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Research Article

Malaria Outbreak and its Management in Hardoi District of Uttar Pradesh, India

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A B S T R A C T

Introduction: Uttar Pradesh is endemic for vector-borne diseases (VBD) like malaria, dengue, chikungunya, Japanese encephalitis (JE), Kala-azar, and lymphatic filariasis. Malaria, JE, and dengue are epidemic-prone, claiming lives during outbreaks. In September 2023, a malaria outbreak in Hardoi district caused numerous deaths due to favourable geo-climatic conditions for vector and parasite transmission. NCVBDC guidelines are crucial for controlling these diseases.

Methods: A team of officers from the Regional Office for Health & Family Welfare (under the National Centre for Vector Borne Disease Control), Lucknow visited the Hardoi district of Uttar Pradesh in September 2023 to assess the various factors responsible for the fever/ malaria outbreak and guide and support the district health authorities for proper implementation of the various intervention measures to contain it.

Results: The detailed investigations revealed an SPR value of 33.99% and an SFR value of 35.48% and exhibited a multifold increase in malaria cases, though the district data reflected a 4-fold rise in malaria positives in 2023 over preceding years and a 6-fold increase in *Plasmodium falciparum* cases in CHC Ahirori. Similarly, SPR and SFR values of 39.24% and 26.58%, respectively, were seen in CHC Tadiyawan. These values confirmed and reflected indigenous transmission of malaria cases in both CHC areas.

Conclusion: The sharp rise in malaria cases confirmed the outbreak, with deaths suspected but not confirmed as malaria-related. The outbreak was attributed to excessive rainfall, inadequate vector/disease surveillance due to insufficient health workers, poor lab facilities, and delayed interventions. RDT screenings showed high positivity for *Plasmodium vivax* (Pv) and *Plasmodium falciparum* (Pf), though no fever-related deaths were confirmed as malaria. Corrective actions were recommended to district health authorities to contain the outbreak.

Keywords: Malaria Outbreak, Neglected Surveillance, Intervention Measures, *Plasmodium vivax, Plasmodium falciparum*, RDT Kits, API, SPR

Introduction

Uttar Pradesh is one of the largest states of India having an area of 243,286 km² and a population of 230 million (199.81 million as per the 2011 census) with a population density of 828 persons per km². The majority of the population resides in rural areas and mainly depends on agricultural practices as the Indo-Gangetic plain provides a lot of developmental opportunities through its fertile agricultural land, not only for the state but for India as a whole. Since the area is traversed by a number of big and small rivers, there are good facilities for irrigation of the crop fields. The co-lateral outcome of the irrigation facility led to the public health problem as every third person suffered due to malaria with high mortality and morbidity prior to the independence. The indoor residual spray (IRS) with DDT 50% WDP was the main tool to achieve success in bringing the malaria incidence to 0.10 million in India in 1965, thereby eradicating the dreadful disease from almost all major parts of India.[1] The malaria-free areas were handed over to the basic health services for maintaining the malaria-free status in those areas but the expectation was unfulfilled due to the occurrence of local and focal outbreaks of malaria with high morbidity and mortality, thereby increasing the toll of malaria cases to 6.47 million in 1977. Therefore, in order to overcome the resurgence of malaria cases, the Modified Plan of Operation (MPO) was launched in 1977, the successful implementation of which, brought down the malaria cases between 2 and 3 million but large-scale malaria epidemics occurred again in 1994 in different parts of India,[2] which led the technical officers to think over this issue seriously. This resulted in an exhaustive exercise which revealed various technical, operational, financial and administrative issues that contributed to and led to the resurgence of malaria.[3] In order to ensure effective implementation of the programme, the National Vector Borne Disease Control Programme (erstwhile National Malaria Eradication Programme, consequently National Anti-Malaria Programme) on the basis of recommendations of a group of experts, formulated the operational guidelines for the malaria action programme in the country in 1995.[1] Moreover, process indicators were developed, which gave the details of various processes to be carried out at each level from primary healthcare to the top most level, along with assessment parameters, to evaluate whether the implementation is going in the right track or not.[3] It becomes more important when the elimination of the disease (malaria) from the country has been planned.[4,5]

