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A STUDY OF EPIDEMIOLOGY, SURVEILLANCE AND CASE STUDY OF MALARIA IN TELANGANA STATE

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Abstract

Historically, malaria in India was predominantly caused by *Plasmodium vivax*, accounting for 53% of the estimated cases. After the spread of drug-resistant *Plasmodium falciparum* in the 1990s, the prevalence of the two species remained equivalent at the national level for a decade. By 2014,, the extent of P. vivax has diminished to 34% broadly, yet with high territorial variety. In 2014, P. vivax represented around 380,000 jungle fever cases in India; close to a 6th of all P. vivax cases revealed internationally. Plasmodium vivax has stayed impervious to control measures, especially in metropolitan regions. Metropolitan intestinal sickness is transcendently brought about by P. vivax and is dependent upon episodes, frequently connected with expanded mortality, and set off by explosions of relocation and development. The study of disease transmission of P. vivax changes considerably inside India, incorporating numerous backslide aggregates with differing latencies between essential disease and backslide. Besides, the hypnozoite repository keeps up with transmission potential and empowers restoration of the parasite in regions in which it was thought killed. The weight of jungle fever in India is complicated due to the exceptionally factor jungle fever eco-epidemiological profiles, transmission factors, and the presence of numerous Plasmodium species and Anopheles vectors. This survey of P. vivax jungle fever in India portrays epidemiological patterns with specific consideration regarding four states.

Keywords: Malaria, Anopheles, Plasmodium, epidemiology, elimination, Telangana, India

1.1. INTRODUCTION

Malaria epidemiology in India is complex due to a wide distribution of all five species of human malaria parasites of the genus *Plasmodium* and ten different species of malaria vectors of the genus *Anopheles*. The presence of species complexes of *Anopheles* vectors, mixed *Plasmodium* species infections in a single human, rising numbers of asymptomatic *P. falciparum* cases, and host-switching of *P. falciparum* from Indian rhesus monkey to Indians make malaria epidemiology even more complex. A wide circulation of medication safe P. falciparum, bug spray safe Anopheles vectors, and jungle fever helpless people establish a climate helpful for jungle fever transmission in India. Two jungle fever disposal models were shown in the new past in profoundly endemic ancestral and unavailable regions in India, demonstrating that jungle fever can be killed with arranged and deliberate endeavors.

Malaria remains a major public health problem worldwide, with an estimated 241 million cases and 6,27,000 deaths in 2020. Although malaria cases have declined in recent years, there has been no significant progress in reducing global malaria cases. Malaria continues to be a major public health problem in India, currently accounting for 1.7% (4.2 million cases and 7,341 estimated deaths) of global malaria cases. Despite India's success in reducing its malaria (9.5 million cases in 2017 to 4.2 million cases in 2021), approximately 1.25 billion people live at risk of malaria. Since 2000, India has made significant progress in reducing the burden of malaria, but the road to elimination has proven challenging in Telangana. Some districts of Telangana that contribute to malaria risk in the country > 2 API. Malaria control and elimination strategies in Telangana are being intensified by the Department of Health and Family Welfare, Government of India and Government of Telangana, Non-Governmental Organizations (NGOs) and other stakeholders. Therefore, trend analysis of malaria data is of utmost importance to estimate the incidence of malaria to scale up intervention activities and to plan new strategies to deal with the disease, as this information is very useful in the fight against malaria. At each stage of malaria control and elimination, malaria risk maps and the identification of high-risk areas through spatial analysis are essential for resource planning and management. So far, no malaria risk maps have been produced for Telangana district and malaria epidemiological trends have not been well documented in the region. These limitations have prompted me to examine the 5-year malaria prevalence trends and identify malaria risk areas in Telangana state and therefore aim to describe the epidemiological scenario and transmission patterns of malaria in Telangana using malaria case data collected from the National Vector Borne Disease Control. Program (NVBDCP) from 2017 to 2020. This part of the study actually demonstrates the epidemiological profile of malaria in Telangana.

1. OBJECTIVES

- To study & analyse epidemiological situation of malaria in Telangana state
- To reduce malaria morbidity.
- To prevent the deaths due to malaria.
- To eliminate & eradicate of malaria from Telangana

3.1. METHODOLOGY

1, Collection of malaria incidence from different districts of Telangana state from the NVCBDP, Telangana.

