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# Evaluation of Cutaneous Leishmaniasis cases in Şanlıurfa in 2019-2022 using geographic information systems

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| Keywords | Abstract |
|---|---|
| Cutaneous Leishmaniasis<br>Environmental factors<br>Geographic Information Systems | Cutaneous leishmaniasis (CL) is one form of the Leishmaniasis disease causing skin sores that may leave scars. Majority of CL cases (%80) worldwide is in WHO Eastern Mediterranean Region. Rural areas rather than urban areas are of greater potential for the transmission of the disease. Major risk factors including socioeconomic conditions, , such as poverty, malnutrition, lack of waste management, population mobility, changes in urbanization, changes in temperature, rainfall and humidity can be classified as environmental factors that exacerbate the condition. Cuteneous Leishmanisasis cases diagnosed upon the application of the patients have been recorded on the health surveillance system in control of the Ministry of Health. Geostatistics analysis methods, which is a type of analysis of Geographical information systems (GIS), were used in order to map the obtained data. During the period of the study 2601 CL cases were reported in Sanliurfa in total. This study showed the potential of the already existing disease in the region. Crowded areas where the settlements are disorganized seem to have higher risk for the CL cases to occur. |

## 1. Introduction

Leishmaniasis is a tropical/sub-tropical disease caused by the Leishmania protozoa, transmitted through the bite of an infected sandfly. Cutaneous leishmaniasis (CL) is one form of the Leishmaniasis disease causing skin sores that may leave scars. CL is seen worldwide including the Mediterranean coast (European Centre for Disease Control and Prevention [ECDC], 2022).

CL is the most common form of leishmaniasis characterized by skin lesions and ulcers on the exposed parts of the body. This form of the disease may leave life-long scars and serious disability or stigma. Between 600 000 to 1 million new CL cases are estimated to occur worldwide annually. The transmission of *Leishmania* parasites is caused by the bite of infected female phlebotomine sandflies. Characteristics of the parasite and sandfly species, local ecological characteristics of transmission sites, current and past exposure of human population to the parasite, and human behaviour are some of the factors that determine the epidemiology of leishmaniasis. Natural reservoir hosts of *Leishmania* parasites consist of nearly 70 animal species including humans. Majority of CL cases (%80)

worldwide is in WHO Eastern Mediterranean Region (World Health Organization [WHO], 2022).

Rural areas rather than urban areas are of greater potential for the transmission of the disease. Climatic factors along with other environmental changes expand the geographic distribution of sand fly vectors and therefore CL cases. The most active periods of the sand fly vectors are evening, night-time and twilight. (Centers for Disease Controland Prevention [CDC], 2022).

Major risk factors including socioeconomic conditions, such as poverty, malnutrition, lack of waste management, population mobility, changes in urbanization, changes in temperature, rainfall and humidity can be classified as environmental factors that exacerbate the condition.

## 2. Method

Şanlıurfa province is located in the southeastern of Turkey at 36°41'28''- 37°57'50'' N, 37°49'12''- 40°10'00'' E and with 18.765km²of surface area is the 7th largest city of the country. Sanliurfa province covers 13 counties. The study subjects are the inhabitans of the province. According to Turkstat data, the population of the

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province by the end of 2021 is 2.143.020 (Turkish Statistical Institute [Turkstat],2021).

Cuteneous Leishmanisasis cases diagnosed upon the application of the patients have been recorded on the health surveillance system in control of the Ministry of Health. The online surveillance system includes CL cases in 13 counties of Sanliurfa Province as of April 2019 and the period of this study ends with CL cases in the early July 2022.

Geostatistics analysis methods, which is a type of analysis of Geographical information systems (GIS), were used in order to map the obtained data. GIS, a large domain that provides a variety of capabilities designed to capture, store, manipulate, analyze, manage, and present all types of geographical data utilizes geospatial and hydrospatial analysis in a variety of contexts, operations and applications. GIS and the underlying geographic information science that advances these technologies have a strong influence on spatial analysis. The increasing ability to capture and handle geographic data means that spatial analysis is occurring within increasingly data-rich environments. GIS provide platforms for managing these data, computing spatial relationships such as distance, connectivity and directional relationships between spatial units, and visualizing both the raw data and spatial analytical results within a cartographic context (Karabulut et al 2022).

