

**RE-EXAMINING MALARIA DISEASE AS A FACTOR IN CHILDREN'S MORTALITY RATE AND ITS IMPACT ON THE PROTECTION OF CHILDREN'S RIGHT TO HEALTH AND WELLBEING IN NIGERIA\***

**Abstract**

*Malaria diseases is one of the multiplicity of factors responsible for high morbidity and mortality rate among Nigerian children. These high morbidity and mortality rates are violations and antithetical to the realisation of the right to health of the Nigerian children. These breaches of children's right to health in Nigeria are contrary to Nigeria's voluntarily assumed obligations under international human rights law including the Sustainable Development Goals (SDGs). Addressing malaria induced violations of children's right to health in Nigeria will require changes in law, policy and programmes necessary to prevent and treat malaria affecting children. Adopting the doctrinal approach, this study examines the significant role of malaria disease in the denial of the right to health and wellbeing of the Nigerian child. This is especially so given the ineffectiveness of the present method and argues for the adoption of broad spectrum of solutions such as legal, policy, technology and programmes. These comprehensive solutions will curb the impact of malaria in the denial of children's right to health in Nigeria.*

**Keywords:** Malaria Disease. Human Rights. Children's Right to Health. Nigerian Law

**1. Introduction**

Children's right to health, like the general right to health of everyone, is a fundamental right recognised under international human rights law. Although, children's right to health is protected under general international human rights law such as the Universal Declaration of Human Rights (UDHR) and the International Covenant on Economic, Social and Cultural Rights (ICESC), there was the need to provide special rights to health for children. The central characteristic of children necessitating exceptional grant of right to health to them stems from their unique vulnerability, particularly during their earliest years, to poor health consequences springing from malnutrition, poverty, adverse environmental circumstances and conditions which relentlessly influence their development. Children's susceptibility to adverse health conditions has longstanding and enduring consequences which considerably and inexorably effect their neurological, cognitive, physical and emotional development. These vulnerabilities are accentuated by children's lack of autonomy.<sup>1</sup> These consequences necessarily impact on their educational and other life attainments. Realising children's right to health creates the necessary environment and conditions that empowers them to develop to their fullest potential and become creative and industrious members of the society or country. Nigeria has failed to protect the right to health of children and one of the important factors that leads to this failure is the impact of malaria disease on the health of the child.

Malaria affects most countries around the equator and at the turn of the century, almost all countries in the region were malaria endemic, but some countries succeeded in eliminating the disease. Nigeria has the highest number of deaths from the disease worldwide with about 300,000 deaths annually while about 100 million Nigerians are at risk of the disease. Malaria contributes to an estimated 11 per cent of maternal deaths in Nigeria and accounts for 29 per cent of global malaria burden. Malaria is the leading cause of mortality for children in Nigeria and in Borno State more people are dying from the disease than all other diseases put together.<sup>2</sup> Nigeria therefore suffers the world's greatest malaria burden. The disease accounts for 60 per cent of outpatient visits to hospitals and leads to approximately 30 per cent of child mortality in Nigeria especially among children who are less than five years.<sup>3</sup> Nigeria's malaria burden contrasts dramatically with the position in Europe and America, where the disease has been eradicated and contrasts significantly with the situation in China and India with more than two billion population and have virtually eradicated the disease.<sup>4</sup> The next section of this paper undertakes analysis of some concepts used in the study, this is followed by an examination of legal framework for the protection of the right to health of the child in Nigeria. The fourth section of this work examines how malaria effects the health of Nigerian children which is followed by the conclusion.

**2. Meaning of Child**

Article 1 of the Convention on the Rights of the Child (CRC) defines a child as 'every human being below the age of 18 years, unless under the law applicable to the child, majority is attained earlier.' Spronk-van der Meer observes that the law identifies the age of majority as the dawn of minority and the beginning of adulthood. At the age of majority, the minor is no longer considered in the eye of the law as a child. The child then assumes control of his own affairs and decisions, resulting in the termination of the parents' or legal guardian's legal control and authority over him.<sup>5</sup> She further argues that each country has its own legal definition of the age when a kid reaches legal majority and this also differs regarding a particular subtheme. This

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<sup>1</sup> N. C. Njoku, Contextualizing Paediatric Euthanasia within the Framework of Children's Right, *The Nigerian Juridical Review*, Vol. 17 (2022), p. 188. Available at <https://tnjr.uneclaw.ng/index.php/tnjr/article/view/33>. Accessed on 25<sup>th</sup> September, 2025 at 3.15pm

<sup>2</sup>Ifijeh, M. & Tyessi, K. Apr. 26, 2018. Closing the financial gap against Malaria. *Thisday Newspaper*. Retrieved Mar. 15, 2023, from <https://www.pressreader.com/nigeria/thisday/20180426/281934543558180>.

<sup>3</sup>Adedigba, A. Apr. 21, 2018. Why Nigeria can't defeat a disease threatening 97% of its population. *Premium Times*. Retrieved Apr. 28, 2022 from <https://www.premiumtimesng.com/health/health-news/265743-why-nigeria-cant-defeat-a-disease-threatening-97-of-its-population.html?tztc=1>.