2. Collection of incidences/ prevalence of malaria fever with respect to: -

- Year wise (2017-21)
- Type of malaria parasites i.e., Pv / Pf (2017-21)
- district wise (2017-21)
- Gender/sex wise (2017-21)
- Seasonal (month) wise (2017-21)

3. Identification of high malaria susceptible areas/hotspots in Telangana. Using case study report data analysed.

4. GIS mapping & analysis using API.

5. Hotspots areas are visited, conducting a survey programme among those tribal areas i.e., community knowledge, awareness and protective practices regarding were addressed among tribal people and students of that area & Rapid fever survey by house-to-house visit in tribal areas. done awareness programme & health camps with the help of PHCs doctors & govt. in high susceptible MBDs areas. Using existing & implementing new tools & strategies to eliminate malaria from Telangana, India.

3.2.Study Location/Area

FIGURE.1: Telangana state (33 districts) as a study area.

This research specifically focuses on the patterns and determinants of malaria transmission in the Telangana. Telangana is south-central in India. It is bordered by the states of Maharashtra to north, Chhattisgarh and Odisha to the northeast, Andhra Pradesh to southeast and south, and Karnataka to the west. Telangana constituted the north-central and northeastern portions of Andhra Pradesh. 18.1124°N, 79.0193° E (Figure 5.1.). It gets downpours during the southwest rainstorm season (June-September) and some precipitation during the withdrawing upper east storm (December-January). Jungle fever shows hypo-to hyper-endemic transmission around here, with significant disease. The jungle fever review was directed by taking 33 locale of Telangana information and contextual analysis in metropolitan regions, though the social study was led in the couple of towns found to have the most noteworthy commonness of intestinal sickness during the intestinal sickness overview. 33 areas which includes 636 essential wellbeing habitats (PHCs) and 249 urban primary health centres for medical services to the community.

4.1. Data Collection.

Month to month jungle fever case information by region wise from January2017 to December 2021 was secured from NVBDCP, Directorate of wellbeing, Telangana, Hyderabad. The jungle fever cases were affirmed by utilizing fast symptomatic test (RDT) units in the ancestral regions, and microscopy technique was utilized to check the presence of Plasmodium parasite in both ancestral and the nontribal locales. Age-wise jungle fever epidemiological information were accessible for the years 2017 to 2021 and Sex-wise information for the years 2017 to 2021.This epidemiological review analyzed jungle fever cases in each of the 33 Areas of the Telangana state between 2016 - 2020. Information were gathered from Locale Wellbeing Center's (DHCs) labs, Essential Wellbeing Place's (PHCs), different sub-focuses, Region Clinic, Sub-divisional Emergency clinic, and jungle fever sentinel fields. Yearly reports of area level totaled intestinal sickness case information were additionally gathered from the Division of Wellbeing and Family Government assistance, TS. Gathered information included species type circulation, age-sex distribution& occasional variety. Profoundly helpless areas of interest/regions are visited. Door to door fever review in the ancestral endemic regions, individuals were examined. The data with respect to LLINs (durable insecticidal nets) and fundamental asset which expected for vector control the information was gathered. What's more, a portion of the optional information is likewise gathered from the WHO, NVBDCP, CDC, NIMR, ICMR research articles/diaries and so forth were taken.)

Figure 2 : Visit to NVBDCP Office, Districts Health Center's (DHCs) laboratories, Primary Health Center's (PHCs), different sub-centers, District Hospital, Sub-divisional Hospital, and malaria sentinel fields.

4.2. Data Analysis

Using MS office. All the 33 districts of Telangana data was statistically analyzed & compared by using MS excel tool& the calculation is done and desired graphs were plotted for then conducted further case study. API CALCULATION and other data variables are summarized in table.5. Annual parasite incidence is calculated of all the 5 years data which was collected.

