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Causes Of Declining Trend Of Malaria In Bundelkhand Region Of Madhya Pradesh

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Abstract

Malaria is a worldwide epidemic. Nine species of Anopheles act as a carrier of *Plasmodium* causing malaria. Its worst scenario can be seen in many African and Asian countries. India is among one of them. In India, state of Madhya Pradesh (MP) was one of the most vulnerable states for Malaria till 2015; afterwards conditions got improved due to the special efforts made by the government, NGOs, researches, awareness programs, ICT etc. For the research work Primary data is collected by using questionnaire in order to find out, why such many out-burst and casualties due to malaria are seen in MP? What necessary measures are required to minimize the cases? Secondary data is collected from the different Government departments, websites and District Malaria Offices in order to get the trend of malaria recorded. Pre and post preventive measures taken to minimize the cases are also summarized. Data is tabulated, graphs are developed. It is found that great decrease is observed in the positivity rate and casualties from 2015 afterwards. It also came into observation is that people were aware about the Vector Borne diseases, distribution and use of ITNs, intensive implementation of National Framework for Malaria Elimination and Active participation of District malaria Officers in Madhya Pradesh, NGOs and research scholar's contribution minimize the number of cases in Madhya Pradesh. Consequently, less than 3% malarial positive cases are remains in the year 2022 in the state MP; base year 2015.

Key words: Malaria, ITN (Insecticide treated nets), NFME (National framework for Malaria Eradication), *Plasmodium falciparum*, *Plasmodium vivax*, NVBDCP (National Vector Borne Disease Control Programme).

Abbreviations used:

MP: Madhya Pradesh, ITN:Insecticide treated nets, NFME; National Framework for Malaria Elimination, NVBDCP: National Vector Borne Disease Control Programme, BSE: Blood Smear Examination, RDT: Rapid Diagnostic Test, Pf: *Plasmodium falciparum*, Pv: *Plasmodium vivax*, ABER: Annual Blood Examination Rate, API: Annual Parasite Index, SPR: Slide Positivity Rate, SFR: Slide Falciparum Rate, LLIN: Long Lasting Insecticidal Nets. WHO: World Health Organisation, NRHM: National Rural Health Mission, AWW: Anganwadi workers, ASHA: Accredited Social Health Activist, NGO: Non-Governmental Organisation.

Methodology:

Secondary data is collected from various reliable agencies. Various meetings were arranged with the District Malaria Officers of Madhya Pradesh, especially in the Districts of Bundelkhand region i.e. Panna, Damoh, Chhatarpur, Sagar, Tikamgarh of MP to ensure the status and fruitfulness of

programs (National Framework for Malaria Elimination) run by state and Central Indian Government. Thereafter, Secondary data is tabulated and bar graphs are developed to correlate the data of different years to understand the cumulative progress.

Primary data was also collected with the help of a questionnaire to find out the impact of Anti malaria programs run by the state Government of MP, India, and other NGOs at the ground zero level. Like ITN was distributed in a sufficient number to needy people and families in the year 2016 or before. *Gambusia* fish dispersal was proper or not. Whether it is controlling the larvae of *Anopheles* effectively or not? In the present research work, it was tried to find out the holistic approach of increasing malaria cases before the year of 2015 and the declining trend of malaria cases after the year of 2015.

Introduction:

Madhya Pradesh is situated between 21.6°N– 26.30°N (latitude) and 74°9'E–82°48'E (longitude) in India. Its 30% area always remains covered with tropical forest throughout the year. Dense forest cover provides well-suited conditions for the mosquito breed. Here, Malaria havocs were seen before the year of 2015 could be as a biological disaster. So, it's a matter of great concern as lots of casualties were recorded in the previous years in the state of Madhya Pradesh, India. This disease is caused by a protozoan of Genera *Plasmodium*. Various species of *Plasmodium* mostly *P. falciparum*, *P. vivax*, *P. malariae*, *P. ovale* affects humans. In the research work, Madhya Pradesh is taken for the study and special attention is given of the Bundelkhand region of MP, as prime vulnerable cases were observed in Madhya Pradesh from the year 1996 to 2007 in comparison to other Indian states and union territories. The same repetition of cases and fluctuations were observed till the year 2014. In November 2011, Sidhi District of MP, 97 deaths were recorded. Similarly, again 5 deaths were reported in November 2014 [13]. Maximum number of positive cases was observed in the year 2015. Then, the trend of sudden decrease in the cases was observed to date.

