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Original Research Article

A Study on the Evaluation of Current Prevalence of Malaria in India

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Abstract

Introduction: The World Health Organization (WHO) estimates that malaria poses a threat to 93% of India's population. One of the main issues with the nation's public health is malaria. The National Vector Borne Disease Control Programme (NVBDCP) reports around 1.5 million confirmed cases each year, of which 40-50% are caused by Plasmodium falciparum. If proper therapy is initiated early, malaria can be cured. Early case detection and prompt treatment (EDPT), active case detection, and passive case detection through fever treatment depots and village link workers in inhospitable and distant locations are the main tactics for controlling malaria in India. India's malaria prevention methods emphasize the employment of long-lasting insecticidal nets, chemical insecticides, bacterial pesticides, larvae fish, and indoor residual spraying to effectively control vectors. It has been seen that there is an association of typical socio-demographic characteristics with vulnerability of malaria infection. There is a need to properly analyze and evaluate the associative factors for proper formulation and implementation of policies and preventive strategies.

Aims and Objectives: This study is intended to evaluate the significant parameters that contribute in current prevalence of malaria infection.

Materials and Methods: This is a retrospective cross-sectional study which is conducted in two phases, namely, extraction of patients' information and surveying the same patients with structured questionnaire to gather their knowledge, behaviour and attitude towards malaria and its prevention. The gather information and data was properly evaluated and statistical analysis was done to conclude the associative parameters contributing to the current prevalence of malaria.

Results: The result shows that age and gender are not significant factor which correlates with Malaria occurrence ($p>0.05$). Education status is found to have significantly correlated with Malaria occurrence ($p<0.05$). Again, it was found that immigrant workers and people with less family income (with annual income of Rs. 0-100,000) were significantly infected with Malaria as compared to other sub-groups ($p<0.05$).

Conclusion: The study has concluded that irrespective of the age and gender, malarial cases have been occurring. Education and income is playing a significant role in getting malaria. The study also concludes that there is a need to improve the well-being of immigrant workers.

Keywords: Malaria, Prevention, Plasmodium, Mosquito, Prevalence.

Introduction

Vector-borne infection cause for some more about, 17% of all communicable diseases worldwide as well as >700,000 mortality annually [1]. In many areas of India, where it is a significant vector borne infection, malaria poses a threat to the overall community [2-5]. *Plasmodium vivax* and *Plasmodium falciparum* are distributed differently in India, which complicates the malaria problem [6]. The World Health Organization (WHO) estimates that malaria poses a threat to 93% of India's population [7]. In India, fatality and comorbidities from malaria have decreased through 59% as well as 89 %, correspondingly, from 2000 to 2017 [8]. One of the main issues with the nation's public health is malaria. The National Vector Borne Disease Control Programme (NVBDCP) reports around 1.5 million verified cases each year, out of which 40-50% is instigated through*Plasmodium falciparum*. If proper therapy is initiated early, malaria can be cured.

In India, 1.3 billion people are at a greater probability of getting malaria. India accounts aimed at 2% of the world's malaria cases in addition to 2% of the disease's mortalities (52% of malaria-related deaths occur beyond the sub-Saharan Africa). In South East Asia, In addition, 85.2 % of the malaria impact is carried through India. It is significant that India, which represents 47% of all *P. vivax* malaria transmission worldwide, is deliberately important for said elimination of malaria, particularly in the South-East Asian region [9].

The nation has achieved significant progress in the fight against the eradication of malaria. There were 6.8 million fewer cases in 2019 than there were in 2016, and the incidence per 1000 people at risk decreased from 10 to 4.3. The number of deaths decreased from 0.018 to 0.006 per 1000 at-risk individuals during the same time period [10]. Malaria is known to mimic the symptoms of numerous common infectious disorders, but if the following features are present, other causes should also be suspected and looked into. Cough, runny nose, and other symptoms of a respiratory infection, Diarrhea/dysentery, lower abdomen ache and/or burning urination, skin diseases or rashes, Abscess, Joint pain and swelling, ear discharge, and lymphadenopathy [11]. Rapid Diagnostic Tests or microscopy should be used to investigate any instances of malaria that are clinically suspected (RDT) [12].