<sup>4</sup> Ifijeh & Tyessi, op cit. (No. 41)

<sup>5</sup>Spronk, S. I. 2014. *The right to health of the child: an analytical exploration of the international normative framework*. Intersentia, Antwerpen. Pg. 29

is illustrated by the fact that in a number of nations, adulthood is reached at 18 years while the age for allowing a child to consume alcohol is 21 years. Again, for the purposes of consenting to medical treatment, the age of majority is fixed for 16 years in some countries.<sup>6</sup> Neither the CRC, the European Convention on Human Rights nor the International Covenant on Civil and Political Rights determined the age childhood commences and as a result the determination of childhood ought to be left to regional conventions and municipal legislation of state parties. Nigeria's Child's Rights Act provided that a child is a person who is less than eighteen years. However, under African traditional environment, the definition of a child is governed by situational elements and dynamics, as a result end of childhood takes diverse forms in different communities.<sup>7</sup> Both the CRC, ACRWC and CRA did not include customary concept of childhood in their definition of childhood. Under customary law the determination of childhood is not contingent on age but on certain circumstances.<sup>8</sup> Some of the circumstances are where a person is seen as not having reached the mental and social adaptation in relation to his environment in order to be able to resolve numerous problems which may challenge him when he is not directly supervised by adults and where an individual is reliant on his parents for his livelihood, maintenance or sustenance.<sup>9</sup> It inexorably follows that the definition of a child under customary law is sufficiently flexible to reflect the dynamics of human nature in differing societies and environments. It is therefore recognised that fixing an arbitrary age to a definition of a child does not take into cognisance the diverse cultures, customs and ways of life of different societies.

### **3. Right to Health of the Child**

Right to health of the child, like the broader concept of right to health<sup>10</sup>, is internationally recognised as one of the most fundamental rights in the International Bill of Rights. This right is decisively entrenched in international law. Although, international law protects the right to health of everyone, including children, it was recognised that it is essential that a specific and distinct right to health be granted to children. It is thought that children, as a result of their childhood and minority status, are inherently vulnerable and therefore requires special grant of health rights. The realisation of the right to health of the child is crucial for a child's complete development and imperative to the enjoyment of other children's human rights. Some of the rights provided in the Convention on the Right of the Child (CRC) are reflective of the principles and norms that are common to other international human rights instruments namely that human rights relate and common to all children without discriminations, distinction; that child's right include civil, political, economic and social rights. Other applicable norms and principles are that children's right impose obligations on individuals and states to respect and fulfil these rights and equally insists that there should be liability and accountability for violations and for non-fulfilment of children's right. The CRC also affirms that children, with the requisite capacity, have the right of freedom of expression and freedom of thought, conscience and religion.<sup>11</sup> It has been suggested that the CRC could be interpreted by adopting the principles of protection, promotion and participation. The principle of protection is defined as children's right to special care and assistance and encompasses the right to be protected from harmful acts and practices. The principles of promotion is the children's right to the possession and reception and access to resources and services from healthcare and education. The principle of participation refers as the child's right to be heard, listened to and involved in decision-making.<sup>12</sup>

The right of the child to health is lucidly enunciated in art 24 of the CRC which specifies that every child has the right to 'enjoy the highest attainable standard of health and access to health care services.' The right to health of the child is not to be understood as simply signifying access to medical treatment for children but must be recognised as encompassing a wide spectrum of dimensions such as physical, mental, social and environmental wellbeing. Right to health of the child not only includes timely and appropriate health services but encompasses rights to programmes that address the fundamental social and environmental determinants of health. This is significant because children's health is affected by many factors and circumstances in addition to availability of health care. These other underlying determinants of health are social and economic resources, nutritious food, clean water, cultural practices, healthy environment, physical and social climate change and the development of new medical technologies and vaccines. Right to health of the child therefore refers to access to healthcare in terms of receiving preventive, curative and rehabilitative medical care. It embraces prevention and treatment of childhood diseases through vaccination programmes and provision of essential medicines. The right includes access to adequate nutrition and clean water to support healthy growth and development of the child as well as living in a healthy environment with access to clean air and sanitation.

### **4. Legal Framework for Protecting Children's Right to Health in Nigeria**

Article 12 (2) (a) of the International Covenant on Economic, Social and Cultural Rights, 1976 (ICESCR), made specific provisions regarding the children's right to health. It provides that the steps to be taken by the State Parties to the covenant to achieve the full realization of the right shall include those necessary for the provision for the reduction of the stillbirth-rate and

<sup>6</sup> Ibid.

<sup>7</sup> Ekundayo O. 2018. Legal issues in adolescents' rights under medical treatment as a constituent of right to health. *Nigerian School Health Journal* 30.1: 140-146. Pg. 141.

<sup>8</sup> Ajanwachukwu, M. A. 2024. *Rights of the Nigerian Child- A Legal Skullduggery?* Inaugural Lecture at the Ebonyi State University, Abakaliki. Pg. 9

<sup>9</sup> Ibid. Pg. 10

<sup>10</sup> O. Aje-Famuyide and F. Anene. Universal Health Coverage and The Right to Health in Nigeria, *U.I Law Journal*, Vol. 10 NO. 1 (2020) Available at <https://journals.ui.edu.ng/index.php/uilr/article/view/1062>. Accessed on 25<sup>th</sup> September, 2025 at 3pm

<sup>11</sup> Chapman, Audrey R. et al. 2023. Promoting children's rights to health and well-being in the United States, *The Lancet Regional Health – Americas*, Volume 25, 100577 p. 2