Health hazards due to malaria:

In India, 28 states and 8 union Territories are classified under 3 categories. States with the least count of malarial cases are kept in category I, then comparatively with a greater number of cases states are kept in Category II. State of Madhya Pradesh is included in the category –III [3]. Category III, means the most prone zone to Malaria i.e. the red zone among all Indian states. It is due to its tropical climatic conditions and wide range of dense forest cover which provide well-suited and favorable climatic conditions for the growth and reproduction of *Anopheles* mosquito.

Most of the cases of Malaria are observed due to *Plasmodium vivax* and *P. falciparum*. Its results are life-threatening. Multi-organ failure is observed during the severity of malaria. In some severe cases of *P. falciparum*; Anemia, still birth, abortions, low neonatal weight, Maternal mortality, and loss of pregnancy was observed[1]. On observing the CBC (complete blood count) – The number of leucocytes (Leucopenia) and Platelets (Thrombocytopenia) are found greatly reduced in most of the *vivax* cases [5].

Fluctuation in the malarial cases from 1994 to 2022:

The continuous increase was observed from the year of 1994 to 1999; even after the implementation of Enhanced Malaria Control Project in the year 1997. The status of the malarial cases was not as decreased as per the expectations [7]. Many reasons are found like an adequate number of District Malaria officers were not in all the districts of Madhya Pradesh. Distribution of ITNs, awareness towards the water accumulation, Larvae of the *Anopheles* were found in most of the districts in MP. So, sincere efforts were needed to be implemented.

Table 1: Showing total malaria Positivity and casualties due to malaria in MP

S. No.	Year	Total Malarial cases in Madhya Pradesh	Deaths
1	1994	323628	28
2	1995	483563	28
3	1996	500574	55
4	1997	451552	58
5	1998	475098	26
6	1999	527510	50
7	2000	194689	92
8	2001	183118	81
9	2002	108818	30
10	2003	99708	22
11	2004	132094	36
12	2005	104317	44
13	2006	116276	44
14	2007	107135	41
15	2008	105312	53
16	2009	87628	26
17	2010	87165	31
18	2011	91851	109
19	2012	76538	43
20	2013	78260	49
21	2014	96879	26
22	2015	100597	24
23	2016	69106	1
24	2017	47541	5
25	2018	22279	1
26	2019	14147	3
27	2020	6760	1
28	2021	3181	1*
29	2022	2988	0

Source: National health profile of different years generated and developed by Directorate of National Vector Borne Disease Control Programme[12]

From the year 2011 to 2013 fluctuations were observed but due to the efforts by the WHO, governments, NGOs etc. Little bit decrease in the casualties was observed. Again, little rise is observed in 2013 in comparison to 2012; reason was first a greater number of diagnostic tests were conducted, increase in population, people were not so aware about the cleanliness. And again, due to increase in the sampling most number of cases was observed in the year of 2015.