Spatial analysis method, which is a type of analysis of geographic information systems, was used to analyze and map the obtained data. With spatial analysis, surface creation tools from values taken from certain points, the user can easily obtain the most accurate surface using geostatistical methods. 13 counties were mapped according to numbers of the CL cases by years and in total.
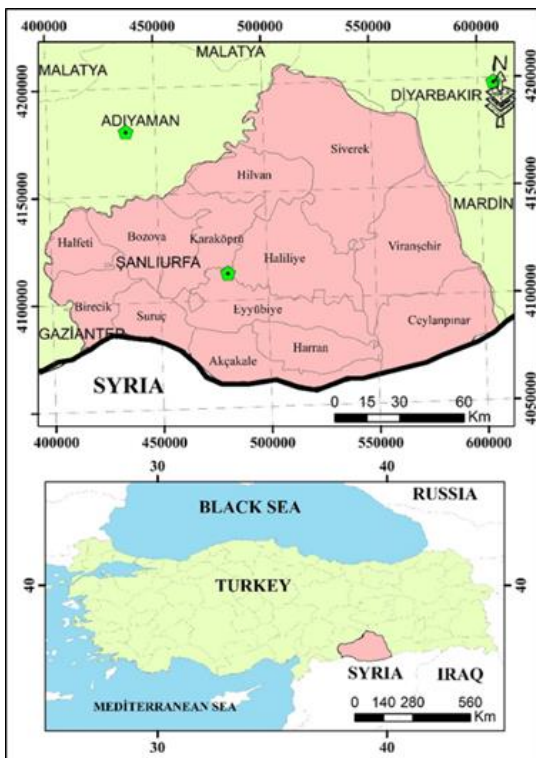


**Figure 1.** Map of Sanliurfa province indicating its location in the region

## 3. Results

During the period of the study 2601 CL cases were reported in Sanliurfa in total; consisting of 1404 (53,98%) children and 1197 (46,02%) adult patients. Of 2601 cases, 1292 (49,67%) were women and 1309 (50,33%) were men.

The cases were classified according to the date of diagnosis and presented in Table1. For 114 cases included in the study, no date of diagnosis was available and those 114 cases (4,38%) are excluded in the table. The distribution of the remaining cases by year is as follows: 136 cases (5,23%) in 2019; 345 cases (13,26%) in 2020; 1404 cases (53,98%) in 2021; 602 cases (23,14%) in 2022(first 7 months) respectively ''Table1''.

**Table 1.** Number of CL cases in the city of Şanlıurfa in each month during the period of study

|  | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|
| January |  | 63 | 44 | 276 |
| February |  | 11 | 36 | 142 |
| March |  |  | 36 | 73 |
| April | 4 | 39 | 19 | 37 |
| May |  | 39 | 24 | 46 |
| June | 1 | 40 | 25 | 26 |
| July | 1 | 32 | 12 | 2 |
| August |  | 22 | 28 |  |
| September | 1 | 18 | 89 |  |
| October | 43 | 17 | 241 |  |
| November | 35 | 22 | 418 |  |
| December | 51 | 42 | 432 |  |
| Total | 136 | 345 | 1404 | 602 |

Age distribution varied from age of 0 to age of 87. Mean age was calculated as 21,71 while median age was 15,00 and mode was 3.

As demonstrated in Table 2, among 13 counties, Eyyübiye has the highest number (n=882) of CL cases (33,91%) during the study period. Eyyübiye was followed by Ceylanpınar(n=456, %17,57) , Haliliye (n=293, 11,26%), Viranşehir (n=284, 10,91%) and Akçakale (n=275, 10,57%)''Table2''.