<sup>12</sup> Ståhlberg, A., et al, 2024. Children's Right to Health through the Principles of Protection, Promotion, and Participation, from the Perspectives for Children, Parents, and Professionals: A Systematic Review. *Child Care in Practice*, 30(4), 537–572. <https://doi.org/10.1080/13575279.2023.2298312>

reduction of infant mortality rate and also for the healthy development of the child. Nigeria ratified the ICESCR but did not take the necessary steps to domesticate the treaty consequently, the treaty is not directly applicable in Nigeria. By virtue of art 14(1) the African Charter on the Rights and Welfare of the Child (ACRWC) made general provision for securing the right to health of the child by stating that every child in the state parties to the Charter shall have the right to enjoy the best attainable state of physical, mental and spiritual health. The Charter included the right to spiritual health as a component of the right to health of the child. The ACRWC is an African regional treaty on the right of the child and its contents is similar to the Nigeria's domestic Act on the right of the child. According to Article 24 (1) of the Convention on the Rights of the Child (CRC), 'States parties recognize the right of the child to the enjoyment of the highest attainable standard of health and to facilities for the treatment of illness and rehabilitation of health. States Parties shall strive to ensure that no child is deprived of his or her right of access to such health care services.' The Constitution of the Federal Republic of Nigeria, 1999 (CFRN) is the organic and supreme law of Nigeria. It is the *grundnorm* and by virtue of that fact, all other laws in Nigeria derive their power, legitimacy and validity from the CFRN<sup>13</sup>. It is the measuring rod by which cogency and authority of other laws, executive, legislative and judicial powers and decisions are determined. Despite the fact that the CFRN is the supreme law of Nigeria, it does not expressly provide for the right to health of the child or right to health at all. Regarding specific child centric legislation, Nigerian has adopted the CRC and enacted it as a national legislation through the Child Rights Act, 2003 (CRA). The right to the health of the child is granted under Section 13 of the CRA. Sub-section 1 of the section grants the right to the highest attainable state of physical, mental and spiritual health. This provision is similar to the grant of right to health under the ACRWC which prescribes the right to spiritual health as a component of the child's RTH. The right to spiritual health is not contained in the CRC. Sub-section 2 of the CRA imposed obligations on governments, parent, guardian, institution or organization responsible for the care of a child shall endeavour to provide the child the best attainable state of health.

### **5. Malaria Disease and the Right to Health of the Child in Nigeria**

Malaria is a serious public health challenge and a major cause of suffering, misery and untimely death in tropical and subtropical countries. Malaria continues to constitute a major disablement to health in Africa especially sub-Saharan Africa. Malaria affects children and pregnant women and is a main reason for illness and death among children. One estimate puts the number of children dying yearly from direct and indirect effects of malaria in Africa as one million.<sup>14</sup> Malaria is a preventable and treatable disease but has attained epidemic proportions in some regions of the world. African children, especially Nigerian children, under the age of 5 and pregnant women in Nigeria are the population that is most at risk. Seriously suffering and distressed children regularly and frequently die less than 72 hours after exhibiting symptoms of malaria. The children that survive the illness, the malaria disease drains vital nutrients from them which inexorably damages and blights their capacity for physical and intellectual growth. Malaria infection in children leads to substantial school absenteeism and has significant impact on economic productivity.<sup>15</sup> The infection also plays important role in causing anaemia in children.<sup>16</sup> Africa continues to bear the heaviest burden of malaria globally. Africa accounts for 95% of all global malaria cases, 96% of all malaria deaths and importantly, 80% of all malaria deaths were among children under the age of 5 years. Four countries namely Nigeria (26%), the Democratic Republic of Congo (12.3), Uganda (5.1%) and Mozambique (4.1%) accounted for almost half of all global cases. Equally, four countries namely Nigeria (31.3%), the Democratic Republic of Congo (12.6%), the United Republic of Tanzania (4.1) and the Niger (3.9%) accounted for 38% of global malaria deaths in children under the age of 5 years.<sup>17</sup> Severe malaria is a major cause of hospital admission among Nigerian children and is particularly so among children less than 5 years. The high incidence of childhood severe malaria admission shows the high burden of malaria among Nigerian children. These severe types of malaria is more common with children under the age of 5 years.<sup>18</sup> Severe malaria deaths are associated with wasting and children under the 2 years of age are more probably to die from severe malaria than older children. Equally the risk of death as a result of malaria is considerably higher when severe malaria is coupled with respiratory distress and hypoglycaemia.<sup>19</sup> The total malaria cases in Nigeria in 2018 was 57, 184, 100 while the malaria mortality rate per 100,000 population for that year was 46. The total estimated malaria deaths for 2018 was 95, 800 while malaria deaths in children under the age of 5 in 2018 was 84, 800. Also, the percentage of all child deaths attributable to malaria in 2018 was 16%.<sup>20</sup> Nigeria bears 25% of global morbidity due to malaria and malaria is responsible for about 60% of outpatient hospital visits. Nigeria accounts for 50 million of global cases of malaria and 100,000 deaths.<sup>21</sup> Of all the population groups in Nigeria, the most

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<sup>13</sup> Section 1(1) of the CFRN, 1999

<sup>14</sup> Nwaorgu, O. C. & Orajaka B. N. 2011. Prevalence of Malaria among Children 1-10 Years Old in Communities in Awka North Local Government Area, Anambra State South East Nigeria. *International Multidisciplinary Journal* 5.(5):22: 264-281.

<sup>15</sup> Ibid. Pg. 265.

<sup>16</sup> Ibid. Pg. 274.

<sup>17</sup> WHO. *World Malaria Report, 2022*. Retrieved Aug. 6, 2023, from <https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2022>.

<sup>18</sup> Orimadegun, A. E., Fawole, O., Okereke, J. O., Akinbami, F. O., & Sodeinde, O. 2007. Increasing burden of childhood severe malaria in a Nigerian tertiary hospital: implication for control. *Journal of Tropical Pediatrics* 53.3: 185-189. Oyibo, W., Ntadom, G., Uhomobhi, P., Oresanya, O., Ogbulafor, N., Ajumobi, O., Okoh, F., Maxwell, K., Ezeiru, S., Nwokolo, E., Amajoh, C., Ezeigwe, N., Audu, M., & Conway, D. 2021. Geographical and temporal variation in reduction of malaria infection among children under 5 years of age throughout Nigeria. *BMJ Global Health* 6.2: e004250.