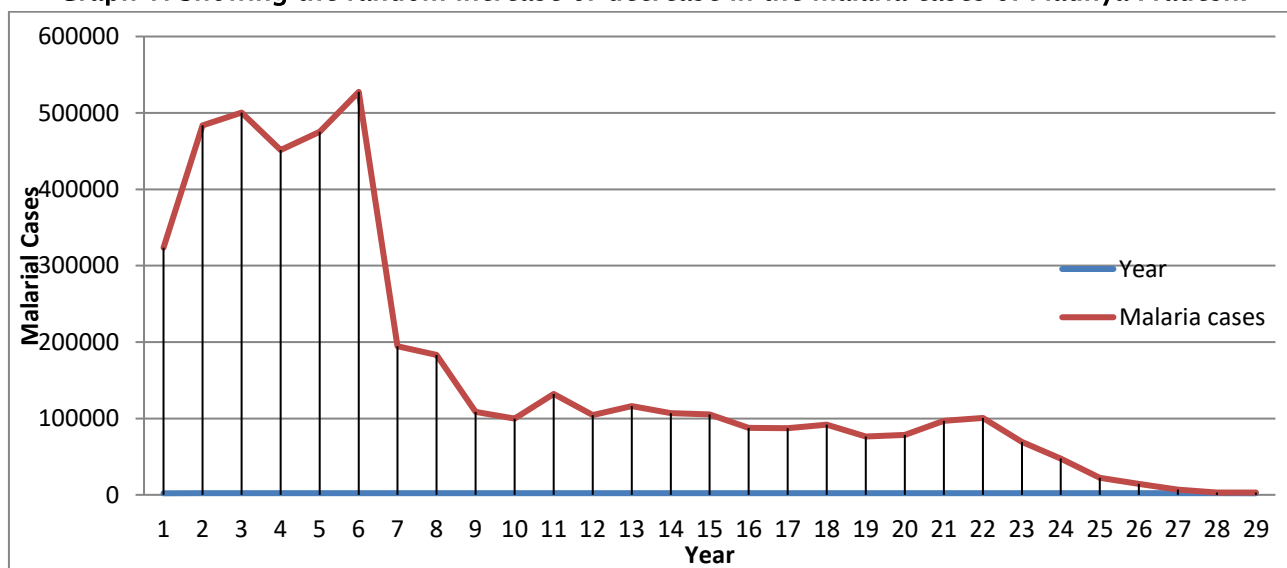
In the year 2009 Government of India launched a program to eradicate the Malaria by focusing the reach of malarial workers to the patient and also recruited mobilized workers like ASHA, under the national Rural Health Mission (NRHM) [8]. Malaria Health Workers etc. and also distributed long lasting insecticidal nets (LLIN) still the cases were raised till the year 2015 in Madhya Pradesh. After that from the year 2015–2030 World Health Organization (WHO) set targets to eliminate it completely. Thereafter Indian Government launches the National Framework for Malaria Elimination

(NFME) through NVBDCP [9]. Consequently, a great decrease is observed in malaria cases, casualties get minimized and larvae of vectors also get reduced due to the effective measures taken in the state of Madhya Pradesh.

The declining trend of Malaria in the last six consecutive years from 2016 to 2022 in Madhya Pradesh:

Malaria cases were observed maximum in the year 2015. Thereafter, a continuous decrease is observed; reasons may be more focus of Indian Government is towards cleanliness, enhancement in the education standards, more diagnostic sampling was observed in these years. Appointment of District Malaria Officers in the state also plays the pivotal role in the minimization of malarial cases.

Graph 1: Showing the random increase or decrease in the malaria cases of Madhya Pradesh.



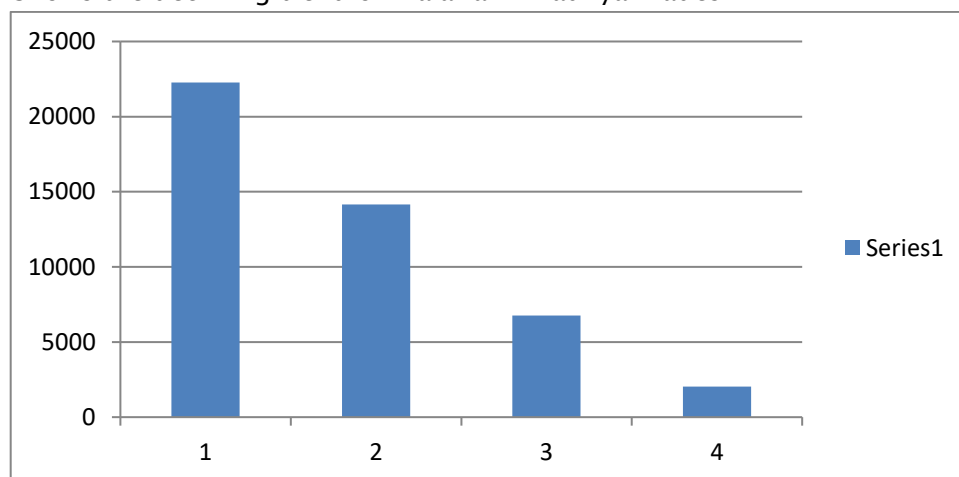
Source: [11] A. Minhas and 12, J. (2023) *India: Number of malaria cases in Madhya Pradesh 2022, Statista*. Available at: <https://www.statista.com/statistics/860091/india-number-of-malaria-cases-in-madhya-pradesh/> (Accessed: 10 November 2023).