**Table 2.** Number of CL cases in the 13 counties in the city of Şanlıurfa during the period of study

| County Name | 2019 | 2020 | 2021 | 2022 | XXXX | Total |
|---|---|---|---|---|---|---|
| Akçakale | 1 | 5 | 186 | 78 | 5 | 275 |
| Birecik | 1 | 10 | 8 | 19 | 3 | 41 |
| Bozova | 5 | 9 | 4 | 6 |  | 24 |
| Ceylanpınar | 2 | 3 | 289 | 160 | 3 | 457 |
| Eyyübiye | 96 | 244 | 333 | 139 | 70 | 882 |
| Halfeti |  | 3 | 2 | 4 |  | 9 |
| Haliliye | 20 | 36 | 161 | 60 | 16 | 293 |
| Harran | 1 | 5 | 122 | 73 | 4 | 205 |
| Hilvan | 2 |  | 12 | 1 |  | 15 |
| Karaköprü | 5 | 21 | 41 | 20 | 5 | 92 |
| Siverek |  |  | 12 |  |  | 12 |
| Suruç |  | 3 | 4 | 4 | 1 | 12 |
| Viranşehir | 3 | 6 | 230 | 38 | 7 | 284 |
| Total | 136 | 345 | 1404 | 602 | 114 | 2601 |

The distribution of CL cases in the 13 counties of Sanliurfa from 2019 to 2022 is demonstrated in Figure 2.
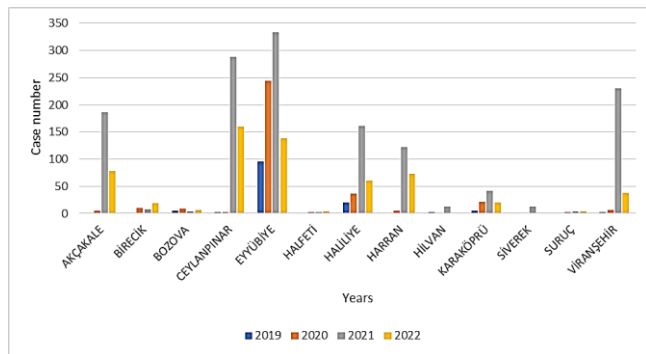


**Figure 2.** CL case numbers in the 13 counties of Sanliurfa from 2019 to 2022

## 4. Discussion

During the study period, 2021 is the year in which CL cases reach the highest number. December and November are the months of highest case numbers. The climatic factors seem to cause changes in the accumulation of the case numbers. Many studies reveal the importance of the season on vector born dieseases transmission (Caminade et al. 2014; Dhimal, Ahrens and Kuch 2015; Ostad et al. 2016).

Supporting our study, a systematic review concluded that for CL, probability of occurrence was greater in years with greater average winter precipitation (Valero and Uriarte 2020).

Also, our study shows different distribution of cases in between the 13 counties. The population group, their socioeconomic factors and other environmental factors may have played role in this distribution. Considering the clustering of the cases in Eyyübiye county, reveals that Eyyübiye county is of the highest risk for its residents compared to other counties of the province. This variation was expected as different studies have shown variations in between different parts of the study areas. (Salimi, Jesri, and Javanbakht 2018).