<sup>19</sup> Ibid. Pg. 186.

<sup>20</sup> Nigeria. Malaria: Status Update on Children. Data Snapshot.

<sup>21</sup> Dasgupta, R. R., Mao, W., & Ogbuaji, O. 2022. Addressing child health inequity through case management of under-five malaria in Nigeria: an extended cost-effectiveness analysis. *Malaria Journal* 21.1: 81; Onwujekwe, O., Uguru, N., Etiaba, E., Chikezie, I., Uzochukwu, B., & Adjagba, A. 2013. The economic burden of malaria on households and the health system in Enugu State southeast Nigeria. *PloS One* 8.11: e78362; Beargie, S. M., Higgins, C. R., Evans, D. R., Laing, S. K., Erim, D., & Ozawa, S. 2019. The economic impact of substandard and

vulnerable are the under-five children and the under-five children in Nigeria experience of 2-4 occurrences per year and are responsible for about 90% of Nigeria's malaria mortality.<sup>22</sup> Consequently, about 36% of under-five mortality in Nigeria is as a result of malaria disease.<sup>23</sup>

Ineffectual malaria treatment for under-five children has catastrophic consequences. As a result, early, timely, prompt and effective response or treatment of malaria for under-five produces positive clinical outcomes. Conversely, in circumstances where treatment is not available, delayed or ineffective, malaria can lead to severe and life-threatening complications.<sup>24</sup> Nigeria's frightening under-five malaria mortality is mainly as a result of the nature of health financing system in Nigeria in which many persons are not insured. The resultant effect of this is that there is high out-of-pocket medical expenditure that necessarily discourages individuals, especially, the poor from seeking medical treatment.<sup>25</sup> It is only about 20% of all under-five children with symptoms of fever or malaria that are brought to hospital for parasitological testing and clinical consultation.<sup>26</sup> The resultant effect is that Nigeria has one of the lowest rates of patients seeking medical care for suspected or supposed cases of under-five malaria disease in the world.<sup>27</sup> As a result, early detection of malaria is imperative especially for children under the age of five. Beyond early detection, the Federal Ministry of Health and states Ministries of Health should develop policies and programmes to ensure timely, prompt and effective treatment of malaria. Equally, these governments should ensure physical access to healthcare for children and in that regard Nigerian governments should establish a health centre in each ward in Nigeria.

However, when patients seek treatment, few Nigerians use the most effective treatment, the Artemisinin-based combination therapy, because it is exorbitantly expensive.<sup>28</sup> The Artemisinin-based combination therapy is 98% effective in the treatment of malaria in children and is the WHO recommended first-line treatment for uncomplicated malaria. The combination therapy is, however, twenty times more costly than the considerably less effective monotherapies which includes chloroquine and sulfadoxine-pyrimethamine.<sup>29</sup> As a result of the expensive nature of artemisinin-based combination therapies, only 40% of under-five children suffering from malaria in Nigeria are treated with the therapies. This is particularly so with respect to the poor since such financial obstacles affect the poor and the vulnerable more than it affects the rich and privileged.<sup>30</sup> It has been shown that suitable diagnosis and treatment are cost effective in the treatment or management of under-five malaria sickness. Nevertheless, there is knowledge gaps concerning the cost-effectiveness of such intercession or intervention in Nigeria.<sup>31</sup> In this regard, the various governments in Nigeria should either make malaria treatment for children free or provide substantial subsidy. It also provides an opportunity for the Federal and state governments to address the broad issue of multidimensional poverty in Nigeria.

There is a strong indication that there is significant subnational variation in the reduction of malaria infection in young children in Nigeria. This shows an ostensible contrast in the geographical zones in Nigeria before and after 2015.<sup>32</sup> An examination of the malaria parasite pervasiveness in children under 5 years of age from 2010, 2015 and 2018 reflects revealing and instructive tendencies for the different parts of Nigeria. Studies have shown that between 2010 and 2018, there were substantial reductions in malaria occurrence rates in 25 of Nigeria's states located in the southern and north-central zones. There were slight reductions in the prevalence rate in the northern states of the federation. A significant percentage of the reductions in prevalence rate in the southern and north-central zones occurred before 2015 and have since stalled or partly reversed by 2018. This is in contrast with the situation in the northern zone where the reduction rate was gradual.<sup>33</sup> The causes of this varying distribution of malaria prevalence in respect of time, different states and zones of Nigeria is not yet clearly understood. However, understanding the

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falsified antimalarial medications in Nigeria. *PLoS One* 14.8: e0217910; WHO. Dec. 11, 2024. *Fact Sheet about Malaria*. Geneva: World Health Organization. Retrieved Dec. 19, 2024, from [www.who.int/news-room/fact-sheets/detail/malaria](http://www.who.int/news-room/fact-sheets/detail/malaria).

<sup>22</sup>Edelu, B. O., Ndu, I. K., Igbokwe, O. O., & Iloh, O. N. 2018. Severe falciparum malaria in children in Enugu, South East Nigeria. *Nigerian Journal of Clinical Practice* 21.10: 1349–1355; United States' Embassy in Nigeria. *Nigeria Malaria Fact Sheet 2011*. Retrieved Mar. 2, 2024 from <https://cutt.ly/Qe16VFZn>.

<sup>23</sup>Dasgupta, R. R., Mao, W., & Ogbuoji, O. 2022. Addressing child health inequity through case management of under-five malaria in Nigeria: an extended cost-effectiveness analysis. *Malaria Journal* 21.1: 81; United States' Embassy in Nigeria. *Nigeria Malaria Fact Sheet 2013*. Retrieved Mar. 2, 2024 from <https://cutt.ly/fe16BTgy>.