Even with the availability of strong technical guidelines, outbreaks of malaria are still occurring in various parts of the country[6–9] as well as the state. District – Hardoi (27.3948º N, 80.1315º E) reported a large number of fever cases and causalities through various media reports. The present article reflects the efforts made to (a) find out the cause of the unprecedented fever incidence, (b) suggest appropriate intervention measures to contain the epidemic, and (c) indicate the correctional actions and necessary steps for future programme implementation in a more effective way in the district.

Methodology

District Hardoi is amongst the oldest districts of Uttar Pradesh. It was created sometime in the middle of the 19th century. It is located in the centre of the state. Districts Shahjahanpur and Lakhimpur Kheri are situated to its north, district Sitapur to its east, districts Farrukhabad and Kannauj to its west, and districts Lucknow and Unnao to its south. Rivers that borders the district boundaries are Gomati (Aadi Ganga) in the east and Holy Ganges alongwith Ramganga in the west. The area of the district is 5,986 km² and the population was 4092845 (as per 2011 census) but the population in 2023 became 4,930,000, which resides in 2070 villages of 19 development blocks and 5 subdivisions. Thus, the density of the district is 684/km². The sex ratio is 868 females per 1000 males as per 2011 census, which is far below the state's sex ratio (894 females/1000 males) but has improved in comparison to the 2001 census (844 females/1000 males). The average literacy rate of the district is 64.57% as per 2011 census, which is far below the state's average literacy rate (75.14%), but has improved in comparison to the 2001 census (51.88%).

In order to find out the facts and the ground realities of the print media insertions regarding increased fever-incidence-associated deaths, if any, the office of the Chief Medical Officer, District Malaria (VBD) Officer, District Hospital, Hardoi. District Surveillance Unit (IDSP), CHC Ahirori (27.3344º N, 80.2935º E), CHC Tadyawan (27.4282º N, 80.2628º E) and the two most affected villages-KhadaKheda and Umri under CHC Ahirori and village Sikhrauri under CHC Tadiyawan were visited. A detailed discussion was held with the district-level as well as the CHC-level health authorities. Though the whole district was under the grip of fever cases, out of 20 and 22 sub-centres of CHCs Ahirori and Tandiyawan, respectively, 4 sub-centres from each CHC had an increased number of fever cases (Figure 1).

The office of the District Malaria Officer/ VBD Officer was visited to find out and analyse the old record pertaining to the malaria epidemiological situation of the district during the past 5 years, the staff availability for implementing Vector Borne Disease Control Programme, the availability of logistics/ infrastructure in the district, the details of intervention measures undertaken by the district so far, the details of fever outbreak in the district, the possible cause of deaths that had occurred in the district and death audit, if any, done by the authorities of CHCs/ PHCs/ district. Some reports were obtained from CHCs Ahirori and Tadiyawan. No data on fever incidence was available in the Integrated Disease Surveillance Programme (IDSP). However, the data obtained from district authorities and surveys done by the team was analysed statistically and the findings are presented in the present paper.

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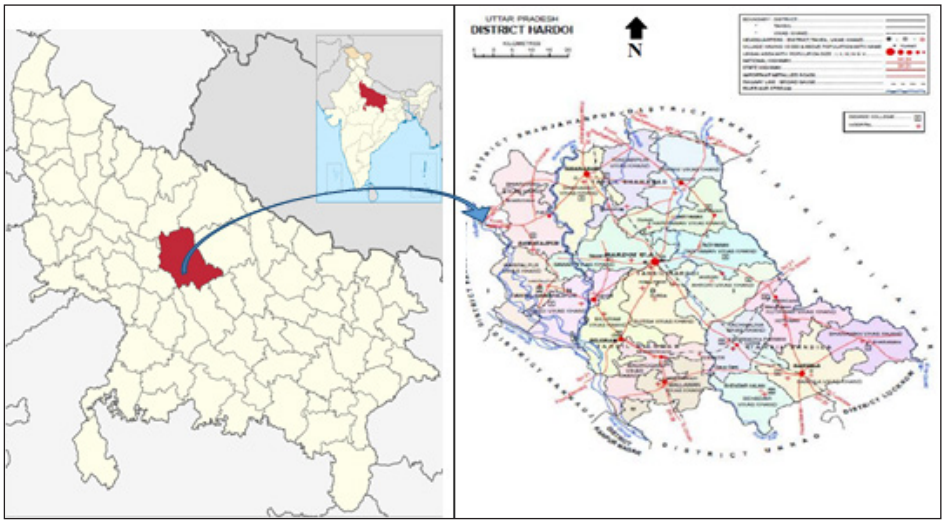