Data variables
1.Pop1000: **Population of the district/state in thousands in a particular year**
2.BSC (Blood Smears Collected): **Blood smears collected in a particular year**
3.BSE (Blood Smears Examined): **Blood smears examined in a particular year**
4.API (Annual Parasite Incidence): **The number of confirmed new malaria cases expressed per 1,000 individuals at risk under surveillance. It can be written as** **API=** $\frac{1000}{total\ population\ (country/state)} * $ **Total positive cases**
5. SPR (Slide Positivity Rate): **the number of laboratory-confirmed malaria cases per 100 suspected cases examined. Itcan be written as** **SPR =** $\frac{\text{Total positive cases}}{Total\ blood\ slide\ examined(BSE)} * 100$
6. ABER (Annual Blood Examination Rate**): It indicates the number of people receiving a parasitological test for malaria per unit population per year. It can be written as**

ABER $= \frac{\text{Number of slides examined}}{population} * 100$

7. AFI (Annual Falciparum Incidence): **The number of confirmed new *Plasmodium falciparum* cases expressed per 1,000 individuals at risk under surveillance. It can be written as**

AFI= $\frac{Total\ positives\ of\ falciparum}{total\ population\ (country/state)} *$ **Total positive cases**

8.Total**: Total Number of malaria cases (*Plasmodium vivax (Pv), Plasmodium falciparum (Pf) and mixed*) in a particular year**

9.Pv**: Total number of *Plasmodium vivax (Pv)* cases in a particular year**

10.Pf**: Total number of *Plasmodium falciparum (Pf)* cases in a particular year**

11.Mixed: **Number of positive cases for *Plasmodium vivax (Pv)* and *Plasmodium falciparum (Pf)* in a particular year**

12.Pf per**: Percentage of *Plasmodium falciparum (Pf)* cases among total cases in a particular year**

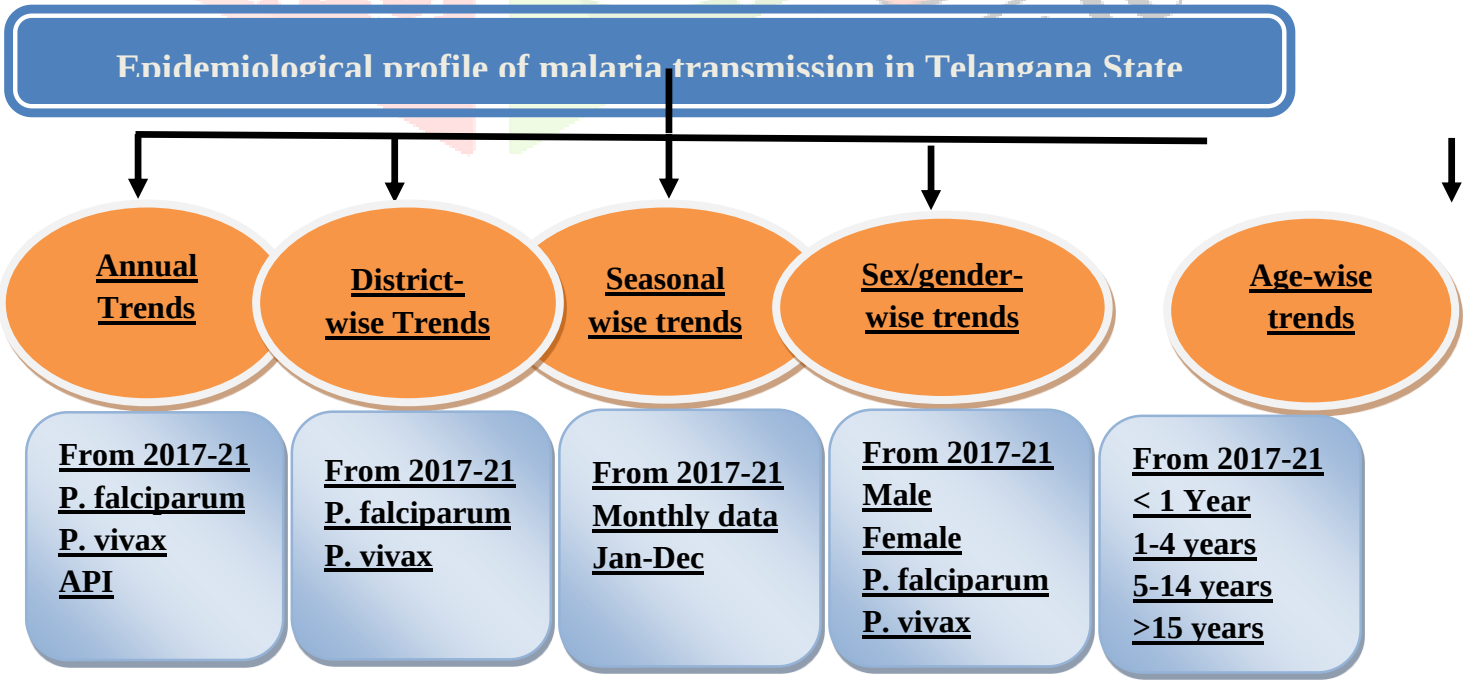
13.RT**: Radical treatment (RT) given in a particular year**