<sup>24</sup> Ibid.

<sup>25</sup>Uneke, C., Sombie, I., Uro-Chukwu, H. & Johnson, E. 2019. Developing equity-focused interventions for maternal and child health in Nigeria: an evidence synthesis for policy, based on equitable impact sensitive tool (EQUIST). *Pan Afr Med J.* 34:158.

<sup>26</sup> WHO. *World Malaria Report, 2019*. Retrieved Aug. 27, 2023, from <https://www.who.int/publications/i/item/9789241565721>

<sup>27</sup> Dasgupta, R. R., Mao, W., & Ogbuoji, O. 2022. Addressing child health inequity through case management of under-five malaria in Nigeria: an extended cost-effectiveness analysis. *Malaria Journal* 21.1: 81.

<sup>28</sup>Ezenduka, C. C., Falleiros, D. R., & Godman, B. B. 2017. Evaluating the Treatment Costs for Uncomplicated Malaria at a Public Healthcare Facility in Nigeria and the Implications. *PharmacoEconomics - open* 1.3: 185–194.

<sup>29</sup>Thwing, J., Eisele, T. P., & Steketee, R. W. 2011. Protective efficacy of malaria case management and intermittent preventive treatment for preventing malaria mortality in children: a systematic review for the Lives Saved Tool. *BMC Public Health* 11.Suppl 3: S14.

<sup>30</sup>National Population Commission of Nigeria. 2018. Nigeria Demographic and Health Survey 2018. Retrieved Aug. 14, 2023, from <https://dhsprogram.com/publications/publication-fr359-dhs-fnal-reports.cfm>.

<sup>31</sup> Dasgupta, R. R., Mao, W., & Ogbuoji, O. 2022. Addressing child health inequity through case management of under-five malaria in Nigeria: an extended cost-effectiveness analysis. *Malaria Journal* 21.1: 81.

<sup>32</sup>Oyibo, W., Ntadam, G., Uhomobhi, P., Oresanya, O., Ogbulafor, N., Ajumobi, O., Okoh, F., Maxwell, K., Ezeiru, S., Nwoko, E., Amajoh, C., Ezeigwe, N., Audu, M., & Conway, D. 2021. Geographical and temporal variation in reduction of malaria infection among children under 5 years of age throughout Nigeria. *BMJ Global Health* 6.2: e004250.

<sup>33</sup> Ibid.

underlying reasons are imperative in order to achieve global aim of malaria reduction since it is undisputed that Nigeria has the largest share of malaria burden. It is estimated that in the region of a quarter of all cases of malaria in the world occur in Nigeria.<sup>34</sup>

Social determinants of health such as housing play important role in determining malaria prevalence rate. Housing is a significant determinant of health, wellbeing and quality of life.<sup>35</sup> Dissimilarities in housing conditions lead to diverse levels of exposure and accordingly different levels of environmental risk. The strength of the association between housing conditions and health consequences differ considerably. Nonetheless, there is a strong nexus between housing characteristics and health.<sup>36</sup> The plan or design of a house contributes to the prevalence of plasmodium falciparum<sup>37</sup> infection. Plasmodium falciparum is also the most prevalent specie of malaria parasite that affects under-five children in Nigeria.<sup>38</sup>

A study conducted in Sri Lanka reveals that the possibility of getting malaria was higher for people living in poorest type of houses. Such houses are usually characterized by incomplete construction with thatched roofs and walls made of mud compared with well-constructed houses with brick, block, plastered walls and tiled roofs.<sup>39</sup> Another study reveals that the likelihood of malaria was 2.5-fold higher for individuals living in poorly built houses than for those living in decent built houses.<sup>40</sup> In the United States, living in improved housing was an important factor in the eradication of malaria while it played significant factor in malaria reduction in Europe.<sup>41</sup> A study conducted in Nigeria reveals that a greater percentage of under-five children who were malaria positive live in rural areas especially in the North-West political zone. It was also discovered that malaria incidence reduces with increased wealth quintile and place of residence. Children who belonged to the richest wealth quintile had a lesser proportion of malaria positives compared to those in the poorest wealth quintile.<sup>42</sup>

Again, the probability of malaria disease infection was significantly lower among children living in houses constructed with better floor materials. This can be compared with those children living in houses constructed with unimproved floor materials where the risk of malaria sickness is significantly higher. The same pattern was noticed for children living in houses constructed with better roof and wall materials. Children living in completely improved houses experienced less significant or reduced occurrence of malaria infection compared to those children who lived in houses constructed with poor housing materials.<sup>43</sup> Quintile is defined as one of five equal groups or clusters into which a set of things can be separated or divided according to the distribution of a particular variable.<sup>44</sup> Malaria infection has a consequential effect on children because anaemia was significantly accompanied with the presence of malaria. Children who were infected with malaria exhibited a greater prevalence of severe anaemia than those who were not anaemic.<sup>45</sup> Anaemia is a health condition in which someone has too few or insufficient cells in their blood. Such health conditions make people to look pale and feel weak.<sup>46</sup> The Nigerian state should address the larger issue of housing deficit and provide mass housing especially for the poor and vulnerable. It should also ensure that building materials are affordable for low-income earners.