Figure 1.A Map of District Hardoi, Uttar Pradesh, India

Results and Discussion

On perusal of the district's malaria epidemiological data from 2017 till the time of the visit (Table 1), it is obvious to get an impression that malaria has been eliminated from the district, as the annual parasite index (API) was very low (0.06 to 0.200 except the years 2018 and 2019, when it reached 0.86 and 0.60, respectively, possibly due to the local and focal occurrence of malaria cases with increase in *Plasmodium falcpairum* (*Pf*) cases (391) in 2018. However, no malaria outbreak and associated deaths were documented during this period.

CHC Ahirori, which reported the highest number of fever and malaria cases, was visited. It is located on the border of district Sitapur. It reflected increased fever incidence and had very little positivity for malaria in reports, but had the highest number of cases in the block as reported by the district VBD office (66 *Plasmodium vivax* (*Pv*) and 16 *Pf*), whereas as per the report communicated from the CHC-Ahirori laboratory, between July 21, 2023 and August 31, 2023, 1552 blood smear examinations were performed, of which, 106 were found positive for malaria (64 *Pv* and 42 *Pf*). Out of 1139 examinations performed from September 1 to 11, 2023, 55 malaria positives (41 *Pv* and 14 *Pf*) were reported (Table 2). On perusal of preceding years' data, the fever surveillance under NCVBDC was found to be very poor as the annual blood examination rate (ABER) did not exceed 1% from 2019 to 2022 and the API did not exceed 0.5. Moreover, the slide positivity rate (SPR) also remained below 2% and no *Pf* case was reported from 2019 to 2021. However, only a few cases of *Pf* were reported during 2022 (Slide Falciparum Rate (SFR): 0.49%). No death occurred due to malaria in this CHC in the preceding years. Though the reported number of malaria cases differed, the difference seems to be very small in comparison to the number of persons who showed clinical symptoms of malaria. This CHC had 249,637 people residing in 97 villages, out of which, the majority of villages were under the grip of fever but the villages belonging to 4 sub-centers were more affected. The CHC had no record of deaths related to fever, though 07 unverified deaths occurred in villages KhadaKheda and Umari during the past one-fortnight duration. On the visit to pyrexia-affected villages and enquiry from close associates of the deceased, it was found that prior to their death, people had typical symptoms of malaria but these were not confirmed through microscopy. It was also observed that 03 laboratory technicians (LTs)/ laboratory assistants (LAs) mainly performed examinations with Rapid Diagnostic Tests (RDTs). The work done by the team in both villages is mentioned in Table 3.

It is interesting to note that all malaria positives declared through RDT examination did not reflect the parasite stage, due to which it could not be ascertained whether the transmission of malaria was indigenous or not. The blood smears of these RDT malaria positives also showed positive results for malaria, which could be identified with the parasitic stage being ring and trophozoite in all 06 *P. vivax* and ring stage in all 33 *P. falciparum* positive cases reflecting 33.99% SPR and 35.48% SFR. The parasitic stages and malariometric indices being very high, confirm the occurrence of localised indigenous malaria transmission. The district data also reflects a 4-fold rise in malaria positives in 2023 over preceding years and a 6-fold increase in *Pf* cases, whereas the team findings reflected a multifold increase in malaria positives and *Pf* cases, leading to the suspicion that the deaths that had occurred, might have been due to malaria, for which the districts/ CHC authorities were asked to verify or conduct death audit on the prescribed NCVBDC (erstwhile NVBDCP) format.

