

The Discursive View on Malaria in Delhi: A Colonial Perspective

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Abstract: Malaria had been the chief cause of mortality in Delhi and a large number of deaths owing to inaccuracy or complete lack of diagnoses was the return under the general term “fever”. Numbers of deaths were registered under the general term “fever” it was extremely difficult to say with anything approaching accuracy as to what proportion of these were due to malaria. Malaria which was a very important cause of sickness in the normal year, at time flares up and gives rise to a very serious condition which not only affects the mortality, health, and economic condition of the Delhi Province. In the urban areas there were some possibilities of proper diagnosis in a certain number of cases but in the rural areas, a large number of cases, patients die without the diagnosis. When the patients die, the death was just recorded as due to “Fever” or due to the most obvious terminal sign. Delhi, other than as a site of Historical interest, sprang into importance when the transfer thither of the capital of the Indian Empire was announced by H.M. the King-Emperor at the Durbar of 1911. Before deciding, therefore, on the actual location of the building of the new Imperial City, a malaria survey was made, extending over sixteen month in 1912-13, by Captain Colonel E.C. Hodgson, whose report revealed the presence of a very serious amount of endemic malaria, the originally selected site for the New City proving the most unhealthy portion of the whole area, and as a result of these investigation. The former capital, Calcutta, had according to Stephens and Christophers in 1914, a nil spleen rate, whereas Delhi, situated in North-West India lies in an area liable to periodical epidemic of fulminant type, The first of which since ‘Ross’ larva discovery founded the modern study of malaria that of 1908, had been studied in detail by Christophers (1914).

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I. INTRODUCTION

Indian literature described that malaria as a king of all disease and it killed and caused more sickness and death any other diseases In India. ‘Throughout the late 1800s and first half of the 1900s, officially estimated that malaria affected 100 million Indian annually and killed over one million per year in India alone.’¹ It was prevalence in the form of the epidemic but this was a matter of happiness for the Delhi Health Authorities that the major infectious diseases such as plague and cholera were partially less venomous during the British period in Delhi. The municipality had been doing unrelenting endeavor to control plague by intensive rat destruction since few years. Municipal had made before another scheme of rat-proof *godowns* (storeroom) but this plan dropped due to practical difficulties. With the improvement of water-supply, cholera risk had reduced but in the regarding of malaria was still a blot on the name of Delhi. Malaria affected the very large area of Delhi, within which scarcely any village or town escaped. In the context of malaria, J.B.S. Haldane’s quoted that ‘Socially malaria is a worse disease than plague or smallpox because it lasts for years and turns most members of a population into chronic invalids.’² Malaria recurred with considerable regularity at some year’s interval; there was major epidemic in 1884, 1890, 1892, 1897, 1900, 1908, 1912 and 1926 and minor epidemic in other years. The actual causes of malaria in Delhi was not entirely clear for the British, it was assumed that it was associated with particular physical characters of the country and that it most serious effects were associated with the rainy season.’³ ‘It is harder to believe the imperialist logic that malaria was associated with rainy season.’⁴ Because malaria was not confined the rainy season but many reports were also indicated that malaria found during the winter season. Civil surgeon of Akola (central India) noted that ‘heavy mortality from the fevers during both rainy and winter season.’⁵ ‘Malaria is produced by a parasite which is carried by a sick man to a healthy man by certain kind of mosquitoes. An attack begins with shivering, then fever and headache if the temperature is very high, then profuse perspiration and the fever goes down.’⁶ It was clear that malaria is spread from man to man by a mosquito. When a mosquito bites someone who has malaria, it held germs of malaria and inject malaria germ into other person’s blood.

The greatest number of deaths due to malaria occurred in the months of September, October, November, and December. There was an appreciable increase in the deaths from respiratory diseases; this could be attributed to debility from the after effects of attacks of malaria. The climate condition was rather, exceptional, the rainfall was in the excess in March, April and the first half of May were exceptionally cool, but from the middle of May to middle of July the weather was extremely hot and oppressive with the frequent dust storm. The monsoon started on July till the August and September was rain fell down. The month of August and September were suitable for breeding of larva of malaria because there was rainier and weather was so salubrious, neither hot nor cold. There were the increasing number of deaths due to malaria in every year and the canal water supply was certainly was responsible for the prevalent breeding place for *Anopheles*. The September to November when there usually occurs a characteristic seasonal rise in admission for sickness and in the death rate generally referred to as the autumnal epidemic. The effect of this autumnal prevalence was usually to be detected especially in bad years in the form of a special rise in the graph of total deaths. The death rises rapidly in September, was maintained at a high level through October and most of November and falls gradually to normal during December. 'The climatology factors of the total annual rainfall of 21.71 inches, 17.21 inches fell within thirty days in July and August.'⁷ This result in a high rise in relative humidity over a prolonged period especially in the month of August, a fact which assisted in the prolonged period especially in the month of August, a fact which assisted in the prolongation of the life of the mosquitoes and ensured the completion of the cycle of development of the malaria parasite in the mosquito. Malaria was not a notable disease and with the wide prevalence of a large number of obscure fevers, it was generally very difficult, if not impossible, to obtain an exact assessment of the incidence of the disease.