The large malaria prevalence in Nigeria has negative impacts on the nation. These negative impacts of malaria burden are multidimensional in nature. They prevent the country from achieving its developmental goals including the sustainable development goals. The human and economic price concomitant with malaria is huge and more often than not leads to low productivity and loss of income. This is because huge amount of money is spent on malaria treatment and malaria infection leads to inability to work during the period of the sickness.<sup>47</sup> Malaria is not just a public health challenge for malaria endemic countries but also a significant obstacle to the development of those countries. In malaria endemic nations where the disease flourishes, such countries suffered economically and socially. There is a significant correlation between malaria and poverty because malaria impedes economic development as a result of its effect on saving and investment, worker productivity, premature mortality, cost of treatment and absenteeism.<sup>48</sup> Malaria therefore plays important role in engendering the vicious circle of poverty. The estimated cost of preventing malaria, treatment and loss of

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<sup>34</sup> Ibid.

<sup>35</sup> Braubach, M., & Fairburn, J. 2010. Social inequities in environmental risks associated with housing and residential location - a review of evidence. *European Journal of Public Health* 20.1: 36–42.

<sup>36</sup> Ibid.

<sup>37</sup> This is the type of mosquito parasite that cause malaria.

<sup>38</sup> Morakinyo, O. M., Balogun, F. M., & Fagbamigbe, A. F. 2018. Housing type and risk of malaria among under-five children in Nigeria: evidence from the malaria indicator survey. *Malaria Journal* 17.1: 311.

<sup>39</sup> Konradsen, F., Amerasinghe, P., van der Hoek, W., Amerasinghe, F., Perera, D., & Piyaratne, M. 2003. Strong association between house characteristics and malaria vectors in Sri Lanka. *The American Journal of Tropical Medicine and Hygiene* 68.2: 177–181.

<sup>40</sup> Gunawardena, D. M., Wickremasinghe, A. R., Muthuwatta, L., Weerasingha, S., Rajakaruna, J., Senanayaka, T., Kotta, P. K., Attanayake, N., Carter, R., & Mendis, K. N. 1998. Malaria risk factors in an endemic region of Sri Lanka, and the impact and cost implications of risk factor-based interventions. *The American Journal of Tropical Medicine and Hygiene* 58.5: 533–542.

<sup>41</sup> Morakinyo, Balogun, & Fagbamigbe, op. cit. (No 642).

<sup>42</sup> Ibid.

<sup>43</sup> Ibid.

<sup>44</sup> Hornby, A. S. 2015. *Oxford Advanced Learner's Dictionary*. New 8<sup>th</sup> ed. Oxford: Oxford University Press. Pg. 1202.

<sup>45</sup> Morakinyo, Balogun, & Fagbamigbe, op. cit. (No 642).

<sup>46</sup> Hornby, A. S. 2015. *Oxford Advanced Learner's Dictionary*. New 8<sup>th</sup> ed. Oxford: Oxford University Press. Pg. 46.

<sup>47</sup> Bayode T. & Siegmund A. 2022. Social determinants of malaria prevalence among children under five years: A cross-section analysis of Akure, Nigeria. *Scientific African* 16: e01196.

<sup>48</sup> Sachs, J., & Malaney, P. 2002. The economic and social burden of malaria. *Nature* 415.6872: 680–685; Gallup, J.L. & Sachs, J.D. 2000. The Economic Burden of Malaria. *The Intolerable Burden of Malaria: A New Look at the Numbers*. Eds. J.G. Breman, A. Egan, & G.T. Keusch. *The American Journal of Tropical Medicine and Hygiene* 64.1(Suppl): 85-96.

income attributable to malaria is about N132B which is an equivalent of USD 835 million. This is poignantly illustrated by the fact that an estimated 97% of Nigerians are in danger of malaria infection.<sup>49</sup> Social determinants of health play important role in the malaria infection prevalence.

Malaria infection excessively affects specific population groups. Malaria burden is more predominant among children and pregnant women. It has been suggested that the reason why malaria affect children disproportionately is because children are yet to develop protective immune mechanisms. Apart from women and children travelers from non-endemic areas are equally prone to severe forms of malaria and suffer more deaths than in children.<sup>50</sup> The grave consequences of malaria infection among children leads to lower cognitive development, anaemia and malnutrition.<sup>51</sup> Nigeria's geographical location at the heart of the tropics plays a critical part in the prevalence of malaria infection and childhood malaria infection is responsible for 25% and 30% of infant and childhood mortality in Nigeria.<sup>52</sup> Social determinants of health (SDH) play a critical factor in the prevalence of malaria infection in Nigeria. These SDH are 'the condition in which people are born, grow, live, work and age that shape their health. Further, these conditions are shaped by the distribution of money, power, and resources at global, national, and local level.'<sup>53</sup> The SDH are social elements and physical circumstances and environments which include social and economic features of the society, physical environmental conditions, poor governance, insufficient preventive measures and poor health seeking conducts and inadequate health infrastructure drive ill health in Nigeria including malaria. These SDH exists outside the health sector but undoubtedly constitute the fulcrum of good health. The social and physical environment which enhances good health can be created within five important determinants which include economic stability, social and community setting, education, health and healthcare, neighbourhood and built environment.<sup>54</sup>

Children development deficits associated to malaria are multifaceted and wide-ranging. Effects of malaria on the different parts of the brain can be diverse.<sup>55</sup> Another study also concluded that continuous exposure of children to malaria disease does not only constitute a threat to their survival but also undermine and impair their cognitive development.<sup>56</sup> Damages on the brain may be as a result of the severity of the malaria and pre-and-post disease exposure.<sup>57</sup> Malaria significantly diminishes language development. Malaria is one of the common reasons for acquired language disorders in children in the tropical regions of the world. Language impairment in children are tremendously seen as a developmental damage or deficiency because it has a congenital foundation. Malaria diseases especially plasmodium falciparum infection may be regarded as the most common reason or cause of acquired neurological impairment in children in the tropics, including Nigeria, and it has connected with speech and language impairments.<sup>58</sup> Malaria impairs motor skills, memory, attention and executive function. Both cerebral malaria and severe malaria anaemia affect neurocognitive function of children. Such consequences are pronounced in all neurocognitive domains of children with cerebral malaria while children with severe malaria anaemia suffer impairment in their visual reception, expressive and receptive language. Motor skills are significantly affected by cerebral malaria than by severe malarial anaemia.<sup>59</sup> The pathway to cognitive diminishing or damage may be the outcome of numerous intermingling biological and social causes. The risk factors for cognitive damage or impairment which accompany malaria include repeated malaria infection, high fever, fetal exposure to malaria, antimalarial treatment, low social and economic position, malnutrition, and malaria symptoms such as diminished consciousness, inflammation, hypoglycaemia and inflammation.<sup>60</sup> Hypoglycaemia is a medical condition characterized by having too low a level of blood sugar.<sup>61</sup>