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The entomological survey conducted by the Zonal Entomological Team from Lucknow reflected very poor density of the malaria vector, *Anopheles culicifacies*, possibly due to the fact that the health authorities undertook indoor space spray with pyrethrum (0.1% solution), larvicidal spray and outdoor thermal fogging in highly affected 8 villages as the vector intervention measures, which might have brought down the vector density to a low level. It was also observed that the Indoor Residual Spraying (IRS) undertaken as the first round in 4 health sub-centres in the second fortnight of June and the first fortnight of July 2023, had no impact on preventing/ stopping the transmission of malaria cases, as the quality of IRS was very poor, patchy and partial, which consequently allowed the vector to play its role in disease transmission.

CHC Tadiyawan was visited as it had the next highest number of fever and malaria cases. The area of CHC Tadiyawan is adjoining CHC Ahirori, located on the border of district Sitapur. It also reflected an increased fever incidence, having very little positivity for malaria in reports but was next highest among blocks, as reported by the district VBD office (60 *Pv* and 6 *Pf* cases). On perusal of the data of preceding years, the fever surveillance under NCVBDC was found to be very poor as ABER did not exceed 2% from 2019 to 2022 and API exceeded 2.0 in 2019 but did not exceed 1.51 in following years till 2022. However, SPR also remained around 2% but *Pf* cases remained in good proportion in 2021 and 2022, which, continued till 2023 (SFR: 1.80%). No death due to malaria was reported in this CHC in preceding years. Keeping in view the pyrexia incidence of CHC Tadiyawan, the number of malaria cases seemed to be very low in comparison to persons who showed clinical symptoms of malaria. This CHC had 220,670 people living in 93 villages. Most of these villages were under the grip of fever but villages belonging to 4 sub-centres were more affected. This CHC had no record of deaths related to fever, though 2 unverified deaths (of people suffering from pyrexia) occurred in village Sikhrori. The CHC conducted a special drive to search and treat malaria cases in August 2023. A total of 18 camps were organised in 18 villages during August 2023, in which 720 blood samples were examined through RDTs, out of which, 26 were found positive for *Pv* only. No *Pf* case was detected from any of the 18 villages. Anti-larval operations were undertaken in 11 villages and space spray was done in 5 villages, but no intervention was done in the other 7 villages. Village Sikhrori was visited. 79 persons suffering from fever were examined through RDTs and their blood smears were also prepared. The village residents were enquired about the deaths that occurred during the preceding fortnight. Two deaths were told to have occurred in the village which were not confirmed due to malaria for want of their blood examination. It was also observed that LT/ LA mainly performed examinations with RDTs and not through microscopy. The work done by the team in this village Sikhrori is mentioned in Table 4.

Table 1.Malaria Epidemiological Situation of Hardoi District (Uttar Pradesh) from 2017 to September 10, 2023

S. No.	Year	Population	No. of BS Collected / Examined	No. of BS Positive for Malaria			ABER	SPR	SFR	API	*Pf (%)*	Death Due to Malaria
				Pv	*Pf*	Total						
1	2	3	4	5	6	7	8	9	10	11	12	13
1	2017	4255455	53838	628	3	631	1.27	1.17	0.006	0.148	0.48	0
2	2018	4342244	99387	3328	391	3719	2.29	3.74	0.393	0.856	10.51	0
3	2019	4342244	82126	2596	8	2604	1.89	3.17	0.010	0.600	0.31	0
4	2020	4342244	52912	271	1	272	1.22	0.51	0.002	0.063	0.37	0
5	2021	4493756	48516	593	123	716	1.08	1.48	0.254	0.159	17.18	0
6	2022	4493756	127006	486	70	556	2.83	0.44	0.055	0.124	12.59	0
7	2023	4685258	74719	801	115	916	1.59	1.23	0.154	0.196	12.55	0