If treatment is put off, there could be fatal repercussions. Controlling the spread of malaria also depends on prompt and efficient treatment. In the past, almost all instances of malaria could be treated with chloroquine. Chloroquine-resistant *P. falciparum* malaria has been seen more frequently nationwide in recent research. One of the causes of the increasing proportion of *P. falciparum*equated toward*P. vivax* is likely the continued use of chloroquine in such patients [12].

The main strategies for managing malaria in India include early case detection and prompt management, active case identification, and passive detection program using fever diagnosis depots and village link workers in hospitals and remote regions. In order to provide early diagnosis, the rapid diagnostic test (RDT) aimed at *P. falciparum* identification based on the histidine rich protein-2 (HRP-2) has lately been widely implemented in the NVBDCP. The National Drug Policy in

India outlines suggestions for treating malaria. The introduction of ACT for the treatment of *P. falciparum* in the high load states follows information of management letdown towards chloroquine. It has been suggested that ACT, which is artesunate-sulphadoxine pyrimethamine, be used in all districts through extraordinary *P. falciparum* percentages. This shields around 90% of the *falciparum infection* in the nation. In recent times, India's most widely utilized therapy for severe malaria remains injectable quinine, in accordance with government treatment standards [11, 12].

India's malaria prevention methods emphasize the employment of long-lasting insecticidal nets, chemical insecticides, bacterial pesticides, larvar fish, and indoor residual spraying to effectively control vectors [12]. The primary therapeutic options under the national drug policy are chemotherapy utilizing artemisinin centered amalgamation treatment on behalf of P. falciparum and chloroquine/primaquine for *P. vivax* [13]. Numerous variables, including the socioeconomic and demographic makeup of the research area, have an impact on malaria transmission [14]. The transmission of malaria has also been demonstrated to be significantly influenced by housing variables [15, 16].

The primary hosts and vectors for Plasmodium parasite transmission are female Anopheles mosquitoes. Vertebrate hosts such as humans are secondary hosts. By feeding on an infected person's blood, the mosquitoes first become infected with the parasite. Gametocytes from the infected person unite to produce an ookinete, which penetrates the gut lining and generates oocytes in the gut wall, in the mosquito's gut. Sporozoites are released when an egg ruptures and travel through the mosquito's body to the salivary glands. The sexual reproduction stage is at hand. The mosquito then gets ready to bite a brand-new victim [16].

Male mosquitoes do not spread the disease since only female mosquitoes feed on blood. The hours between dusk and dawn are when mosquitoes bite. Blood transfusions from an infected person can also transmit the disease. The malaria parasite travels through two phases once inside humans: an exoerythrocytic phase and an erythrocytic phase [17].

This study aims at evaluating the prevalence of malaria in High Burden to High Impact (HBHI) strategic areas and analyzing the various socio-demographic parameters with vulnerability to malaria infection.

Materials and Methods

Study Design

This current cross-sectional retrospective study was conducted during the period of eight months. The study was focussed on the population of High Burden to High Impact (HBHI) areas in India.

The study has two parts, namely, extraction of patients' information including anthropometric measurements, diagnostics, treatments, from the hospital and studying the same patients with questionnaire for other information like knowledge about malaria, treatment seeking behaviour, etc.

The study employed survey questionnaire to conduct studyof the individuals with active malaria infection. The study was characterised by employing a structured questionnaire, specially individuals from Madhya Pradesh, Chhattisgarh West Bengal and Jharkhand, which are HBHI strategic areas according to World Health Organization [16,17]. This study is conducted by using questionnaire distributed online and data related to Malaria occurrence and various socio-demographic characteristics were analyzed. The questionnaire featured queries related to awareness and knowledge of malaria, while the anthropometric measurements, malaria

diagnostic information and treatment of each patient was derived from the hospital records.

Inclusion and Exclusion Criteria

The study included individuals with active malaria infection and those who agreed to cooperate with the whole study process. This includes the sharing and allowing us to analyze the blood reports, treatment details, travel history, required questions regarding disease awareness and knowledge. Our study also sought the result of Rapid Diagnostic Test Kit for considering the causal organism of Malaria including *Plasmodium falciparum* and *Plasmodium vivax*.

The patients who did not agree to provide all the results and documents were excluded. The patients who did not give complete information including anthropometric measurements or did not share their views on the queries asked in the questionnaire, were also excluded. After applying inclusion and exclusion criteria, the study finally considered 100 patients.