Endemic malaria had become severe venomous and epidemic disease in the mid nineteenth and twentieth century because British had started huge constructed railways, roads, deforestation, and drainage work for commercial agriculture in India. These work created a haven for malaria breeding and due to huge construction, the large number of labors were hired for these workers. Labours were to become the vehicle of malaria-carriers from one place to another place because they were used to move to search for the job from one place to other place. Economic opportunities in the ineffective areas from malaria, attracted labors and they brought malaria mosquito with their in these areas. 'In irrigation projects, which were largely managed to achieve greater profitability, engineers neglected drainage while concentrating attention on the more lucrative parts of irrigation.'⁸ The development in the virgin areas brought disruption of ecological balance and its repercussion was on the public health. Construction of new canal, drainage, bridge, deforestation for the railway and railways embankment altered the water flows of the river and it created the flood, accumulation of stagnant water, pools, cistern etc. Whenever flood happened then extra water could not flow out from the natural flood way because Government had stopped all natural way and created an obstacle in the flood way. In the consequence, excess flood water enters into village and town and created stagnant water pool and waterlogging, subsequently increased malaria breeding grounds and led to malaria.

Canal irrigation, wells and flood was important sources of malaria larvae and these areas were well known for the agriculture. Canal irrigation areas in Delhi, which were most victim area from malaria, Government reached at this conclusion that canals or drainage should be closed. The existence of Western Jumna Canal had been a big cause of malaria in Delhi, while Jumana canal area was excellent breeding places for *Anophelines* more especially culicifacies. Wells were also major source of the malaria of Delhi

In 1908, this was the first time, when authority focused on malaria in Delhi; however, Government had recognized the negative impact of malaria. British had started the work of the plantation of cinchona after 1858 for the produced quinine in India. By 1909, Government did not take serious interest in the eradication of malaria larvae. It might be that plague, cholera, and small pox diseases were much attentive diseases than malaria for the Government. But 1908-9, Government convened the Imperial Malaria Conference at Shimla, Government formally recognized malaria is a serious problem in India. And there was a needed a general malaria policy for the India. From the Shimla conference, a resolution comes out that a Provincial Malaria Committee was to be established for each Province. This meant that Province and Government had to be work together and incurred all expenditure of malaria. The city had been affected by many of the greatest malaria epidemics which had devastated the Punjab. In common with Palwal and many other towns and a vast number of villages in these parts, Delhi suffered severely from malaria. The causes and effects of the large epidemic malaria of 1908 were investigated by Colonel Christophers, who stating that the actual cause of such epidemic malaria was not quite clear. He found that its most serious effects were associated with actual, usually widespread, flooding. For this reason, certain riverine and water-logged areas were often very prominently picked out and the *Bela* land at Delhi was an example of such an area. In the 1908 epidemic, the mortality rates per mile per annum, for the month after the epidemic was at its height rose in the Delhi. The question of the prevalence of malaria in Delhi came up again as an acute problem in 1912 when the site for New Delhi as a capital was under consideration and, as a result, Colonel Hodgson, I.M.S., was deputed to make a thorough investigation of the prevalence of malaria in Delhi. His investigation showed that a high degree of malaria was

present in many parts of the Delhi. Colonel Hodgson dealt with the question of malaria in five different areas: - (1) Canal Area of the city where there was much heavily irrigated country. (2) The Durbar area to the north of Delhi with much flat land liable to inundation. (3) Delhi City and its suburbs. (4) The southern area (including the present Raisina area). (5) The proposed new Cantonment site. The canal area showed very high spleen rates approaching or exceeding 90 per cent. The reason for this malarial endemic city was easy to understand, this was practically a waterlogged area due to excessive and wasteful irrigation. The Canal area North of the city suffered most seriously; the old city lying on the edge of the *Bela* was next in order of malaria intensity, while the area South of the city was least affected. The main factor of suffered most seriously malaria in the canal area was water-logging due to canals, railway embankments and second in the Southern area, the *Bela*, Brickfields, and obstruction to natural drainage. The recommendations made by Colonel Hodgson (in abstract) were:-

Canal area:- Canal water (Western Jumna Cana) to be cut off entirely and canal filled up. Irrigation from wells, Drainage of Railway borrows pits and surface drainage.

Durbar area:- Precautions against flooding. Canalization of creek and *nullahs*.

The City area:- Treatment of Bela. The closing of the canal to Queen's Gardens, etc. Abandonment of Daryaganj and non-extension of the city in this direction.

New City area:- Properly built storm water channels. Filling up of Brickfield, wells, and pits of all kind. Okhla Navigation area cut to be filled up and removal of all bunds and obstruction to drainage.