BS: Blood Samples
Pv: *Plasmodium vivax*
Pf*: Plasmodium falciparum*
ABER: Annual Blood Examination Rate
SPR: Slide Positivity Rate
SFR: Slide Falciparum Rate
API: Annual Parasite Index

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Table 2.Block / CHC wise Malaria situation from January to 10th September, 2023 of District-Hardoi (Uttar Pradesh)

S. No.	Name of Block/ CHC	Population	No. of blood slides collected /examined	No. of blood slides positive for malaria			ABER	SPR	SFR	*API	*Pf %*	Death due to Malaria
				Pv	*Pf*	Total						
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Ahirori	249637	2175	66	16	82	0.87	3.77	0.736	0.328	19.51	0
2	Sursa	255776	3385	6	1	7	1.32	0.21	0.030	0.027	14.29	0
3	Tandiyawan	220670	2606	60	6	66	1.18	2.53	0.230	0.299	9.09	0
4	Bawan	216165	2212	22	0	22	1.02	0.99	0.000	0.102	0.00	0
5	Hariyawan	230317	1442	21	1	22	0.63	1.53	0.069	0.096	4.55	0
6	Pihani	267500	1407	7	0	7	0.53	0.50	0.000	0.026	0.00	0
7	Toderpur	213397	1733	8	0	8	0.81	0.46	0.000	0.037	0.00	0
8	Shahbad	311322	2368	14	0	14	0.76	0.59	0.000	0.045	0.00	0
9	Bharkhani	262508	626	1	0	1	0.24	0.16	0.000	0.004	0.00	0
10	Harpalpur	203000	1377	0	0	0	0.68	0.00	0.000	0.000	0.00	0
11	Sandi	217000	3272	11	0	11	1.51	0.34	0.000	0.051	0.00	0
12	Bilgram	276554	2191	5	0	5	0.79	0.23	0.000	0.018	0.00	0
13	Madhoganj	234313	1665	1	0	1	0.71	0.06	0.000	0.004	0.00	0
14	Mallawan	196554	2907	1	0	1	1.48	0.03	0.000	0.005	0.00	0
15	Kachhauna	215610	2253	0	0	0	1.04	0.00	0.000	0.000	0.00	0
16	Behendar	200877	916	0	0	0	0.46	0.00	0.000	0.000	0.00	0
17	Sandila	309209	3325	1	0	1	1.08	0.03	0.000	0.003	0.00	0
18	Kothawan	218000	6899	3	0	3	3.16	0.04	0.000	0.014	0.00	0
19	Bharawan	218257	1660	4	0	4	0.76	0.24	0.000	0.018	0.00	0
20	Hardoi	168592	12891	34	0	34	7.65	0.26	0.000	0.202	0.00	0
Total		4685258	57310	265	24	289	1.22	0.50	0.042	0.062	8.30	0

*Figures upto 10th September, 2023

Table 3.Results of Surveillance and Microscopy in the Villages of CHC Ahirori, Hardoi District

S. No.	Name of Village	Total RDTs	RDT Results				No. of BS with RDT Positive for Malaria	BS Exam. Results			
			Pv	*Pf*	Total Positive Cases	Total Negative Cases		*Pv*	*Pf*	Total Positive Cases	Total Negative Cases
1	Khada Kheda	49	06	15	21	28	21	06 (rt)	15 (r)	21	Nil
2	Umari	44	00	18	18	26	18	00	18 (r)	18 (r)	Nil
Total		93	06	33	39	54	39	06	33	39	Nil

BS: Blood Samples/Slides
r: ring stage
rt: ring and trophozoite stages

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Table 4.Results of Surveillance and Microscopy in Village Sikhrori, Hardoi District

S. No.	Name of Village	Total RDT Tests	RDT Results				No. of BS with RDT Positive for Malaria	BS Exam. Results			
			Pv	*Pf*	Total Positive Cases	Total Negative Cases		*Pv*	*Pf*	Total Positive Cases	Total Negative Cases
1	Sikhrori	79	06	18	24	55	24	06 (rt)	18 (r)	24	Nil
2	Sikhrori	-	-	-	-	-	07 (Negatives)	04 (rt)	1(r),1(g), 1(rg)	07	Nil
Total		79	06	18	24	55	31	10	21	31	Nil