## 5. Conclusion

This study showed the potential of the already existing disease in the region. Children consist of more than half of the cases in the study period. Evironmental factors play a significant role in the transmission of the disease. Crowded areas where the settlements are disorganized seem to have higher risk for the CL cases to occur.
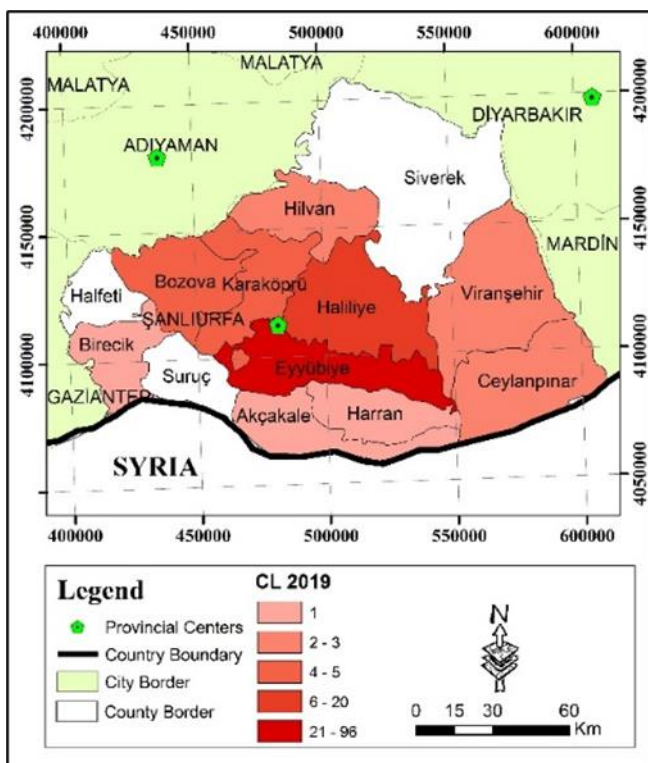
## Acknowledgement

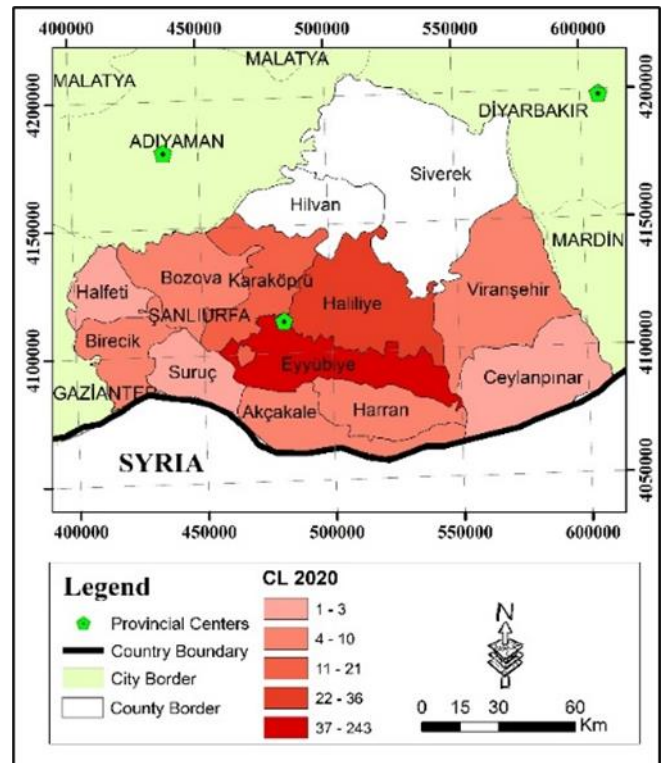**Figure 3.** CL case numbers distributed in 13 counties of Sanliurfa in 2019