Statistical analysis

The study has used SPSS 25 and excel software for effective statistical analysis. The statistical tests employed was ANOVA. The study has expressed the descriptive type of data as mean value±standard deviation and the significance level was considered to be $\alpha = 0.05$.

Results

The study has evaluated the socio-demographic characteristics of the study sample. The socio-demographic characteristics show that there is 51 males and 49 females out of 100 patients. The study has found that malaria has infected in all the age groups. Among the study subjects, 35 patients had infection of *P. vivax* while 65 patients had infection of *P.falciparum.* The study has also shown that more than half of the patients are educated at secondary level or below. It was also found that 62 patients were either immigrant worker or construction workers. The study patients who were immigrant workers were all working in construction sector. More than half of the patients from lower income group whose annual income was within Rs. 100,000. Table 1 shows detailed findings of socio-demographic characteristics of the patients.

Table 1: Socio-demographic characteristics and the corresponding number of patients in this study

Socio-demographic Characteristic	Number of patients	Percentage (%)
Total Patients	100	100
Male	51	51
Female	49	49
Age (years)		
2-19	30	30
20-39	25	25
40-59	22	22
59-79	23	23
Parasites		
Plasmodium falciparum	65	65
Plasmodium vivax	35	35
Educational status		
Secondary education or below	51	51
Undergraduate	28	28

Graduate or above	21	21
Work or occupation		
Immigrant/construction workers	62	62
Service	12	12
Self employed	9	9
Students	13	13
Others	04	04
Annual Family Income		
0-100,000	56	56
100,001-500,000	29	29
500,001-10,00,000	15	15
Past History of Malaria		
No	44	44
Yes	32	32
Not sure	24	24

The study has found that all the patients had symptoms, weakness, myalgia and fever. Only 21 patients had severe anemia. Table 2 listed the features of Malaria that have been found in the patients.

Table 2: Features of Malaria recorded for each patient

Feature	Number of patients
Asymptomatic	0
Symptoms present	100
Weakness	100
Fever	100
Headache	99
Vomiting	78
Nausea	91
Chills and sweats	98
Myalgia	100
Thrombocytopenia	89
Hepatosplenomegaly	74
Hemoglobinuria	85
Severe anemia	21

The study has found that 69 patients reacted when felt abnormal. Out of this, there were 25 of them, who had allopathic drugs and 20 of them applied some home remedies. Again, 46 patients took more than a week to seek proper treatment and 31 patients took almost a week to seek proper treatment. This happened, because 62 patients reported that they had financial problems while 47 patients could not understand whether to go to a clinic or not.

The study also observed that 24 patients use bleeching surrounding the house on regular basis and only 36 patients clean their house regularly. There are 31 patients who reported that they use mosquito repellant while only 18 patients use bed nets. Table 3 gives the detailed findings of the survey regarding the treatment seeking attitude, knowledge and awareness about malaria among the patients.

Table 3: Treatment seeking attitude, knowledge and awareness about malaria

Factor/behaviour/attitude	Number of patients
Action took after feeling unwell	69
Taken allopathic drugs	25 (out of 69)
Had herbal solution	12 (out of 69)
Undertaken home remedy	20 (out of 69)
No measure was taken	03 (out of 69)
Time to treatment sought after feeling unwell	
Within 1 day	04
Within 3-4 days	19
Within a week	31
More than a week	46
Reason (s) for time required to sought treatment	
Could not understand whether to go or not	47
Could not understand where to go	28
Did self medication	20
Had financial problems	62
Cleanliness of the house and its surroundings	
No open drains or stored water	7
Drains present around the house but cleaned regularly	14
Inside of house is cleaned on regular basis	36
Use of bleeching surrounding the house on regular basis	24
Steps taken to prevent malaria	
Using bed nets	18
Using window nets	2
Using repellants	31
Elimination of breeding sources regularly	11

The study used SPSS 25 to carry out statistical analysis. The result shows that age and gender are not significant factor which correlates with Malaria occurrence. But education status is found to have significantly correlated with Malaria occurrence ($p<0.05$). More people with less educational status were patients in this study. Again, immigrant workers and people with less family income (with annual income of Rs. 0-100,000) were significantly infected with Malaria as compared to other sub-groups ($p<0.05$) but other groups were not significantly vulnerable to Malaria. Table 4 shows the details of significance test and respective remarks if required.