Children living in endemic areas like Nigeria who are usually exposed to repeated malaria infections and other risk factors for malaria, the disease can be regarded as a condition or disorder with heightened elongated term brain, cognitive and behaviour effects.<sup>62</sup> The neurocognitive functions that are impaired by malaria infection may be dependent on the phase of the brain growth and in some circumstances such impairment or damage may not be noticeable until the child is older.<sup>63</sup> There is also a multifaceted and intricate inter-relationship between malaria disease and numerous other risk factors. These risk factors are equally associated with impaired

<sup>49</sup> WHO. *World Malaria Report, 2019*. Retrieved Aug. 27, 2023, from <https://www.who.int/publications/i/item/9789241565721>.

<sup>50</sup> Artavanis-Tsakonas, K., Tongren, J. E., & Riley, E. M. 2003. The war between the malaria parasite and the immune system: immunity, immunoregulation and immunopathology. *Clinical and Experimental Immunology* 133.2: 145–152.

<sup>51</sup> Bayode & Siegmund, op. cit. (No 651).

<sup>52</sup> Ibid.

<sup>53</sup> WHO. *World Malaria Report 2020*. Retrieved Aug. 6, 2023, from <https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2020>.

<sup>54</sup> Ibid.

<sup>55</sup> Kihara, M., Carter, J. A., & Newton, C. R. 2006. The effect of Plasmodium falciparum on cognition: a systematic review. *Tropical Medicine & International Health* 11.4: 386–397.

<sup>56</sup> Fink, G., Olgiati, A., Hawela, M., Miller, J. M., & Matafwali, B. 2013. Association between early childhood exposure to malaria and children's pre-school development: evidence from the Zambia early childhood development project. *Malaria Journal* 12:12.

<sup>57</sup> Holding, P.A., & Boivin, M.J. 2013. The assessment of neuropsychological outcomes in pediatric severe malaria. *Neuropsychology of children in Africa: Perspectives on risk and resilience*. Eds. M. J. Boivin & B. Giordani. Springer Science + Business Media. 235–275.

<sup>58</sup> J Carter, J. A., Lees, J. A., Gona, J. K., Murira, G., Rimba, K., Neville, B. G., & Newton, C. R. 2006. Severe falciparum malaria and acquired childhood language disorder. *Developmental Medicine and Child Neurology* 48.1: 51–57.

<sup>59</sup> Bangirana, P., Opoka, R. O., Boivin, M. J., Idro, R., Hodges, J. S., & John, C. C. 2016. Neurocognitive domains affected by cerebral malaria and severe malarial anemia in children. *Learning and Individual Differences* 46: 38–44.

<sup>60</sup> Milner, E. M., Kariger, P., Pickering, A. J., Stewart, C. P., Byrd, K., Lin, A., Rao, G., Achando, B., Dentz, H. N., Null, C., & Fernald, L. C. H. 2020. Association between malaria infection and early childhood development mediated by anemia in rural Kenya. *International Journal of Environmental Research and Public Health* 17.3: 902.

<sup>61</sup> Hornby, A. S. 2015. *Oxford Advanced Learner's Dictionary*. New 8<sup>th</sup> ed. Oxford: Oxford University Press. Pg. 739.

<sup>62</sup> Milner, E. M., Kariger, P., Pickering, A. J., Stewart, C. P., Byrd, K., Lin, A., Rao, G., Achando, B., Dentz, H. N., Null, C., & Fernald, L. C. H. 2020. Association between malaria infection and early childhood development mediated by anemia in rural Kenya. *International Journal of Environmental Research and Public Health* 17.3: 902.

<sup>63</sup> Holding, P.A. & Kitsao-Wekulo, P. K. 2004. Describing the burden of malaria on child development: What should we be measuring and how should we be measuring it? *Amer. J. Trop. Med. Hyg.* 71: 71–79.

growth and development.<sup>64</sup> One of the critical factors influencing neurocognitive and behavior impairment is the age of the child at the time of malaria infection.<sup>65</sup> The pathways linking malaria infection and child development change with the age of the child.<sup>66</sup> Malaria infections are more prevalent and severe in younger children. Equally neurocognitive effects of malaria infection might be worse in children that are under five years of age. Cerebral malaria is a risk factor for numerous adverse neurocognitive outcomes. These neurological outcomes include disruptive behavioural disorders, epilepsy, and neurodisabilities which manifests in form of sensory, motor or language skills.<sup>67</sup> Disruptive Behaviour Disorders refer to health conditions that normally share difficulties in moderating aggressive behaviours or conducts, self-control, and impulses with resulting conduct that create a threat to others' safety and social norms of the society.<sup>68</sup>

