age groups. Cutaneous lesions, ulcers, and nodules have been identified as the most frequent clinical characteristics. The interval between the beginning of the CL lesion and the diagnosis might range from less than two months to more than a year. The result showed statistically significant (R=0.503, P=0.005) reduction in number of lesions with an increase in months (Table 1).
- ➢ The highest and least occurrence of average incidence CL in each union council of five Tehsils of Dera Ismail Khan is visually described in figure 2A. A choropleth map (Fig. 2B) demonstrated the highest CL incidence in Tehsil D.I.K (n= 712, 62.7%) followed by Paharpur (n=109, 9.6%), Paroa (n=80, 7%) Kulachi (n=66, 5.8%), and lowest CL incidences were reported from Daraban (n=22, 1.95). The incidence of CL has been decreased with high altitudes and highest in Zaffar Abad and Chahkan village of Tehsil D.I.K (Fig. 2C).
- ➢ The future epidemic threats of CL infection were validated by IDW analysis, where the CL cases were high at D.I.K, Kulachi and Paharpur. The IDW analysis justified the threats of CL infection in the areas located closer to the highest CL presenting villages (Fig 3A). Cluster and Outliers analysis was performed, and high cluster villages were D.I.K (z-score= 1.8, P=0.071397) and Paharpur (z-score= 1.4, P=0.142513). The other villages were fond not significant (Fig. 3B).



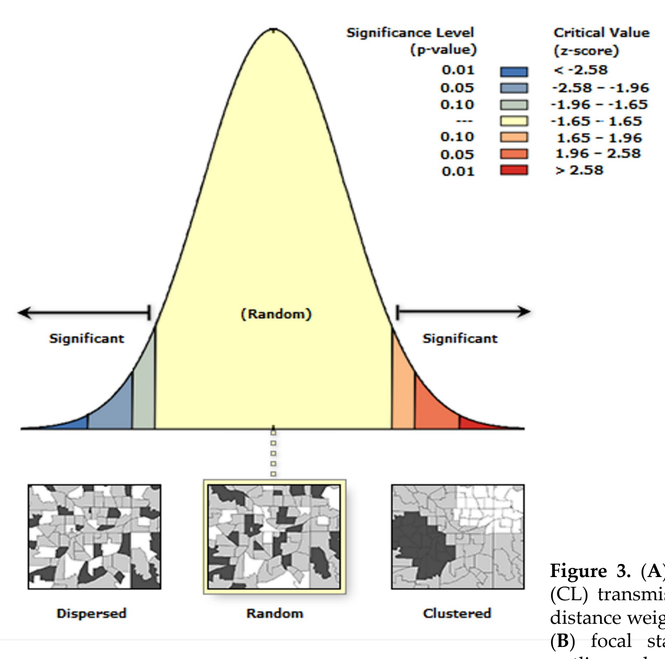


Figure 3. (**A**) Cutaneous leishmaniasis (CL) transmission analyzed by inverse distance weighting (IDW) interpolation; (**B**) focal statistics with cluster and outlier analysis.

Table 1: Demographic and clinico-epidemiological characteristics of the studied population (2019-2022).

Variables		2019 n (%)	2020 n (%)	2021 n (%)	2022 n (%)	Total (%)	R(adjusted)	R(squared)	Significant value
Annual Incidence		423(37.3)	419 (36.9)	215(18.9)	78(6.9)	1135 (100)			
Age groups (years)	1-20	262(70)	271(65)	146(68)	55(71)	734(64.7)	0.556	0.645	0.005
	21-40	114(27)	95(23)	46(21.3)	19(24.3)	274(24.1)			
	41-60	38(9)	41(10)	66(31)	2(3)	101(8.9)			
	≥61	9(2.1)	12(3)	3(1.3)	2(3)	26(2.3)			
Gender	male	256(61)	259(62)	132(61.3)	53(68)	700(61.7)	0.27	0.166	0.316
	female	167(39.4)	160(38.1)	83(39)	25(32)	435(38.3)			
No. of lesions	single	316(75)	341(81.3)	154(72)	53(68)	864(76.1)	0.329	0.425	0.08
	multiple	107(25.2)	78(19)	61(28.3)	25(32)	271(23.9)			
Site of lesions	face	126(30)	128(31)	69(32)	25(32)	348(30.7)	0.194	0.23	0.9
	upper extremity	116(27.4)	107(26)	69(32)	38(49)	330(29.1)			
	lower extremity	142(34)	154(37)	77(36)	15(19.2)	388(34.2)			
	mixed	39(9.2)	30(7.1)	0(0)	0(0)	69(6.1)			
Duration of lesion (months)	1-2	239(57)	267(64)	106(49.3)	36(46.1)	648(57.1)	0.503	0.68	0.005
	3-4	100(24)	93(22.1)	56(26)	23(29.4)	272(24)			
	5-6	31(7.3)	15(4)	25(12)	13(17)	83(7.3)			
	7-8	38(9)	29(7)	16(7.4)	6(8)	89(7.8)			
	≥9	15(4)	15(4)	13(6)	0(0)	43(3.8)			
Area	D.I.K	286(68)	256(61)	129(60)	41(53)	712(62.7)	0.57	0.663	0.001
	Daraban	6(1.4)	15(4)	1(0.4)	0(0)	22(1.9)			
	Kulachi	13(3)	43(10.2)	8(4)	2(3)	66(5.8)			
	Paharpur	26(6.1)	29(7)	40(19)	14(18)	109(9.6)			
	Paroa	26(6.1)	23(5.4)	19(9)	12(15.3)	80(7)			
	Adjacent areas	66(16)	53(13)	18(8.3)	9(12)	146(12.9)			

Conclusions

Leishmaniasis prevalence was high among the local population, but a temporal increasing pattern was seen in the tehsil D.I.K. and Paharpur, which suggests a potential danger for the spread of CL. For disease prevention and management at the individual and community levels, the area needs to get the right attention.

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Acknowledgments

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