A study of Hodgson's report shows an extremely high malaria incidence, and it was believed that the year 1912 was above the average in respect of this, but city wards running up to 67 per cent and surrounding by villages up to 96 per cent. Hodgson records 11 species as found during the course of his survey. There 11 species were recognized as primary vectors of malaria in Delhi. He records in his report and finding *Rossi* species as early as April. It was the most common *Anopheline* present. The *fuliginous* species were a cold weather species; its larvae almost founded in numerous channel in Delhi. While, *Stephensi* species apparently hibernates in wells, and was found as a larva in natural water with the first warm weather in February-March. Primarily a wells breeder, it was in reality extremely catholic in its test, and, especially in spring, invades outside bodies of water, but after the onset of the monsoon, it seemed largely confined to wells, in which it was then extremely common. Hodgson seemed to be the opinion that there were, with maxima during the rains. *Culicifacies* found commonly as a hibernating fourth stage larva at the end of the very cold weather, but by the third week in February such had pupated and emerged. Young larvae were found in April, but the species was rare until after the onset of the rains. It then became common, and continued so until the end of October. It was then *Stephensi* and *culicifacies* which were responsible of the malaria at Delhi.

The existence of Western Jumna Canal had been a notorious cause of malaria in Delhi. First time in 1845, a commission was appointed to enquire into the cause of malaria and commission reached the conclusion that waterlogging caused by Canal was largely responsible for malaria's condition. Delhi Fort and Daryaganj Cantonment were well popular for malaria because that this area was very soggiest. The main channel was flowing through this area and behind of this area was the bed of Yamuna River which was the main site of the larva of *Anopheline*. As a result of Hodgson's recommendation, canal-water was cut off from a considerable area, many channels, large areas were leveled in Raisina and Subzi Mandi (Vegetable market) and the portion of the *Bela* land north of the city filled in. In the autumn of 1926, another epidemic malaria broke out which, although slight in comparison with the 1908 epidemic, gave rise to a very large amount of sickness in Delhi and its vicinity and led to a great deal of dislocation of business. The result of this epidemic was serious enough to require immediate investigation and Colonel Christophers was debuted for this purpose.

Colonel S.R. Chiristophers (1914) was appointed to enquire into the cause of malaria and condition of canal irrigation in Delhi. He found that the work which had followed on Hodgson's recommendation had resulted in a noticeable reduction, especially certain areas of the facilities for breeding anopheles. His investigation was especially directed to the New City area and its surrounding and he found that malarial incidence, as judged by the spleen rates of the labour camps, was still very high, more especially in the portion of this area which adjoins the *Bela*. He shows in his report that the general physical features of Delhi were suitable for malaria because there was much floodable and water logging area. He described that the Delhi branch of the water Jumna Canal is passing along the watershed of the alluvium, it gives off numerous branches which irritated the country. On the western part of the Jumna Canal was most important because this track was used for the agriculture purpose and called field irrigation. He concluded that 'such water in most places in regard to the formation of breeding places for Anopheles was of little importance. But this area was excellent breeding places for *Anophelines* more especially *Culicifacies*. Christophers said that 'over the southern portion of the Jumna Canal area the irrigation is mostly in connection with fruit gardens. These gardens or orchards are quite feature of Delhi.'⁹The orchards were being irrigated one needs everywhere flowing streams of water, deep water standing on the ground, pools often of large size and all the evidence of large bodies of water being poured without stint upon the soil. Chirstphers had also referred Captain Sopwith's report on the Hydraulic

condition in Delhi and a number of measurements of the subsoil water level were taken by Captain H.H King I.M.S and Chirostophers in March and April 1914. At this time there had been no rain for several months and the normal winter rain had failed. But water level was still good. 'The most striking hydraulic phenomenon in the Delhi area was the water table of the alluvial wedge forming the Canal area. The subsoil water here lies for the most part at a depth of from 10 to 20 feet from surface but approaches this more closely in certain place.'¹⁰Where it reached to within 6 feet of the surface the ground had been considered waterlogged. This type of area was considered sources of breeding malaria larvae.

The canal irrigation, wells, Jumna River, and, temporary breeding places due to rainfall, there were four breeding places of the local carrier species at Delhi. The Western Jumna Canal was found by Hodgson to breed, especially when the flow of water had been cut off and the water was moving slowly along its weed grown bed. The between Kishangunj Railway Bridge and the canal trail at *Pul Mithai*, there was copious *Culcificies* breeding after September. Weeks previously the water in the canal had been cut off and there were only relict pools in the section of producing *rossi*, but when fresh water was let down the species was everywhere abundant save in very foul spots, and this accounts amply for the very high spleen rate in *PulBangash*. The canal water was likewise used for irrigation in that part of the Civil Lines around Delhi Club that was not too high for it to reach and here again, *Stephensi* appears in the canal water. Further out from the city the canal gives off the usual irrigation branches, one of which, the Wazirpur Channel, nearest the city, was examined in detail from its head to it near the Kingsway Camp night soil depot. The *Culcificies* was found in many of the embayments in the grass edge bank, and in swampy areas caused by irrigation. Now the section of Western Jamuna Canal near Delhi was peculiar in that feeds the large fruit gardens area North-Western of Delhi. This not only means great actual breeding but also raised the general humidity. The canal water was also sources of the flow in the Khudsia garden. Finally, the canal terminates both in the Civil Lines and in the Queens Gardens, in Brick sumps from which Mills fill their watering pots. There were some of the worst sources of *Stephensi* within the Delhi area.