Trends of declining malarial cases were observed from the year 2016. It proves that the programs running by the Government in order to minimize the malarial cases are now fruitful [6]. Among all Indian states and union territories, from top to bottom (maxima to minima), its rank is sixth in the year 2018, same rank was observed in the year 2019, and became 8th in the year 2020 means decline of 2 ranks and then 10th in the year 2021 means again decline of 2 ranks was observed. Thus we can conclude that effective eradication of malaria is observed in Madhya Pradesh.

Table 2: Showing declining trend of malaria in Madhya Pradesh.

Declining rank of Madhya Pradesh in malaria cases after the implementation NFME in 2016		
YEAR	No. of Positive cases	Rank of Madhya Pradesh among all Indian states and UTs (28+8=36) from Maxima to Minima
2018	22279	6
2019	14147	6
2020	6760	8
2021	2025	10

Bar graph 2: Shows the declining trend of malaria in Madhya Pradesh.



Graph: Number of positive malaria cases observed in the year 2018 to 2021 (Here, 1 is for 2018, 2 for 2019 and so on) in Madhya Pradesh.

Source: RAJYA SABHA SESSION – 255 UNSTARRED QUESTION No 242; C: Cases; D: Deaths; *: Data West Bengal is provisional in the year 2017; **: Data Provisional till September 2021; NA: Not Available.

Causes of decline in the Malaria cases from 2015 to 2022 in the Bundelkhand Region of MP

Here for the study of five districts of Bundelkhand region i.e. Panna, Damoh, Chhatarpur, Tikamgarh and Sagar of MP was considered. In which various indices were studied.

Table 3: Showing the decline in various parameters of malaria indices.

Year	Total Population	Total BSE + RDT	Total Malaria Positive	Total Pf	ABER	API (Positive case X 1000/Population)	SPR	SFR	Pf %	Malaria Death
1	2	3	4	5	6	7	8	9	10	11
2014	7947473	936022	5041	403	12	0.634	0.538	0.043	8	0
2015	8105728	918061	5117	864	11	0.631	0.557	0.094	17	0
2016	8327064	986340	4239	460	12	0.509	0.429	0.046	11	0
2017	8518837	903397	2461	185	11	0.288	0.272	0.020	8	0
2018	8421370	814449	1148	62	10	0.136	0.140	0.007	5	0
2019	8391126	928560	783	52	11	0.093	0.084	0.005	7	0
2020	8736129	854218	206	21	10	0.023	0.024	0.002	10	0
2021	8838958	979852	119	15	11	0.013	0.012	0.001	13	0
2022	8990004	1087097	112	8	12	0.012	0.010	0.000	7	0