**Figure 4.** CL case numbers distributed in 13 counties of Sanliurfa in 2020
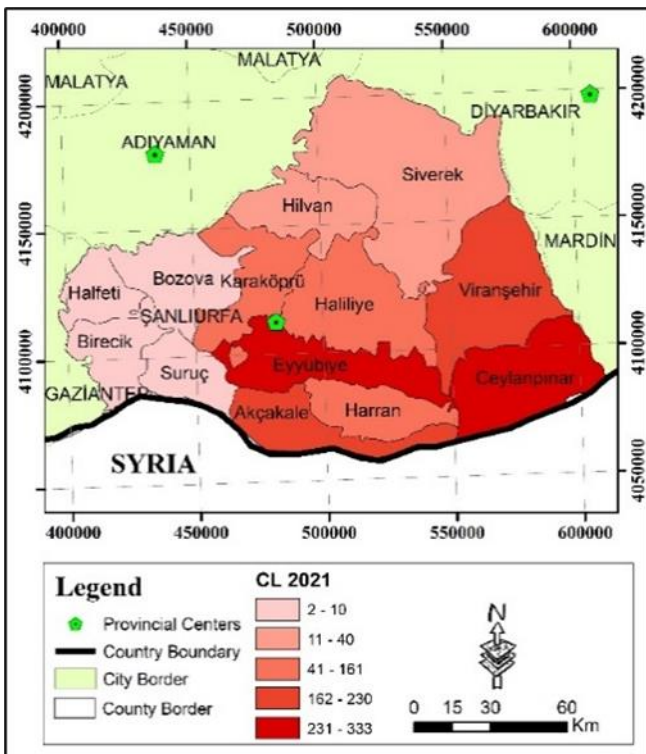
**Figure 5.** CL case numbers distributed in 13 counties of Sanliurfa in 2021
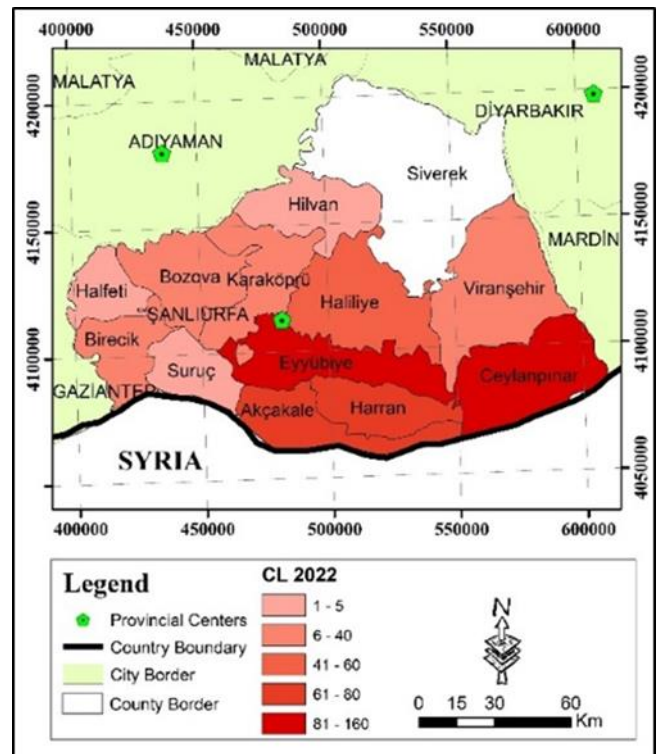


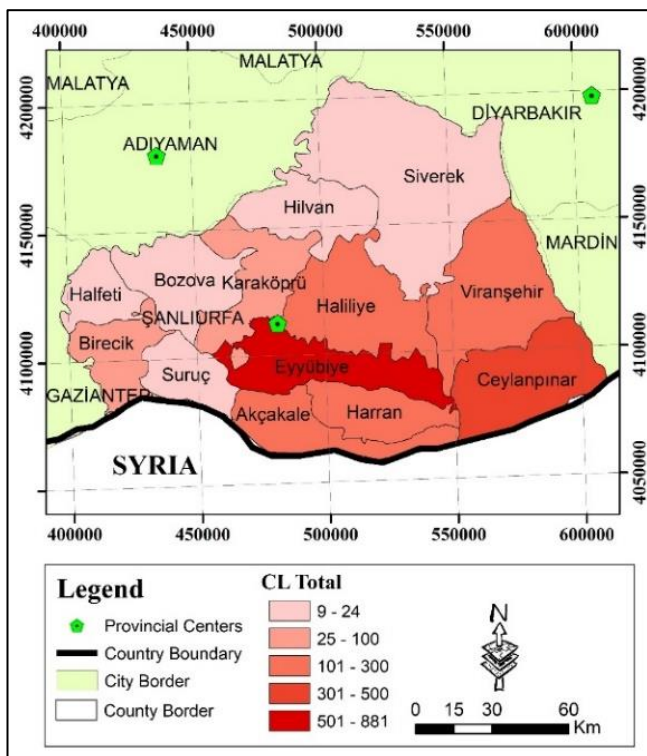**Figure 6.** CL case numbers distributed in 13 counties of Sanliurfa in 2022



**Figure 7.** CL case numbers distributed in 13 counties of Sanliurfa in 2019-2022

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