## **6. Anaemia Mechanism, Malaria and Early Childhood Development**

Anaemia is one of the corridors that malaria uses to impact early childhood development. Malaria is one of the major causes of anaemia in particular among children under the age of five years in sub-Saharan Africa including Nigeria.<sup>69</sup> It is clear that malaria causes anaemia and does this by diverting iron from bone marrow and erythropoiesis as an aspect of the inflammatory response.<sup>70</sup> Erythropoiesis are the main sites where the red blood cells are produced. Erythropoiesis are the thin spaces of the vertebrae, breastbone, ribs and pelvis where the red cells are continuously produced.<sup>71</sup> There are two main methods by which malaria causes anaemia. The first is that malaria causes quick destruction or damage of red blood cells and secondly by virus-induced systemic inflammation. This systemic inflammation activates a release of the iron-regulatory hormone known as hepcidin from the liver. The hormone hepcidin successfully prevents the absorption of iron in the intestine and causes the confiscation of iron in the macrophages. Macrophages are large cells that have the capacity to remove harmful substances from the body. These cells are found in the blood and tissue.<sup>72</sup> A prolonged hepcidin-induced hypoferrremia can cause iron-deficiency anaemia. Hepcidin has consequences which results in inflation on the brain iron metabolism which also has consequences on cognitive development. Hepcidin regulates systemic iron metabolism and plays a twofold role in neuronal iron load and inflammation. Both neuronal iron load and inflammation are pathophysiological developments regularly connected with neurodegeneration.<sup>73</sup> Children between 6 months and two years of age with iron deficiency anaemia are at risk for worse social-emotional, motor, cognitive and neurophysiologic development both in the short- and long-term time frame. As a result, iron deficiency anaemia may be a significant device in the relationship between malaria and child development.<sup>74</sup> On the whole, malaria may be associated with short-term child development outcomes at a critical period in the child's development. Malaria infection induced anaemia rather than anaemia caused by iron deficiency in the diet may play an important role in the association between malaria and poor child development outcomes.<sup>75</sup> The Nigerian state must give children's health the requisite attention that it deserves by increasing budgetary allocation to health especially children's health. Constitutional amendment is imperative to make children's health a fundamental right under the constitution. In that regard, extensive laws, policies and programmes ought to be developed to address the multifaceted health interests of the Nigerian children.

## **7. Conclusion**

Nigerian children have a fundamental right to health. This right is being denied in Nigeria and malaria disease is one of the causative factors that underpins the violation of this right. Right to health is foundational to the growth, physical, emotional, cognitive and neurological development of the child. Deprivation of children's right to health has long-lasting consequences including the entrenchment and sustenance of vicious circle of poverty. It makes it impossible for children to attain their full potentials and are unable to become productive adults later in life. This has consequences for the larger society since it negatively impinges on the economic and social development of the country. The federal and state governments must develop robust legal and policy frameworks to address this issue which is central to national development.

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<sup>64</sup> Ibid.

<sup>65</sup> Ibid.

<sup>66</sup> Milner, E. M., Kariger, P., Pickering, A. J., Stewart, C. P., Byrd, K., Lin, A., Rao, G., Achando, B., Dentz, H. N., Null, C., & Fernald, L. C. H. 2020. Association between malaria infection and early childhood development mediated by anemia in rural Kenya. *International Journal of Environmental Research and Public Health* 17.3: 902; Fink, G., Olgati, A., Hawela, M., Miller, J. M., & Matafwali, B. 2013. Association between early childhood exposure to malaria and children's pre-school development: evidence from the Zambia early childhood development project. *Malaria Journal* 12:12.

<sup>67</sup> Boivin, M. J., Gladstone, M. J., Vokhiwa, M., Birbeck, G. L., Magen, J. G., Page, C., Semrud-Clikeman, M., Kauye, F., & Taylor, T. E. 2011. Developmental outcomes in Malawian children with retinopathy-positive cerebral malaria. *Tropical Medicine & International Health* 16.3: 263–271.

<sup>68</sup> Milone, A., & Sesso, G. 2022. Disruptive Behavior Disorders: Symptoms, Evaluation and Treatment. *Brain Sciences* 12.2: 225. Retrieved Aug. 4, 2023, from <https://doi.org/10.3390/brainsci12020225>.

<sup>69</sup> Milner, E. M., Kariger, P., Pickering, A. J., Stewart, C. P., Byrd, K., Lin, A., Rao, G., Achando, B., Dentz, H. N., Null, C., & Fernald, L. C. H. 2020. Association between malaria infection and early childhood development mediated by anemia in rural Kenya. *International Journal of Environmental Research and Public Health* 17.3: 902.

<sup>70</sup> Prentice, A. M., Ghattas, H., Doherty, C., & Cox, S. E. 2007. Iron metabolism and malaria. *Food and Nutrition Bulletin* 28.4 Suppl: S524–S539.

<sup>71</sup> Conley, C.L. & Schwartz, R.S. *Red blood cells (erythrocytes)*. Retrieved Sep. 4, 2023, from <https://www.britannica.com/science/blood-biochemistry/Red-blood-cells-erythrocytes>.

<sup>72</sup> Hornby, A. S. 2015. *Oxford Advanced Learner's Dictionary*. New 8<sup>th</sup> ed. Oxford: Oxford University Press. Pg. 891

<sup>73</sup> Vela, D. 2018. The dual role of Hepcidin in brain iron load and inflammation. *Frontiers in Neuroscience* 12: 740.

<sup>74</sup> Milner, E. M., Kariger, P., Pickering, A. J., Stewart, C. P., Byrd, K., Lin, A., Rao, G., Achando, B., Dentz, H. N., Null, C., & Fernald, L. C. H. 2020. Association between malaria infection and early childhood development mediated by anemia in rural Kenya. *International Journal of Environmental Research and Public Health* 17.3: 902.

<sup>75</sup> Ibid.