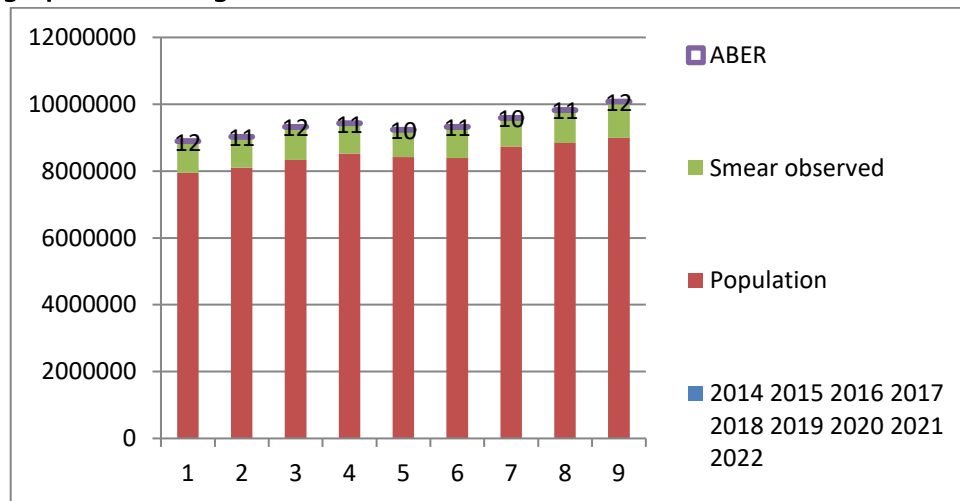
Different indices are helpful in the planning to minimize the outburst of the Malaria endemic:

To assess the malaria in Madhya Pradesh many indices of significant importance were used by Indian Central and State governments’ related information is gathered from the five districts of Bundelkhand Region, Madhya Pradesh in order to minimize the malaria.

SIMS: SIMS (Index of Malaria Surveillance) indicates that which area is prone for the malaria parasite. So Chances of disease outburst will be more in that site. So, implementation of preventive measures could be done in proper and effective way. Nowadays effective preparedness and planning is observed in most of the districts of India before the monsoon. Thus, such a decrease in the malaria cases became possible.

Annual blood smear examination rate (ABER): If it is more than 1% per month and more than 10% per annum of total tests taken for diagnostic then it is considered as proper and optimum investigation. Above table indicates that ABER is found above 10% per annum in the study area, after the year 2014 indicated with violet color. So, it can be considered a great attribute helped in declining the malaria parasites from the Bundelkhand region of MP.

Pictograph 3: Showing the Annul Blood smear examination and continuous hike in it.

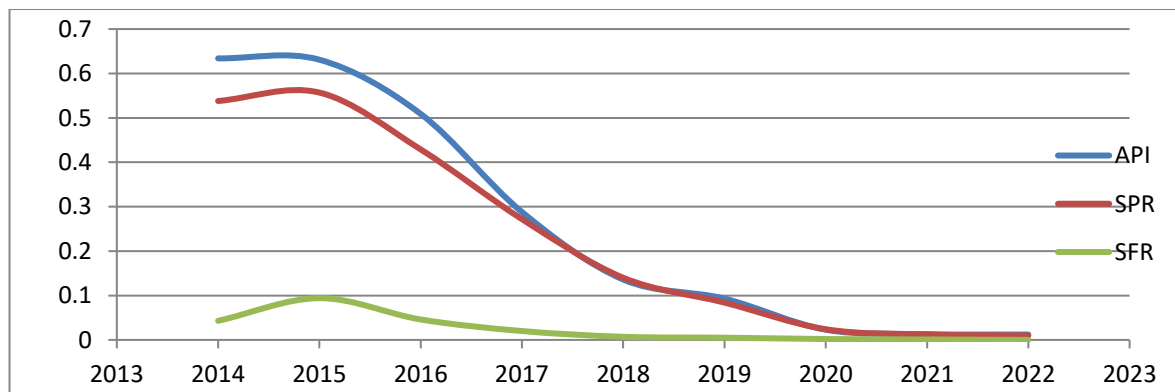


$ABER = \text{Annual smears examined} \times 100 / \text{Total Population}$

Pictograph indicates that the Annual Blood smear Examination Rate is more than 10% per annum of the total population of the region means more than 10 % population is examined for the malaria Parasite. High sampling rate gives more accuracy in the results which is observed above. Thus, cases get declined.