14.Total Death**: Total deaths due to malaria (cases due to *Plasmodium vivax, Plasmodium falciparum and mixed cases*) in a particular year**

15. Pv Death**: Total deaths due to *Plasmodium vivax (Pv)* malaria in a particular year**

16.Pf Death**: Total deaths due to *Plasmodium falciparum (Pf)* malaria in a particular year**

5.1. RESULT & DICUSSION



Scheme.1. Schematic representation of various analyses employed for investigating the epidemiological profile of malaria in Telangana from 2017 to 2021.

5.2. Annual trends of malaria cases from 2017 to 2021

The annual malaria cases reported from all the 33districts from 2017 to 2021 were shown in Table 2.1. A total of 7,931 cases of malaria were notified between 2017 and 2020 including 943(11%) *Plasmodium vivax* (*Pv*) and 6,988(88%) *Plasmodium falciparum* (*Pf*) cases (Table). The highest number of malaria cases were reported in 2017, whereas, a declining trend in malaria cases from 2017 to 2021. Subsequently, the malaria cases were declined during the following three consecutive years (2017-2021). *Plasmodium falciparum* was the most predominant parasite in Telangana state with cases ranging from 2,385 in 2017 to 762 in 2021. Similarly, *Plasmodium vivax* cases ranged from 303 in 2017 to 108 in 2021. This analysis suggests that the state climate and environmental factors are more favourable for the survival and transmission of *Plasmodium falciparum* parasite as well as the vector mosquito. Similarly, the annual parasite incidence (API) declined significantly ($P < 0.00$) from 2 per 1000 population in 2017 to 0 per 1000 population in 2021.

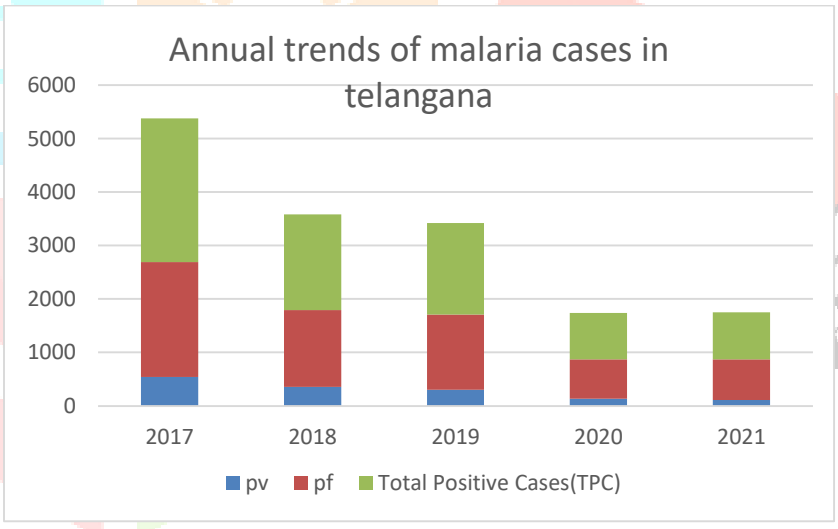


Figure.3: Annual trends of malaria cases in Telangana from 2017 to 2021. Red colour bar represents *Plasmodium falciparum* cases, blue colour bar represents *Plasmodium vivax* cases. Green colour line represents total positive cases (TPC).

