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Herding and Stampeding: The Albatross of Mosquito/Malaria Control

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Abstract

Malaria is lingering globally with 3.3 billion people at risk of infection and 1.2 billion others classified as high risk. The economic burden caused by the disease and vectors is humongous globally. The epicenter is Sub-Sahara Africa which accounts for 92% of the annual death burden of 435,000 of which 61% are children of less than five years. Result of elimination activities are manifest in all other WHO regions except in Sub-Sahara Africa where efforts to control the disease/vector bear unsatisfactory testimony. This worst case scenario in the region is the handiwork of weak governments and institutions that appear to lead control strategies by showiness via information media; but in reality, they are part of the albatross that stampede the processes. Remedying the situation would require multi-tactics including arm-twisting relevant authorities in Africa by the international community and knowledge-based actions by private individuals and communities to stem the tide.

Keywords: malaria control, mosquito control, Sub-Sahara Africa

1. Introduction

Malaria occurs in all six WHO regions where about 3.3 billion people are at risk of catching the infection or development of the disease and 1.2 billion others are considered as high risk persons [1]. WHO's 2018 report shows that 219 million cases of malaria occurred worldwide consequently causing 435,000 deaths with the weight concentrated in the WHO African Region which accounted for 92% of all malaria cases and children under 5 years accounting for 61% of all deaths [2]. Nigeria as the most populous country in the region also takes his fare share of the burden – most cases were suffered by Nigerians and about 25% of global deaths were also Nigerians [3]. The prevarications of climate may worsen the foregoing data. Sharma *et al.* [4] earlier observed that the impact of malaria could be stable but may not be abetted in years of intense precipitation and flooding. Moreover, there is heterogeneity in malaria prevalence [5] so may ameliorate or exacerbate the debility or fatality associated with it. Malaria could waver in strength at the local, regional and national level, becoming more resilient by acquisition of resistance which can enhance both vectors and parasites to take deep roots and diversify into various ecotypes [5]. The point being made here is that parasites and vectors could make use of opportunities offered by climate to make their effects more or less threatening to man.

Malaria is caused by protozoan parasites which are transmitted to humans when *Anopheles* mosquito feeds on man. *P. falciparum*, *P. vivax*, *P. ovale*, *P. malariae* and *P. knowlesi* are five *Plasmodium* species known to infect man. Each of the species has peculiar distribution globally, for instance, *P. falciparum* dominates in Sub Sahara Africa. Clinical manifestations vary among those five species. However, *Plasmodium falciparum* cause most of the global health problems. Most merozoites are produced by this species so causes more severe fever, anaemia, mortality [6] and accounting for 99.7% cases in WHO African Region [2]. Apart from pain and suffering during illness and subsequent death that may follow malaria, the burden on the socio-economy especially in Sub Sahara Africa is colossal [2, 7, 8].

After the discovery of malaria parasite life cycle by Ross in 1897, man had been unyielding in her efforts to eradicate them. Unfortunately, the result is a pyrrhic victory without mosquito/malaria shifting significantly from its Sub Sahara Africa hub even though there are reports of almost malaria eradication in some countries [9, 10]. For every bus, there must be a driver and every herd of cattle there must be a herder; so in every manner of success that is recorded in diseases control, there must be a driver. In well organized societies, this responsibility lies squarely on governments. Others, such as non-governmental organizations and social groups, are also important components of a successful driving crew who mobilize secondary interested parties to lubricate the process. Wherever there are such synergist drivers, any diseases control programme will be successful in significantly reducing incidence of such disease. The kernel is that there must be effective governments to herd mosquito/malaria control programmes if malaria must be eliminated in Sub Sahara Africa.

What is the current situation in Nigeria? Here the government who is supposed to nurture all anti mosquito/malaria programmes turns out to be the albatross. This happens because some persons within the government hijack governments or government programmes and upturn every strategy targeted at malaria elimination. This they do by sabotaging the conceived vision and mission by the underhand activities they engage in to divert fund meant for such projects into their bottomless pockets. They misapply the processes/programmes that work elsewhere whether it is health care, politics, commerce, industry, economy, etc. The outcomes of their clandestine activities include but not limited to a divided nation almost perpetually prosecuting internecine wars with many fronts. Would the health care sector be different? It will not because you cannot sow the wind and not reap the whirl wind.

In this paper, we attempt to present evidence that, not minding all the crisis in Nigeria, governments do provide facilities and services that appear to move mosquito/malaria control in a positive direction strategically to minimize the troubles mosquitoes/malaria impose on us. However, what is gained by constructive government maneuvers is undermined by unfolding activities of the same government that ultimately would only exacerbate the damages inflicted on Nigerians by both vectors and parasites. This scenario informs the title of this paper about the treachery in certain quarters in conformity with the adage in our place that the person herding animals may be the same person who is stampeding them.