BS: Blood Slides/Smears
r: ring stage,
rt: ring, trophozoite stages and g: gametocyte

It is interesting to note that all malaria positives declared through RDT examination were found positive in blood smear examination too but the parasite stage could not be declared in RDT examination. In all, RDT showed 6 *P.vivax* and 18 *P. falciparum* positive cases, but in the blood smear examination, *Pv* cases reflected ring and trophozoite stages (rt) and *Pf* cases reflected ring stages (r). However, 7 persons with conspicuous symptoms of malaria who were found negative for the parasite in the RDT examination, were also screened for blood smear through microscopy, in which it was surprising to note that all 7 persons were found positive for malaria [4 *Pv* (rt) and 3 *Pf* (1 r, 1 rg and 1 g)] increasing the toll of malaria positives to 31 (10 *Pv* and 21 *Pf* cases) reflecting 39.24% SPR and 26.58% SFR, which is very high showing a multifold rise in malaria and *Pf* occurrence. Thus, the survey findings confirm the occurrence of localised indigenous malaria transmission, which led to the suspicion that the deaths that occurred, might have been due to malaria, for which the districts/ CHC authorities were asked to verify and conduct a death audit on the prescribed NCVBDC (erstwhile NVBDCP) format.

The entomological survey conducted by the Entomological Team, Lucknow reflected very poor density of the malaria vector, *Anopheles culicifacies*, possibly due to the fact that the district health authorities undertook vector intervention measures such as indoor space spray with pyrethrum (0.1% solution) and larvicidal spray in highly affected 11 villages, which might have reduced the vector density. The IRS Ist round, undertaken in 4 health sub-centres from June 20 to July 16, 2023, possibly had no effect on preventing/ stopping the transmission of malaria cases, due to very poor, patchy and partial quality, consequently allowing the vector to play an active role in disease transmission. It is also apparent that the tests performed through RDTs are not standard ones, as they reflected 7 (12.73%) persons negative for malaria though they had typical symptoms of malaria and were confirmed to be malaria cases through a microscopic examination conducted by the team. It is suggested that RDTs, if being used in the programme, must have recognition from some reliable institution. It was also surprising to observe that though the persons suffering from fever were approaching CHC, where they were suspected of malaria, the treatment for malaria was not provided to them due to non-availability of the antimalarial drugs. Moreover, the ASHAs had RDTs with them and were testing persons in the field, but they did not have antimalarial drugs to treat the suspected malaria cases, if found positive through RDT. Such a type of negligence will definitely not contain the disease but may claim the lives of innocent people. No participation of the District IDSP Unit, Hardoi was found in the communication of early warning signals of fever from different CHCs/ PHCs and in working out the ongoing outbreak of malaria in the district.

It is pertinent to mention here that RDTs are not recommended in the programme, where malaria microscopy facilities are available. The state team must arrange LTs during the period of outbreak of fever for quality diagnosis by blood smear microscopy and prompt radical treatment. The district has been indiscriminately using different makes of antigen-based bivalent RDTs supplied by various firms. Different types of RDTs showed different results, which might be due to the variation in their sensitivity and specificity. Hence, microscopy is the gold method to identify the malaria parasite, which will reflect a true picture of the situation and accordingly intervention measures may be planned to contain the malaria outbreak.

The team findings reflected 33.99% SPR and 35.48% SFR which is very high confirming a multifold increase in malaria cases, though the district data reflected a 4-fold rise in malaria positives in 2023 over the preceding years and a 6-fold increase in *Pf* cases in CHC Ahirori. Similarly, 39.24% SPR and 26.58% SFR were found in CHC Tadiyawan, which also reflects a multifold rise in malaria cases and thus the deaths that occurred, though not confirmed to be due to malaria, were suspected to have been caused by malaria.