5.3. Locale wise pervasiveness of intestinal sickness cases from 2017 to 202

Among every one of the locale of Telangana, Bhadradri Kothagudem, Mulugu, Asifabad regions recorded greatest number of cases during the review time frame followed by hyderabad, bhupalpally, medchal, mahebubabad, warangal, and rangareddy, while the base number of cases were accounted for in sangareddy, wanaparthy, Karimnagar and so on areas. The jungle fever case information shows that, besides in metropolitan regions, the greater part of the jungle fever cases are accounted for from the ancestral region of the locale which lie along the temporary zone between the Ancestral region and the Seaside region (Table.). The locale wise

intestinal sickness case information show that, of the complete 7,931(from most recent 5 years i.e., 2017-2021) cases revealed during the review time frame, Kothagudem area announced the biggest number followed by mulugu and Asifabad. The State in 2021, recorded 877 instances of jungle fever, much below the norm of the most recent three years, 1157, according to the Public Vector Borne Infectious prevention Program. The Test energy Rate (TPR) has tumbled to 0.03 in December 2021 when contrasted with the past three years' normal of 0.04. In the greater part of the long stretches of 2021, the TPR was pretty much as low as 0.02. The infection is anyway confined to the areas of Bhadradri Kothagudem and Mulugu. There have been zero passings because of Jungle fever in the State starting around 2017. From that point forward, the State has additionally recorded declining instances of jungle fever, with the exception of the minor ascent in 2021. While the quantity of jungle fever cases in 2017 was 2,688, the State just saw 1,792 cases in 2018, and 1,711 out of 2019. In a major plunge, the State just enrolled 870 cases in 2020, while 877 cases were kept in 2021.

Table.1: Year wise & district wise in 33 districts of Telangana state from 2017-2021

SL.NO.	DISTRICTS	2017	2018	2019	2020	2021	TOTAL
1	ADILABAD	58	7	1	9	2	77
2	ASIFABAD	161	70	100	78	76	485
3	BHUPALPALLY	568	545	18	56	58	1245
4	GADWAK	3	7	0	0	0	10
5	HYDERBAD	682	438	305	21	31	1477
6	JAGITYAL	12	5	5	2	1	25
7	JANGOAN	11	9	6	6	7	39
8	KAMAREDDY	22	6	7	1	0	36
9	KARIMNAGAR	10	9	5	7	6	37
10	KHAMMAM	45	7	5	7	0	64
11	KOTHAGUDEM	726	447	604	364	351	2492
12	MAHABUBABAD	21	41	33	22	30	147
13	MANCHERIAL	72	3	2	11	0	88
14	MAHABUBNAGAR	8	5	5	7	6	31
15	MEDAK	20	12	13	2	1	48
16	MEDCHAL	55	35	76	8	4	178
17	NAGARKURNOOL	10	5	7	2	2	26
18	NALGONDA	3	2	0	0	0	5
19	NIRMAL	6	6	1	0	2	15
20	NIZAMABAD	2	1	4	2	1	10
21	PEDDAPALLY	2	1	4	2	2	11
22	RANGAREDDY	23	21	58	3	3	108
23	SANGAREDDY	47	39	48	1	2	137
24	SIDDIPET	7	5	4	4	0	20
25	SIRICILLA	1	1	1	2	2	7
26	SURYAPET	10	10	5	1	1	27
27	VIKARABAD	12	3	9	4	1	29

28	WANAPARTHY	7	0	15	29	3	54
29	WARANGAL(Urban)	22	5	9	22	34	92
30	WARANGAL(Rural)	26	19	16	20	34	115
31	YADADRI	3	1	1	1	4	10
32	MULUGU			315	174	206	695
33	NARAYANPET			3	2	0	5