Another source was the Najafgarh Lake, though not so much irrigation as an outflow channel. It flows from a lake sixteen miles west of Delhi to the Jumna (Yamuna) and it crosses beneath the Western Jumna Canal some miles outside the city, and bounds the Civil Lines, to the North. The Dahalia Escape Channel in the fruit Gardens areas carries surplus water from the canal to the cut. The Najafgarh breeds dangerous species throughout that length of it that had come under the examination of malaria officials. Malaria officials found *culcificies*, *Stephensi* in it, both west and east of the line length. The surplus canal water was responsible for the still high rate of malaria in Rajpur.

The entire Delhi area was a mass of wells, most of them *pakka*. Within the City and its suburban area, there were said to be about 797, of which 675 were private ownership. On its taking over by the Imperial Government there were about over 600 within the New City area. The majority of the bungalows in the Civil Lines had wells. There were many within the perimeter of the Fort. In spite of canal irrigation facilities, there were quite a number of wells in the N.W. fruit garden area. These wells were as a problem of the greatest magnitude. In his recommendation Hodgson lent towards the replacement of canal by wells irrigation, choosing the lesser of two evils. However, wells were also the major source of the malaria of Delhi. Of 97 examined by malaria officials in 1928, around the city no less than 40 per cent were found to be breeding *Stephensi* at a single examination. As stated earlier it was not known whether there were annual fluctuations in the number of this species within wells, but even if this was so it appeared to be commoner in them during the monsoon than at other times, just when it was most dangerous. The whole question of wells in Delhi was a most complicated one. The only good thing was that from the malaria point of view was that, as it taken the effort to raise water, thus was not wasted or used excessively in irrigation, as canal water. But it was the drinking well that was the chief problem. Filtered tap water was laid on almost throughout the area, but the people themselves prefer their wells for drinking. At the back of this lie religious prejudices that it was difficult to combat. Apart from the wells, *Baoli* were also sources of breeding of larvae, in which, the main *Baoli*, however, could not be closed for strategic reasons. On the Ridge, within the Civil Line, there were two historic *Baolis*, one of which in the compound of the Hindu Rao Hospital was found and other *Baoli*, on the *Subzi Mandi* side the Ridge. These were equally dangerous for malaria but due to financial reasons, these could not fill. The *UgarSenBaoli* in Curzon Road (Connaught Place) was an appalling source of *Stephensi*. The health officer of Delhi had this filled.

Almost any collection of water in Delhi seems capable of producing *Stephensi* larvae; whilst as usual *culcificies* larvae were found where fresh clean temporary water was available. It was impossible to enumerate all the spot of such nature where dangerous breeding had been, a few more general instances must suffice. Rain pools in depression and small normally dry borrow pits. These were not very fruitful sources of carriers the principal species found being *Rossi*, but as *Stephensi* and occur in them. Three areas were very bad ones, affecting the health of the city, areas:- (a) along the Grand Trunk Road and in the irrigation area generally. The second was Nizamuddin Area, and third was along the Delhi Ambala-Kalka Railway. The main sources of *anopheline* breeding in Delhi were wells, irrigation channels and their tributaries, flooding, especially of the

Bela and the consequent damming back of water into drainage channels such as the Khudsia Creek, Metcalf House Nullah, Nazafgarh drain and the storm water channel of New Delhi.

The Government of India wants to make a malaria free Delhi because now it was their capital of India. For this objective, they took many measures such as Health Officer of Delhi recommended that the Western Jumna irrigation system should be stop at Pembari Bridge, only the right bank distributed as far as Ganeshpur was being taken. The canal from Pembari Bridge to its tail at PulMithai must then be filled in, or its empty bed will hold pools during the rains. They assumed that the proposal would vitally affect the fruit gardens area north-west of the city. The owners must be supplied with unfiltered pipe water at rates commensurate with canal water, or will else have to be compensated for the losses of their gardens. Their recommendation was too that Nazafgarh drain should be stone lined with cement. There was decided that all wells of Delhi must be closed and drinking water should be supply by piped water. Unfiltered pipe water for garden purposes should be provided at low rates in the Civil Lines, Queen Garden, Daryaganj, and wherever else it was required.