Table 4: Findings of significance tests (*p*-value)

Parameter	Significance	Remarks
Age (years)	$p>0.05$	
Gender	$p>0.05$	
Educational status	$p<0.05$	Occurrence of malaria infection is significantly different between the groups, that is, the chance of infection increases with decreasing educational status
Work or occupation		
Immigrant/construction	$p<0.05$	Significantly higher in this group as

workers		compared to other groups
Service	$p>0.05$	
Self employed	$p>0.05$	
Students	$p>0.05$	
Others	$p>0.05$	
Annual Family Income		
0-100,000	$p<0.05$	Significantly higher in this group as compared to other groups
100,001-500,000	$p>0.05$	
500,001-10,00,000	$p>0.05$	

Discussion

The socioeconomic and demographic composition of the research area is one of many variables that affect malaria transmission. The transmission of malaria has also been demonstrated to be significantly influenced by housing variables. Studies on the socioeconomic and household drivers of malaria in India are extremely scarce and tend to concentrate on a small number of regions. The main housing risk variables were the category of household, the urinal competence, in addition to the water supply, while the main socioeconomic determinants included social groupings, family size, and monthly income, according to multiple Indian researches [18]. Income inequality, dwelling type, proximity towards the health sub-center, awareness and understanding of malaria, frequency of infected mosquitoes each day, of the use of mosquito nets were all substantially connected with the occurrence of malaria. Reduced malaria-connected morbidities will be achieved by expanding the number of health sub-centers adjacent towards village communities, enhancing economic conditions, and raising public awareness of malaria prevention strategies.

An increased risk of malaria is associated with illiteracy and only having received a primary education. This was anticipated because literacy improves knowledge of infectious diseases and the necessary precautions. However, past research [12, 18] conducted in India did not discover a link amongst education in addition to threat of malaria. In one reported [18], there were only 71 households in the sample, but as per another reported study [15] solitary included no schooling, basic besides secondary grades, and did not include college education in their list of educational characteristics. When associated in the direction of the national average of 73%, ST who is more susceptible to malaria had a lower literacy rate (59%) [19].

When compared to those who are self-employed or receive a pay or salary, individuals who engage in agricultural and related activities are at a higher risk of contracting malaria. Those who work in agriculture must spend a lot of time outside and are more likely to get bit by mosquitoes. According to a recent study from the Madhya Pradesh district of Mandla, malaria is significantly more common in households with their own farmlands [20].

The number of people living in the household (>6 members) significantly increased the risk of malaria. A significant risk factor for malaria is the size of the family, the number of occupants in the home, and the number of people living in each room [15, 19–22]. Crowding attracts more mosquitoes due to strong smell cues. Access to outside water sources is a significant risk factor for malaria, as seen in studies conducted in India [15, 19], Because of their reliance on outside water sources, particularly in the evening and early morning, Ethiopia, Indonesia, and

sub-Saharan Africa are more likely to get mosquito bites. Furthermore, households that use tube wells for their outdoor water source are at risk for malaria [20], as tube wells may have more stagnant water nearby due to improperly maintained drainage systems. Another important household risk factor for malaria is poor sanitation, according to data from India [20] and other nations [24]. Use of unclean cooking fuel is a substantial additional malaria risk factor (odds rise by 1.5 times).

More than 80 million Indian homes have received free clean cooking fuel (a connection to a liquid petroleum gas supply) thanks to the Pradhan Mantri Ujjwala Yojana (PMUY) program [25]. By 2019 [26], it is anticipated that this program would provide clean cooking fuel to 80% of homes. The PMUY program may aid in attempts to control and eradicate malaria in addition to raising living standards.

Curiously, despite the fact that malaria prevalence is higher among the poorest, after correcting for other socioeconomic factors, it was shown that malaria risk was slightly higher in the richest than in the other economic categories. Due to the fact that this was a pan-Indian study, it is possible that a higher percentage of respondents who tested positive for P. vivax were from urban areas and were therefore more likely to be socioeconomically advanced. Urban malaria is mostly caused by P. vivax. For instance, P. vivax predominates in Uttar Pradesh, India's most populated State. Richest people are also more likely to get tested quickly and provide accurate results, especially in urban areas. But socioeconomic housing risk factors, such as rural residency, caste (ST), education levels, housing conditions, sanitation, filthy cooking fuel, inadequate water source, and wet wall/ceiling, strongly imply that poverty is a risk factor for P. falciparum malaria [17, 20].