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The district and CHC/ PHC authorities were asked to ensure the preparation and examination of blood smears of the fever cases declared positive by RDTs for verification of the parasite prevalence and its potential role in the occurrence of widespread fever in the area. While RDTs reflect the presence of *Pf*, there are higher chances of detecting *Pf* in blood smears. The district authorities were asked to conduct a rapid fever survey through microscopic blood screening to delimit the actual affected areas in the blocks of the whole district and promptly provide radical treatment as per the NCVBDC guidelines, in which the health worker must possess antimalarial drugs. Appropriate space spray, indoors as well as outdoors, followed by IRS with the available insecticide must be undertaken to interrupt the transmission. The resident villagers must be sensitised to undertake protective measures to prevent mosquito bites and remove the stagnation of water in and around their houses. Moreover, they should be made aware that in case of fever, the nearest health facility must be contacted immediately (worker/ CHC/ PHC/ hospital) for prompt treatment.

Malaria is very simple to treat in an individual person, but it is very complex when we undertake it as a programme because the disease transmission is governed by many factors related to the parasite, vector and host behaviour, which may vary depending on the changing environmental conditions. Chand et al. attributed the malaria outbreak in Madhya Pradesh to the prevalence of the rice cultivating ecosystem without any interventional measure like insecticidal spray, in spite of being qualified for undertaking intervention measures according to the NCVBDC (NVBDCP) guidelines.[6] Joshi et al. attributed the malaria outbreak in Uttar Pradesh to neglected surveillance.[8] The present fever outbreak cannot be denied to be associated with malaria. The outbreak of malaria may be attributed to negligent disease and vector surveillance as well as poor quality of malaria screening and accordingly to want of proper treatment as per the NCVBDC (NVBDCP) guidelines.[9] The focus must be applied on the blood smear screening through a microscope, for which laboratory strengthening is a must and should be exercised in routine practice, otherwise, such outbreaks will continue to occur and will also lead to failure in achieving the goal of malaria elimination within the stipulated time frame.

The state VBD programme authorities were advised to review the availability of technical staff related to surveillance and diagnosis of fever/ malaria in the district and other districts of the state as well, in order to prevent any such outbreak or epidemic in future.

Conclusion

On the basis of the survey findings and foregoing discussion, it becomes apparent and can be concluded that the upsurge in fever cases in the villages of 4 sub-centres of each of the CHCs, Ahirori and Tandiyawan of the district, was due to the outbreak of malaria as the district data reflected a 4-fold rise in malaria cases and a 6-fold rise in *Pf* cases in CHC Ahirori and a 3 to 4-fold rise in malaria and *Pf* cases in CHC Tandiyawan in 2023 over preceding years. However, the team findings reflected a multifold increase in malaria and *Pf* cases in both CHCs (33.99% SPR and 35.48% SFR in CHC Ahirori and 39.24% SPR and 26.58% SFR in CHC Tadiyawan). Thus, though malaria was not confirmed to be the cause of the deaths that occurred in the villages, it was definitely suspected to be the cause.

The district technical staff (LT/ LA) was found to perform blood examination mainly through RDTs, which cannot reflect the parasite stage, required to ascertain whether the transmission of malaria is indigenous or not. The district authorities were asked to conduct a rapid fever survey through microscopic blood screening to delimit the actual affected areas in the blocks of the whole district and promptly provide the radical treatment as per the NCVBDC guidelines, with the health workers being in continuous possession of the antimalarial drugs. Appropriate indoor and outdoor space spray, followed by IRS with available insecticide, must be practised to interrupt the transmission. The resident villagers must be informed about the protective measures for preventing mosquito bites and removing the stagnation of water in and around their houses. The importance of immediately contacting the nearest health facility (worker/ CHC/ PHC/ hospital) in case of fever for prompt treatment must also be explained. Accordingly, the state VBD programme authorities were advised to assess the availability of technical staff related to surveillance, diagnosis and logistics to combat fever/ malaria in the state, to prevent any such future outbreak or epidemic.

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