In addition to this, Senior White reported that although most of the wells in New Delhi were filled, yet new ones were being dug. However, New Delhi had a pipe water supply that's why J.A Sinton suggested that it should be punishable offense to make wells and all wells should be closed in in the New Delhi area at least. Moreover, many branches of the Western Jumna Canal were closed and this seemed to have had a markedly beneficial effect on the incidence of malaria. There was, however, still a large amount of irrigation to the north of the Old Delhi and as pointed out by Senior White this was responsible for the breeding of numerous dangerous *anophelines*.

The flooding of *Bela* had loomed large in all the investigations into the prevalence of malaria in Delhi. There was no doubt that subsoil water level had risen in Delhi and subsoil water level was due to the Western Jumana Canal. It was also possible that the construction of the Agra Canal Headwork at *Okhla* by converting the stretch of the Jumna opposite New Delhi into a large lake had thus raised the level of the subsoil water. Senior White in his report notes that this Headwork apparently interfered with the drainage of New Delhi and by blocking back the water in the storm channel provided abundant breeding places for dangerous mosquitos. Apart from the raising of the general subsoil water level, it seems possible that the Headwork by obstructing flood water in the Jumna was one of the causes of flooding in the *Bela*. Apart from flooding acting as a breeding place of mosquitos it must be remembered that this condition by raising the relative humidity of the air prolongs the life of these insects and so enables them to live long enough for the malarial parasite to undergo complete development in them and also to carry the infection during a longer period of life. The breeding in Khudsia Garden, Metcalf House *Nullah*, etc. was intimately connected with flooding for it was when water was blocked back in these channels that the maximum breeding occurs.

There were some reasons by which malaria could not control in Delhi; the first reason was that failure to exclude Canal irrigation from the residential area of north of the City. Second, failure to obliterate and fill the dead end of the Western Jumna Canal, and allowing this cul-de-sac to continue as an irrigation channel to certain areas of the city, and thirdly, failure to deal with the *Bela* where it lies over against the Fort and City. In 1914, First World War broke out in which Britain was engaged and India was forcibly supported to British that's why anti- malaria operation in Delhi had been stopped. In the meantime, Municipal Committee and local bodies carried on work to prevent malaria without success. After the long period, British government again gave attention towards malaria because local bodies and Municipal had failed to prevent malaria. Municipal Committee and local bodies had always been facing financing problems and from the Government were not receiving any financial help. As compare to other epidemic diseases such as plague and cholera, malaria was not such as vigorously because cinchona febrifuge and quinine medicine were easily available for the people. However, malaria was the most frequent cause of deaths. Even statistics records show that malaria was responsible for a large percentage of sickness and deaths. In spite of maximum death from malaria, anti-malaria campaign had been faced crises due to financial constraints. British Government was reluctant to spend funds on preventive measures of malaria because they expected that Municipalities and other Local bodies should take responsibility and managed funds for the preventive measures of malaria. In 1924, Government considered that malaria drugs "Quinine" was much costly than other drugs that are why Government tried to use of cinchona febrifuge drug for malaria. 'In view of the enormous saving in money which follows the substitution of cinchona febrifuge coasting Rs. 8/-per *lb*, for quinine sulfate at Rs. 28/-per *lb*.'¹¹ It was 'assumed that Cinchona Febrifuge was necessarily equally sufficient in all forms of malaria.

Chief Medical Officer of Delhi (1920), assumed that 'as malarial fever was an epidemic and it was necessary to take some immediate steps both to prevent the disease and alleviate the suffering therefrom.'¹² The Chief Medical Officer of Delhi proposed to establish 4 itinerary dispensaries and 4 anti-mosquito gangs. These were under the supervision of the Special Medical Officer. The abnormal prevalence of malaria amongst the troop station in Delhi Fort had always been a notorious fact and a large amount of money had been spent. When J.A Sinton, Major, I.M.S visited Delhi in 1927 then he found that a large number of *Stephensi* larvae inside the Red Fort. Senior White, Central Malaria Organization Officer, had confirmed it. There was strong

evidence from the investigation of different workers that wells were the fruitful source of malaria-carrying mosquitoes in Delhi. Although there were taken legal regulation dealing with such condition this seemed to be strictly enforced. The regulation was apparently enforced at one time but now the well covering had become so damaged as to be useless as a prevention of mosquito-breeding. J.A Sinton suggests to the urgent matter that steps should be taken to prevent mosquito- breeding in wells, as these were the chief source of malaria in that area where irrigation and flooding do not play a factor.