Another risk factor for the development of malaria was the distance between the home and the closest medical institution. Numerous other studies of a similar nature found that people's decisions to seek medical care were influenced by their distance from health centers, which made the malaria problem worse [26]. The distance to a health center may be taken into consideration when determining how accessible a facility is, with patients bearing the cost of travel. Due to the expense and time lost at work, a household may decide against frequently evaluating a health center that is too far away. According to the research, family members who live close to health facilities have quicker and easier access to medical care than those whose homes are farther away. Additionally, as they engage with the medical staff more frequently, households who are closer to health centers have more knowledge and awareness [26].

The prevalence of malaria was higher among participants in the research area who had lower incomes, lived in bamboo huts, and were dispersed far from a health sub-center. Additionally, usage of bed nets, the quantity of daily mosquito bites, and knowledge and awareness of malaria were linked to the occurrence of the disease. However, malaria incidence was unrelated to the study participants' degree of education. Although there are many factors that affect malaria incidence, the current study shows that the factors connected to poverty, inadequate health infrastructure, and malaria knowledge are the most crucial ones for reducing the risk of malaria [26, 27].

Conclusion

Malaria is very prevalent disease throughout India but HBHI areas are more vulnerable and density of Malarial patients is significant. The study has gathered detailed information regarding the attitude and knowledge about malaria. The socio-demographic characteristics have been

collected and analzyed with respect to getting infected with malaria. It has been found that irrespective of the age and gender, malarial cases have been occurring. Similar to the malaria prevalence throughout the country, *P. falciparum* is more prevalent than *P. vivax* in these areas. Education is playing a significant role in getting malaria. Hence, the authors suggest that there is a need to increase general education and also specific awareness of malaria among the people. The study has pointed out an important finding that the immigrant workers are more vulnerable to malaria as their living condition and economic status needs to be better. The inspection and monitoring surrounding the construction site and the places where construction workers stay, should be done regularly and if required, it needs to be improved. Also, the study has found that the people in a family with less annual income is more vulnerable to malaria as they cannot afford to buy nets, repellant and cannot live in a better surrounding. However, the author suggests that the cleaning and hygiene can be improved and maintained at governmental or non-governmental level which can provide these people a better living. In addition, there is a need to destroy breeding grounds of mosquito in HBHI areas and continuous monitoring should be conducted.

The study has been conducted with 100 patients and more studies should be conducted with larger and varied population. This current study has made important points regarding malaria prevalence and also highlighted the feasible and required ways of prevention.

Reference

1. Vector-borne diseases [https:// www. Who. int/ news- room/ fact- sheets/ detail/ vector- borne- diseases].
2. Dash AP, Valecha N, Anvikar AR, Kumar A. Malaria in India: challenges and opportunities. J Biosci. 2008; 33: 583–92.
3. Dash AP, Adak T, Raghavendra K, Singh OP. The biology and control of malaria vectors in India. Curr Sci. 200 7;92:1571–8.
4. Kumar A, Valecha N, Jain T, Dash AP. Burden of malaria in India: retrospective and prospective view. Am J Trop Med Hyg. 2007;77:69–78.
5. Singh V, Mishra N, Awasthi G, Dash AP, Das A. Why is it important to study malaria epidemiology in India. Trends Parasitol. 2009;25:452–7.
6. Sarma DK, Mohapatra PK, Bhattacharyya DR, Chellappan S, Karuppusamy B, Barman K, et al. Malaria in North-East India: importance and implications in the era of elimination. Microorganisms. 2019; 7:673.
7. WHO. World Malaria R 2018. Geneva WH, Organization. 2018.
8. Rahi M, Anvikar A, Singh O, Jambulingam P, Vijayachari P, Das A, et al. MERA India: malaria elimination research alliance India. J Vector Borne Dis. 2019;56:1–3.
9. Asia Pacific Leaders Malaria Alliance. [https:// www. aplma. org/ upload/ book/ leade rs- roadm ap. pdf].
10. National Framework Malaria Elimination. India 2016–2030 [https:// www.who. int/ docs/ defau lt- source/ searo/ india/ health- topic- pdf/ natio nalframe work- malar ia- elimi nation-india-2016-2030.pdf?sfvrsn=606b352 a_2].
11. Subbarao SK, Nanda N, Rahi M, Raghavendra K. Biology and bionomics of malaria vectors in India: existing information and what more needs to be known for strategizing elimination of malaria. Malar J. 2019;18:396.
12. Sharma RK, Singh MP, Saha KB, Bharti PK, Jain V, Singh PP, et al. Socioeconomic & household risk factors of malaria in tribal areas of Madhya Pradesh, central India. Indian J Med Res. 2015;141:567–75.
13. Gamage-Mendis AC, Carter R, Mendis