Further, we maintain that this jeopardy is redeemable if government could change tactics. We propose to canvass, in dancing to the dictates of a global village, that anomaly anywhere in the world could be perceived as anomaly everywhere else in the world that must be tackled. This treatise intends to provoke the International Community to look inwards so as to alter her compulsive lukewarmness in internal affairs of nations such as ours where leaders plunge citizens into unending squalor, diseases and poverty. The individual citizen would also be prompted to challenge mosquito/malaria by applying simple innovations which researchers in sub Sahara Africa had made to ameliorate the pangs of mosquito malaria.

2. Government herding mosquito/malaria control and showiness

In this section we use the term ‘government’ generically to mean any or all levels of governments. In Nigeria there are three levels: federal, state and local governments. There is only one Federal Government which seats in Abuja, the capital city of Nigeria. The second tier consists of 36 state governments with their respective capitals spread across the country. Abuja is also the seat of the Federal Capital Territory that operates as a quasi state with its own paraphernalia of government structures. Lastly, the local governments, which number up to 774 across the federation with their respective headquarter and structure of government. We briefly consider here how government had been in the forefront in the fight against mosquitoes and malaria (**Figure 1**), albeit with showiness.

As far back as 1899, the importance of having a passionate government mounting the driver seat of mosquito/malaria control was demonstrated in Lagos. The government was led by a chief executive in the person of William MacGregor who was appointed by the Colonial Office (London) as Governor of Lagos. According to Oluwasegun [11], he was on transfer from Queensland, Australia, and he had considered Lagos a graveyard like his peers from Europe who knew that environmental

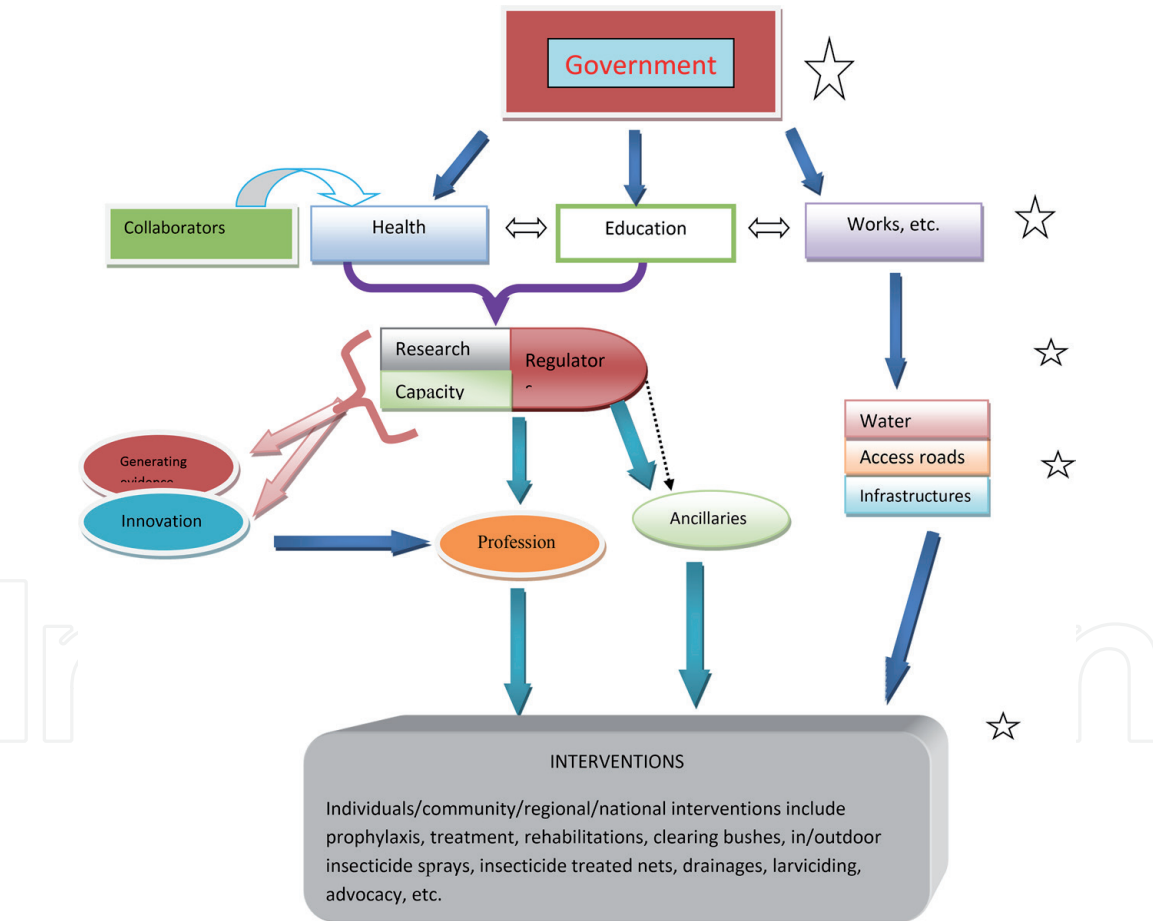


Figure 1. Organizational framework for malaria/mosquito control based interventions. Government control is via the ministries such as Ministry of Health, Ministry of Education, etc. that are all interconnected and interwoven. Collaborators include donors, international agencies such as UNICEF/UNDP/World Bank, WHO, TDR, etc. The Nigerian state of anomie under President Buhari has highlighted security (which is normally not considered as a factor of consequence), represented by the star, is now the *sine qua non* or *primus inter pares* before any form of activity, whether as infrastructure, goods or service delivery can be embarked upon as it must superintends all government anti-malaria programs. Security became more pervasive following the emergence of criminals and fanatical religious terrorist group like Boko Haram. Ancillary refers to all other professions and their products that governments allow. The arrows pointing to it indicate both weak and strong controls: strong control via such agency as NAFDAC, weak control of native doctors, bone setters, patent medicine practitioners etc.