Christophers in own his "*Report on Malaria in Delhi*"(1927) shows the mortality figure for the different Wards of the city. In which, he described that the figures were the mortality rates per mile annum for the month at which the epidemic were at their highest (October, except in a few cases where the figure were somewhat higher in November). He found that in the ward XI (Daryagunj and facing Fort) were the spleen rate 86 and 70 per cent. Respectively on the outskirts and central portion, in ward VI (Center City) in an area of density packed houses the spleen rate was 17 per cent. In following were remarks made at this time (Christophers, *Malaria in the Punjab*, Scientific Memories No. 46) regarding the nature of breeding places and the occurrence of adult Anophelines. He said that "In pools in the bed of the Jumna and in swampy parts of BelaAnopheles were found breeding in large number."¹³ They were especially numerous in small pools made in the stand by the side of the river, in pools left by the river, and in a creek. Such breeding places, however, were a mile or more from the city proper. In ward XI (Daryagunj and facing Fort) a number of large wells were found to be swarming with larvae on *N. Stephensi*, but in the ordinary small wells of the city, Christophers did not found larvae. Examination of houses, sheds, etc., in ward XI yielded a small number of Anopheles including *M. culicifacies*, *N. Stephensi* and *N. fuliginosus*. In the center of ward IV *Anopheles* were found fairly abundantly.

The year of 1926, under report was an exceptionally unhealthy one, the total deaths from all causes being 21,456 compared to the previous year with the death of 14,849. There was no epidemic of infectious diseases to account for this large mortality. The chief cause of the high mortality was the prevalence of malaria fever which was epidemic over this part of India. 'The number of deaths due to malaria, in the year of 1929 had reached at 1,046, however, the number of deaths due to all other fever were 6,585 or 43.65 per cent.'¹⁴ The death rate from the fever in the urban area per mile was 7.60 while in the rural area the death rate amounts to 18.29. The mortality rate for malaria was registered in 1931 was 0.02 per mile of the population while the total mortality rate from all kinds of fever was 10.91. Public Health Report on Delhi Province for the Year 1931 illustrated that in 1927 malaria cases were 100, 015 treated and next two year slightly increased with 106,165 and 116, 561 following the year of 1928 and 1929. The year of 1930, the cases of malaria were dropped with the number of 108,473, but again next year in 1931 the number of cases reached the highest point with 129,055. (Source: - Public Health Report on Delhi Province, 1931) It was most surprising that all the record of the deaths due to malaria or fever were found from the hospitals while in many rural areas of Delhi, fever patients were not admitted to hospitals. There were great expenses and distance and lack of awareness about the fever for the rural people that's why they did not use hospitals for their diseases. Otherwise, death's data could have been increased in the city. 'Even, after Ronald Ross had discovered malaria to be caused by the bite of an infected mosquito, no work on the prevention of malaria was under taken either in India or abroad.'¹⁵

Now Delhi had become research center of malaria and Government had invited many malaria specialists in Delhi so that they could help in the anti-malaria operation. Dr. Ross, I.M.S. physician serving the military branch throughout his career in India. He visited at Delhi when an outbreak of malaria in 1926, even, Dr. Christophers had already visited Delhi two or three weeks ago and he recommended for the formation of a committee of Malarial Board. According to his recommendation, a Malarial Engineer was appointed for Delhi. Ronald Ross discovered mosquito-malarial theory in 1897 and he found that cause of malaria was Anopheles mosquito. Few months later, he solved the last riddle of transmission by establishing the fact that the parasites work their way into the mosquito's salivary glands and pass into the blood of the anopheles.¹⁶ Government of India was also invited to the malaria Commissioner of the Health Committee of the League of Nation with five members, Professor S Chueffner (German), Institute of Tropical Medicine, Amsterdam, Professor Swellengrebel (Dutch), Institute of Tropical Medicine, Amsterdam, Professor Ciuca, former Professor at Jassy University, Roumania and Secretary of the Malaria Commission of the League of Nation Health Organization visited at Delhi in 1928. The government of India considered that India had become a house of malaria and they would give valuable suggestion to reduce of malaria.

Later on, Senior White carried out of the Colonel Christopher's recommendations and in the 1927 and 1928, he found that there was still a serious amount of malaria in the city. The spleen rates in some areas lying between 50 and 70 per cent. It seemed that a malarial sick rate amounting to 14 per cent of the population, during the month of August to October. In 1928, the Government also started five years program for the expansion and public health facilities in the Delhi. The program falls into five parts: - District Board Scheme, Shadara Notified Area Scheme, Civil Station Notified Area Scheme, Delhi Municipality Scheme, and Delhi Administration's requirements. 'The total cost of the program as now proposed by the District Board amount to

Rs. 6,34,011/- which sum the Board allows to the following four categories :- (1) Public Health-3,76,561/- (2) Medical-42,450/- (3) Improve Veterinary service-50,000/- (4) Roads- 1,65,000/-.¹⁷ The Government of India had sanctioned separately expenditure of Rs. 41,050/- on the scheme for medical inspection of school children. 'The amount sanctioned for the three years, 1929-30, 1930-31, and 1931-32 totaling Rs. 31,574/- there was to be deducted from the proposed Government grant of Rs. 3,17,475/-.'¹⁸