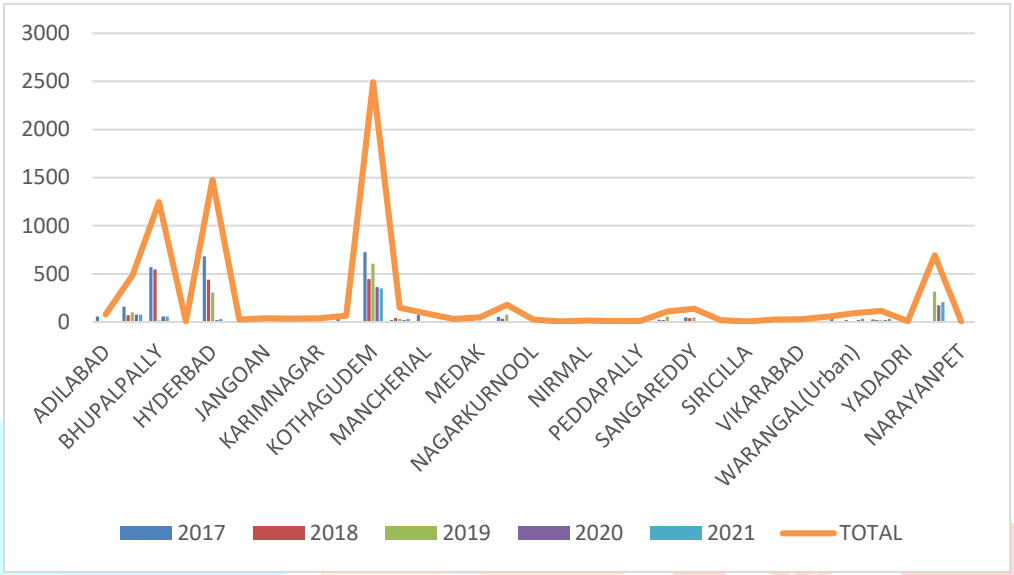


Figure .4. District wise Prevalence of malaria cases from 2017 to 2021

	2017	2018	2019	2020	2021
Plasmodium falciparum	79.87%	79.87%	82.17%	84.48%	87.64%
Plasmodium vivax	20.13%	20.13%	17.83%	15.52%	12.36%

Table 2. year wise distribution of malarial parasites (Plasmodium falciparam & Plasmodium vivax)

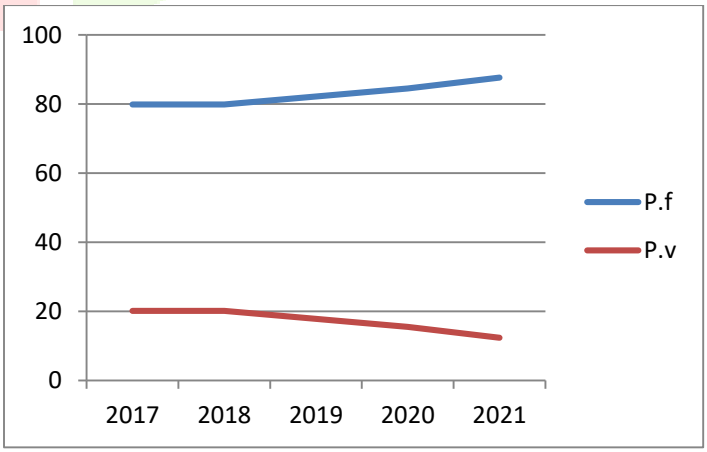


Figure: 5. year wise distribution of malarial parasites (Plasmodium falciparam & Plasmodium vivax)

5.4. Sex-wise prevalence of malaria cases from 2017 to 2021

The sex-wise cases of malaria were analysed for the years 2017 to 2021. The male-female caseratio reveals that the male cases were dominant than female cases throughout the study period(Figure 2.5.). Out of 7,931 confirmed malaria cases from 2017 to 2021, 4,546 (57.31%) [640 *vivax* and 3,907*falciparum*] cases were reported in male population and 3,384 (42.66%) [303*vivax* and 3,081*falciparum*] cases in female population. It was also observed that *Plasmodiumfalciparum* malaria was high in both male and female population than *Plasmodium vivaxmalaria* (Figure 2.5.).