Annual Parasite Index (API) and **Annual *falciparum* Index (AFI)** indicate the disease burden and its impact on the population in the given period of time *i.e.* number of positive cases per 1000 people of the population. It is an area independent parameter but helpful in planning to apply the mitigating measures since the lethality % is observed more in case of *falciparum* in comparison to the vivax. But numbers of death are similar in both the cases [4] and both are equally responsible for the lethality.

Graph 5: Showing the declining trend of different malaria indices for the 5 districts of Bundelkhand.



$API = \text{Total positive cases} \times 1000 / \text{Total population}$

SPR (Slide positivity rate): It was found maximum in the year 2015 among the 5 districts of Bundelkhand region of Madhya Pradesh.

SFR (Slide falciparum rate) : Sharp decline in the cases of falciparum were observed after the year of 2015.

PF%: *Plasmodium falciparum* percentage indicates the dominance of *P. falciparum* in particular area. So, special medical preparedness (Intravenous artesunate, Pentoxifylline drug) is needed unless it may cause cerebral malaria; a neurological disorder which is considered more fatal in children in comparison to the adults [5]. It ruptures the blood brain barrier and may cause hemorrhage in the brain [13]. To diagnose the *P. falciparum*, Peripheral Blood Smear (PBS) test is conducted. Here, infested RBC was observed.

Mitigations:

Due to observation of the malarial cases in past few months and years, effective preparedness were needed and now most of the Districts malarial department of Madhya Pradesh have adopted the following mitigative measures.

1. Nets (Insecticide treated bed nets; ITN) and long lasting insecticidal nets (LLIN) are treated once or sometimes twice with insecticidal spray and the mosquito net distribution were observed in various malarial prone areas. It is approximately 1 net for 2 persons. And more than 80% of the villages are covered till now [3]. Till the year 2016, 13, 70000 Long Lasting Insecticidal Nets were distributed.
2. Pyrethrin spray and insecticidal chemical sprays were observed once or twice in a year especially in the monsoon season to kill the mosquitoes.
3. Gambusia fish dispersal was done in ponds and river channels to minimize the larvae of the mosquitoes.
4. Larval survey is conducted at various centers especially at the watershed management sites, water supply tank sites, in order to minimize the number of vector mosquito larvae.
5. MPH (Multipurpose health worker), ASHA and AWW workers are trained to use the RDT and to dose Artemisinin based combination treatment (ACT) for the falciparum as found resistant to the Chloroquine .
6. Indoor Residual spraying (IRS) is going on especially if the cases are detected.
7. National Framework for Malaria Elimination (NFME) was implemented by the Government of India in the year 2016 and intensive elimination programs are now fruitful.
8. Track, Test, Treat and again Test (T4) strategies helped in the great reduction of malarial cases in Madhya Pradesh. [10]

Decline in various Indices of the Malaria in the Bundelkhand region of Madhya Pradesh:

Five districts Panna, Damoh, Chhatarpur, Tikamgarh, and Sagar are included in the Bundelkhand region of the state Madhya Pradesh. Bundelkhand is also an economically backward area in comparison to other regions of the MP. So, special attention is paid on it.

Result and Discussion: In this research work it is found that Government run number of programs to minimize the Vector borne diseases like Malaria. Secondary data indicates that up-to the year of 2015 number of malarial cases were rising continuously but from 2016 due to intensive programs on Malaria, increase in the number of sampling, Larvae sampling and observance of Anopheles in any residential areas then robust efforts to kill them were taken like spraying of Synthetic Pyrethroid. Appointment of malarial officers in every district, sudden decrease in the malarial cases was observed in the state of Madhya Pradesh. Primary data indicates that the awareness of the laymen

towards cleanliness and to minimize mosquito breeding centers, the use of ITNs (Insecticide-treated nets) also plays a pivotal role in the reduction of Malaria.

Outcomes and findings:

Before the year of 2014, Madhya Pradesh was one of the vulnerable states to malaria. After this continuous decline is observed in malarial cases. A similar decline is also observed in the Bundelkhand regions of the State.

More than 10% ABER index indicates that more sampling helps eradicate malaria.

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