C, De Zoysa AP, Herath PR, Mendis KN. Clustering of malaria infections within an endemic population: risk of malaria associated with the type of housing construction. Am J Trop Med Hyg. 1991;45:77–85.
14. Ghebreyesus TA, Haile M, Witten KH, Getachew A, Yohannes M, Lindsay SW, Byass P. Household risk factors for malaria among children in the Ethiopian highlands. Trans R Soc Trop Med Hyg. 2000;94:17–21.
15. Sharma RK, Rajvanshi H, Bharti PK, Nisar S, Jayswar H, Mishra AK, et al. Socio-economic determinants of malaria in tribal dominated Mandla district enrolled in Malaria Elimination Demonstration Project in Madhya Pradesh. Malar J. 2021;20:7.
16. Yadav K, Dhiman S, Rabha B, Saikia P, Veer V. Socio-economic determinants for malaria transmission risk in an endemic primary health centre in Assam, India. Infect Dis Poverty. 2014;3:19.
17. Mohan I, Kodali NK, Chellappan S, Karuppusamy B, Behera SK, Natarajan G, Balabaskaran Nina P. Socio-economic and household determinants of malaria in adults aged 45 and above: analysis of longitudinal ageing survey in India, 2017–2018. Malaria journal. 2021;20(1):1-9.
18. Yadav K, Dhiman S, Rabha B, Saikia P, Veer V. Socio-economic determina-nts for malaria transmission risk in an endemic primary health centre in Assam, India. Infect Dis Poverty. 201 4;3:19.
19. Ministry of Tribal Affairs [https:// tribal. nic. in/ downl oads/ Stati stics/ Statistics 8518. pdf]
20. Sharma RK, Rajvanshi H, Bharti PK, Nisar S, Jayswar H, Mishra AK, et al. Socio-economic determinants of malaria in tribal dominated Mandla district enrolled in Malaria Elimination Demonstration Project in Madhya Pradesh. Malar J. 2021;20:7.
21. Jusler Kalsingh T, Mathai MT, et al. Socio-demographic and household attributes may not necessarily influence malaria: evidence from a cross sectional study of households in an urban slum setting of Chennai, India. Malar J. 2018;17:4.
22. Saha KB, Sharma RK, Mishra R, Verma A, Tiwari BK, Singh N. Establishing communication mechanism for malaria prevention in Baiga tribal villages in Baiga Chak area of Dindori district, Madhya Pradesh. Indian J Med Res. 2015;141: 576–83.
23. Foster T. Predictors of sustainability for community-managed handpumps in sub-Saharan Africa: evidence from Liberia, Sierra Leone, and Uganda Environ Sci Technol. 2013;47:12037–46.
24. Semakula HM, Song G, Zhang S, Achuu SP. Potential of household environmental resources and practices in eliminating residual malaria transmission: a case study of Tanzania, Burundi, Malawi and Liberia. Afr Health Sci.2015;15:819–27.
25. Ministry of Petroleum and Natural Gas. Official Website of Pradhan Mantri Ujjwala Yojana. [http:// www. pmujj walay ojana. com/].
26. Lowassa A, Mazigo HD, Mahande AM, Mwang'onde BJ, Msangi S, Mahande MJ, Kimaro EE, Elisante E, Kweka EJ. Social economic factors and malaria transmission in Lower Moshi, northern Tanzania. Parasites & vectors. 2012 Dec;5(1):1-9.
27. Al-Khafaji D. K. H., Al-Quzwiny K. Y. H., & Al-Daami Q. J. Analytical Implication of Cardiac Biomarkers in Patients with Acute Ischemic Stroke: A Cross-Section Study. Journal of Medical Research and Health Sciences, 2022;5(8): 2145–2152.