Malaria problem was also recognized in this five years program and about fifteen resolutions passed by Anti-Malaria Committee. The Government sanctioned four lakhs rupees for five years program to prevent malaria in the Delhi. This money had to be partly spent on closing the canal irrigation system at a point near the Tis Hazari Maidan (Tis Hazari Court), near the pool at Mithai-ka-Pul. The Scheme was that filtered water had to be supplied to this area thus replacing the irrigation supply which had been proved to be one of the main sources malaria dangers in this area. Another canal at Pembari Bridge was also had to be closed because it was also the source of malaria larvae. But the problem was that the fruit garden owners, the village agriculturists were not ready to close the canal because these canals were main sources of irrigation of their field. But negotiation to deal with problem followed by the Government and offered money to them so that they could satisfy with money and could full fill their losses.

By 1930, malaria had become out of control and there was no coordination among Government's authorities to eradication of malarial. For this reason, Military and Civil authority started together work for the eradication of malaria from the Delhi. The Military authority launched a scheme to the eradication of malaria in the Cantonment area. It had often been found that mosquitoes breed intensively in localities immediately adjoining cantonments. Out of Cantonment area, other authorities such as Municipal Committee, District Board, Railway or other authorities were responsible for the eradication of malaria. Prevention of malaria had become most important policy

However, British Government was claiming of taking sufficient steps to destroyed mosquitos but the allotted fund was so scanty for the anti-malaria operation. In 1931, the total expenditure incurred on anti-malaria measures in New Delhi was Rs. 17, 684 out of which Rs. 1,800 and Rs. 15,884 were contributed by the Local Government and the Public Works Department, respectively. This fund was not sufficient for malaria operation and moreover, in the rural areas where the number of malaria cases occurred much the city, the District Board did not spend much for malaria. The Local Government contributed Rs. only 4,500 for carrying out anti-malaria measures. Out of which 784 were spent for the purchase of Quinine tablets which were distributed to the members of the District Board, District Inspector of Schools, the head masters of the schools and the sub assistant surgeons in charge of the dispensaries. In spite of the number of deaths were high due to malaria but Government was apathy towards the health of all and sundry. The Government incurred the all medical cost such as providing quinine, hospitals, and dispensaries etc. In fact, Government was reluctant to spend much money on public health but due to a lot of public pressure did little work on malaria. By 1934, there was no legal obligation on a local authority which had provided a hospital for the treatment of infectious disease in pursuance of section 131 of the Public Health Act, 1875, to receive into the hospital a person suffering from infectious disease who was an inhabitant of the Delhi. While, primary public purpose of the hospital treatment of infectious disease was to prevent the spread of the disease. Provincial Government draws attention towards certain cases in which an authority disclaimed responsibility for the treatment of person temporally living in Delhi. Provincial Government made regulation that authority could not denied to treatment of disease who was not inhabitant of Delhi

'Public health official understood that malaria was primarily a rural disease, with the marked difference in malaria incidence between rural and urban parts of India. The Government of India estimated that 900,000-98,000 of annual malaria deaths occurred in rural areas, where treatment was scarce, and sanitation poor.'¹⁹ It appeared that the deaths in the rural due to malaria was double than the town. In 1937 a "Preliminary Malaria Survey of the Shahdara Thana of Delhi Province" was made and its report demonstrated that 'The villagers are entirely dependent on shallow wells for their water supply and in most places the water is brackish. The surrounding of these wells are invariably swampy as no drainage is provided for the spilling of water from the well, and the collection of water so formed were found to be breeding larvae freely.'²⁰ The report also told that most of the wells were in the dilapidated condition. The report found that mosquitoes were breeding in the following places:- The water channels in the Western area, villages ponds near Bakapur and Ghonda, irrigation Channels Mandauli Village, Collection of water around drinking wells, Borrow Pits, unused wells, The Jhils etc. During the survey total 387 adult mosquitoes were collected and mostly they were *A culicifacies*, *A Subpictus*, *A Stephensii*, *A anularis* and the rest were *culicine* mosquitoes. It appeared that Northeastern was the most highly malarious area. High spleen rate at Ghonda village was highly suffered and behind of its reason was large water channels with holds flood water. But highest incidence recorded was that at Babarpur (64.37) and there was no doubt that this was due to the overgrown and broken down irrigation channels in the area. The Report recommended that dilapidated well should be repaired by the Government and all canal distributaries required to keep free from silting and blockage and treatment with diesel oil mixture once a week. Unused irrigation wells

should treatment with Diesel oil mixture once a week. It was proposed to establish two observation centers in the northern section at Babarpur and Ghondi.