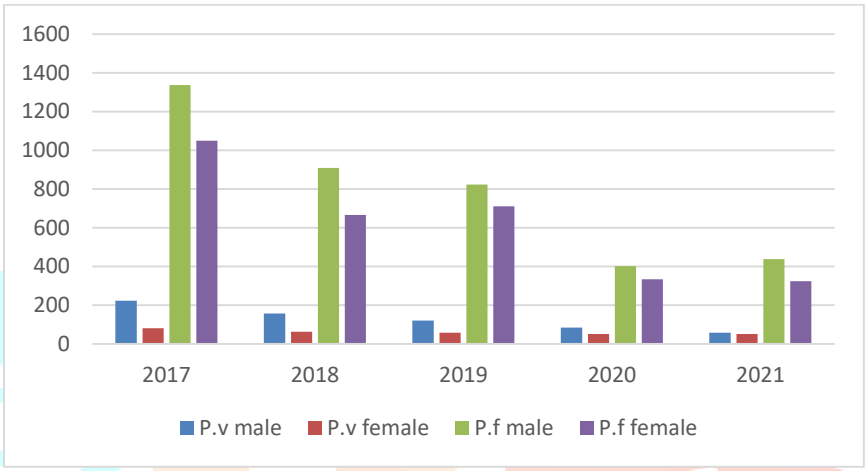


Figure.5: Sex wise distribution of malaria cases in Telangana state from 2017 to 2020.

5.5. Age-wise prevalence of malaria cases from 2008 to 2015

A total of 7,931 malaria cases were reported among all the age groups in the study area from 2017 to 2021. The higher prevalence rate [n= 5,130 (64.68%)] of malaria was observed in >15 years age group followed by 5–14 years age group [n=1,690 (21.30%)], 1–4 years age group [n= 605 (7.62%)]. The lowest prevalence of malaria was observed in <1 year of age group [n=99 (1.24%)] (Figure 2.6.). The occurrence of *Plasmodium* species among various age groups shows that *Plasmodium falciparum* is the most commonly reported species in all age groups, and it was maximum in >15 years age olds followed by 1–4-year-olds. Similarly, *Plasmodium vivax* cases were higher among the > 15 years age group and 5–14 years age group (Table.).

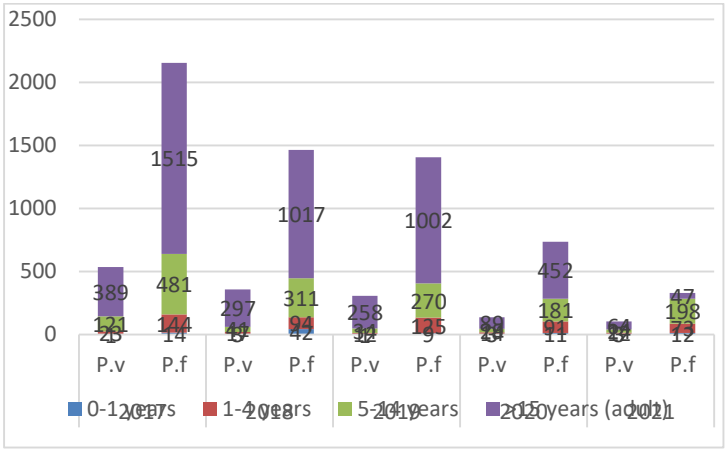


Figure.6: Distribution of malaria cases in different age groups in Telangana state from 2017 to 2021.

AGE CATEGORY	PLASMODIUM FALCIPARUM CASES(%)	PLASMODIUM VIVAX CASES (%)
0-1 YEARS	11 (0.13)	88 (1.10)
1-4 YEARS	78 (0.98)	527 (6.64)
5-14 YEARS	249 (3.13)	1441 (18.16)
>15 (ADULT)	1097 (13.83)	1097 (50.85)

Table: 3. The prevalence of malaria cases in different age groups in state from 2017 to 2021

5.6. Seasonal trends of malaria in Telangana

It receives rains during the southwest monsoon season (June-September) and some rainfall during the retreating northeast monsoon (December-January). Malaria displays hypo- to hyper-endemic transmission in this region, with major infection.

	2019	*2020*	*2021*
JANUARY	90	86	51
FEBRUARY	73	138	84
MARCH	57	79	58
APRIL	68	55	21
MAY	79	53	11
JUNE	59	39	49
JULY	556	115	214
AUGUST	205	80	109
SEPTEMBER	169	28	67
OCTOBER	104	45	46
NOVEMBER	138	49	60
DECEMBER	113	103	104