A monthly progress report on anti-malaria operation in Delhi published in 1940. The report illustrated that malaria occurrence during the whole year. The government had been taking many steps to control of larvae, such as an area of approximately 100 acres south-east of FerozeshahKotla had been leveled. For this work, Government made a special grant of Rs. 5,000/-. Many works carried on in the five years' program in 1940 such as raising the bed of Jamuna Village Drain. This project includes also the reconstruction of certain subsidiary channels discharging into the main drain. In the "Forty Seventh Report on Malaria Operation in the Delhi Area" had focused on canalization of KushakNala, Filling pits in Paharganj and Kishanan, canalization and stone pitching of Darhalia Escape and part of Najafgarh drain, and filling borrow-pits between New Delhi Station and Harding Railway Bridge. But all efforts were failed because malaria patients were increasing the whole year. 'There was an increase in the incidence of "fever" during the year, from 65,306 in 1939 to 75,824 in 1940.'²¹ However, since 1936, malaria control measures in the urban area had been carried out under the direction and supervision of the Malaria Institute of India. A sum of Rs. 5, 29, 550 was sanction for permanent engineering works for the financial year 1940-41 for which have discussed above. Major M. K. Afridi, I.M.S. was appointed as a special drainage technique officer. He was employed in draining the extensive Brickfield area south of New Delhi. This had proved equally successful and had resulted in the saving of a further Rs. 5 lakhs which had been estimated for the work in this area. Next, Major Jaswant Singh, I.M.S., who was succeeded Major Afridi as Assistant Director, Malaria Institute of India, carried out all anti-malaria measures, which included minor leveling and draining operation.

However, anti-larval measures were carried out throughout the year but no single institution was responsible for it. The different institution such as urban local bodies, Malaria Institute of India, Municipalities etc. was responsible for these measures in their respective jurisdiction. So far as the anti-mosquitos measures were concerned these were carried out under the National Malaria Control Scheme. Under this scheme, every village in the state was subject to residual spraying twice in the season at an interval of two months. British Government claimed the success of these measures during the last decades in reducing malaria. The Annual Public Health Report on Delhi Province for the year of 1940 illustrated that "fever" cases in the rural area appeared 27520 in 1936 and 15888 in 1940."²² A comparative study shows that the numbers of malaria cases were much treated in the dispensaries in the rural area during the year 1936 than 1940. It is very difficult to reach any conclusion that what was the real cause of fewer malaria patients in rural than the city but it appears reasonable to deduce that the villages treated with quinine and spraying did as well as. The Government divided villages into three groups so that malaria could be controlled. In the first group, total numbers of 32 Delhi villages were selected and only quinine for the treatment of cases of malaria was distributed in 16 groups of villages. For the B group, Quinine plus anti-larval measures were taken. While, the group of C villages, distributed quinine and adult spraying time to time. Each group contains villages fully representative of different condition obtaining in each area. The preventive measures which were adopted by the Government and Local Bodies were free distribution of quinine, prevention of mosquitos breeding, destruction of mosquitos, repaired and if necessary to close off canals and drainage and treatment of the drinking water in wells. It was considered there were abundant gardens in Delhi which were also the important source of larvae, these should be emptied regularly and water brushed out in the week. 'A mixture of one part crude oil and three parts kerosene oil with a little castor oil forms a most effective larvicide.'²³ His type of mixture was sprayed by the pump on the surface of stagnant water or pool, cistern etc. Paris green was also used to the eradication of larvae which were responsible for malaria. Another useful method was fumigation, all these measures were taken by the Government, Municipal Committee, and Local Bodies; reduce to the number of cases of malaria in Delhi.

Despite the astounding many reports on maximum deaths from malaria, Municipalities and Government did not spread-out beyond the city limits. The Municipalities and Local bodies always cried for lack of fund but Government never made enough funds for malaria operation. The Government made always made a common excuse of lack of funds. However, Government approved the plans and estimates relating to anti-malaria scheme and sanction of Rs. 5,29,000/- for the year of 1940-41. It was proposed to utilize Rs. 35,300/-out of this for drainage of GulabiBagh area which bounded by the Darhal Escape, Najafgarh Cut, Delhi Ambala Kalka Railway and the Western Jumana Canal. This area lies immediately to the west of the Roshanara extension area which was being developed. For drainage of Nizamuddin and Jangpura village was provided Rs. 1, 92,100, including sewerage work and that the anti-malaria work.

When Government made the budget estimate of Anti-malaria operation for the year 1941-42 then funds was no increased in the comparing of previous year budget of 1940-41. It was clear that malaria was less priority in their list while other issues were important for them. In this budget made a provision of a post during the malaria season. He had to carry out of anti-malaria operation and the minor drainage operation in Delhi. It was proposed that they should be given a grade equivalent to corresponding posts in malaria Institute of India. For the Anti-malaria operation, total ten posts were to be the sanction in this budget and the total amount of

provision was fixed for the year. But after that it Second World War broke out in which Britain forcibly put pressure on India to joined Second World War. Due to Second World War, all development work in the regarding of malaria had been stopped. After the Second World War, India underwent political crises in which riot, strikes, and political ambitions were common and obliterated all anti-malaria operation. During 1947.

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