Table .4. Seasonal prevalence of malaria cases from 2019 to 2020

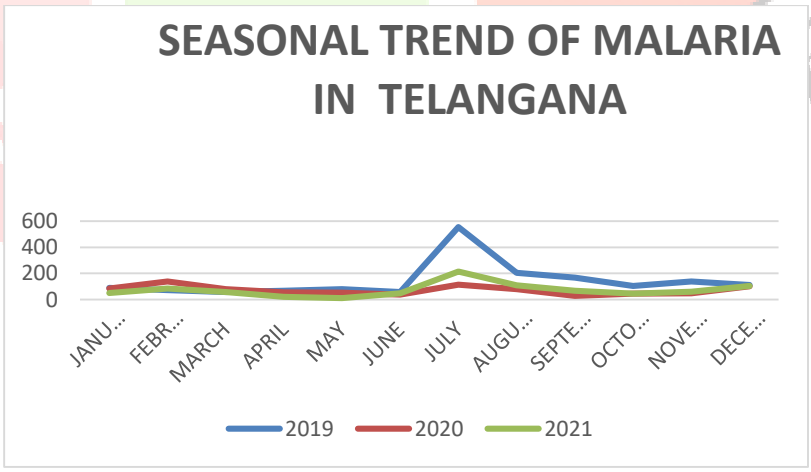


Figure : Seasonal prevalence of malaria cases from 2019 to 2021

5.7. API (Annual Parasite Incidence) analysis:

The number of confirmed new malaria cases expressed per 1,000 individuals at risk under surveillance. It can be written as API= $\frac{1000}{total\ population\ (country/state)} * $ Total positive cases

Years	API (Animal parasite incidence)
2017	0.08
2018	0.08
2019	0.05
2020	0.02
2021	0.02

Table.5: Year wise API (annual parasite incidence) of malaria in telangana

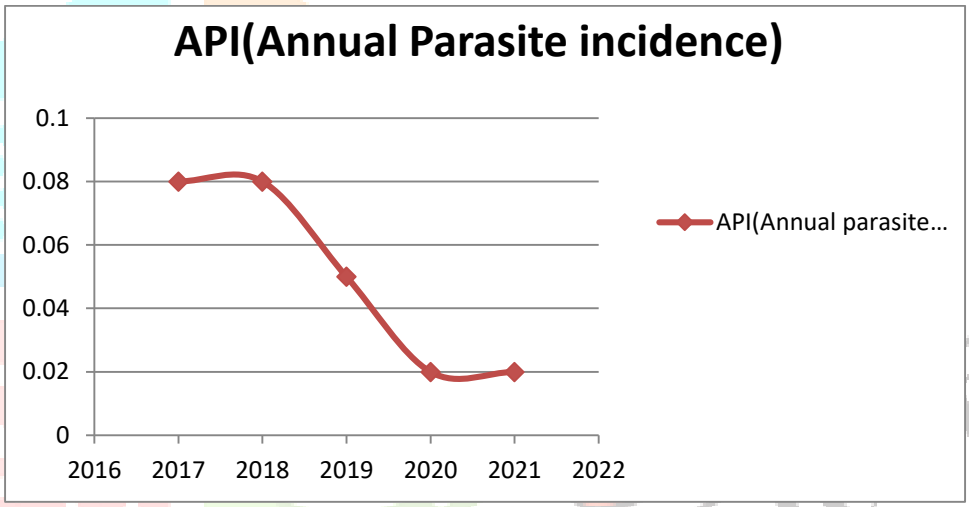


Figure .7: Year wise API (annual parasite incidence) of malaria in Telangana.

Conclusion

It has been presumed that the decrease in jungle fever trouble in Telangana per the contextual analysis was led as of late it is moved into classification 1, yet portrays this, face many difficulties and detours in its excursion towards jungle fever disposal by 2030. The difficulties are fragmented paper based totalled reconnaissance, missing confidential area contribution, absence of a stage for computerized reconciliation of information and the requirement for additional touchy indicative instruments. Unfortunate consistence to primaquine and presence of G6PD lack further adds layers of intricacy to disposal of P. vivax jungle fever. Dangers of medication and bug spray opposition in jungle fever keep on posing a potential threat for the world. Also, open air transmission of jungle fever and social difference in vectors make current vector control apparatuses less compelling. Absence of cooperation and collaboration between public jungle fever program and different players in the field likewise represents an obstruction to effective reception of examples learnt and proof produced by different organizations

working here. We have proposed a few arrangements and ideas which can be end up being huge advantages in India's fight against jungle fever and can sling India towards disposal of intestinal sickness.

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