factors compelled it to be one of the most infamous mosquito-breeding locations on the West African Coast. As he arrived Lagos, he was confronted with a horrible statistics: malaria mortality was 71.12/1000 European population in 1898 and rose up to 87.64/1000 two years later. Consequently he decided to eliminate mosquitoes from Lagos so as to get rid of malaria. He had been advised to approach the matter by segregating the population on racial grounds, a proposal he refused to acknowledge because it would not benefit the colonialist on the long run economically and would trigger opposition from the highly educated elites in Lagos then. He perceived that there was no racial segregation and that allowing natives to live with their more enlightened Europeans would offer them education which was vital to checkmate mosquitoes/malaria. Lastly he considered it unwise to start any form of racism rather his idea was: destroy mosquito breeding, make certain modern sanitation, educate the natives on the risk of mosquitoes and the management of malaria. He began sustaining a malaria-free Lagos via land reclamation. In fact, he reclaimed the Elegbeta and Idumagbo creeks and built the MacGregor Canal.

Today, the approach to mosquito/malaria control is not different from the measures Governor William MacGregor introduced more than a century ago. He emphasized education which is still what present day researchers [12, 13] also arrived at after applying their mathematical model which states that change in human conduct (following acquisition of knowledge) will significantly reduce the burden of disease like malaria in places where the level of education is soaring; not like areas with deprived education where the disease persist. They recommended that massive and continuous health education should be combined with other forms of interventions for all persons staying within the area assaulted with malaria. The government had been unrelenting in building public schools. She also allows private schools to blossom such that today, we have lost count of the number of primary, secondary and tertiary institutions across the nation. In all these schools students are taught how to deal with mosquito/malaria. One veritable way education has helped in reducing the menace of mosquito/malaria is housing. Research has established that reduction in malaria burden and improvement in health status is attributed to health education and improved houses [14, 15]. Throughout Nigeria and particularly in Southern Nigeria, houses are so modernized that mosquitoes' entry into houses, to some extent, are excluded. In my locality thatched and mud houses had disappeared and every house built in the last 10 years has an intact ceiling in place. This implies that fewer mosquitoes get access to humans within because the usual eaves route for *Anopheles* is effectively blocked [16–19].

The government is also involved in building health centres where the sick are treated and nursed back to life. They are organized into primary, secondary and tertiary health care centres/hospitals with the last serving as schools where health care professionals are grounded. Primary care centres are located nearly in every large community today to offer the most basic health care services directed at prevention of infective diseases. These centres are also involved in distribution of drugs such as ivermectin, immunization and bednets as well as treatment of uncomplicated malaria and counseling pregnant women. Secondary health centres consist of 'general hospital' where patients are given much more detailed attention. Some laboratory investigations are obtainable here as well as minor surgical services. Pregnant women gain better attention and knowledge of mosquitoes/malaria is deepened here. Tertiary hospitals offer all the foregoing services which could not be handled at the primary and secondary centres. The best of all health care professionals are concentrated here and the government designates some of them 'centre of excellence' where state of the art services and equipment are available. Governments spend a lot of money. One example of the extent of fiscal

spending will suffice. The Federal Ministry of Health 2016 Appropriation Act in Naira showed that personnel cost 217,472,115,158; overhead was 3,940,432,929; capital expenditure was 28,650,342,987; while total allocation summed up to 250,062,891,075. In 2017, the various governments (federal, state and local) contributed 8% of 1.7 trillion Naira expended on malaria [20]. Governments pay for all these to support health in addition to payment through other ministries such as scholarship for students elsewhere who may end up joining the fight against malaria control such as doctors, engineers, epidemiologist, etc. who train abroad. However, government sometimes authorizes charging of minimal fees to augment running cost of health care generally [21].

Beyond building of schools, hospitals and health centres, government from time to time allow programmes designed as morale booster to mosquito and malaria control to be. One of the most popular ways this was accomplished was through the Roll Back Malaria partnership designed to achieve universal protection to all persons at risk by using appropriate interventions for prevention and treatment [22, 23]. In **Table 1**, we show some of the projects that had been popularized by direct and indirect involvement of government. She also puts in place organogram which allocate responsibilities among stake holders [24]. Government also pays for malaria management and public health jingles or allows commercial interests some space to canvass for customers throughout the country. Nowadays, both manufacturers of plant based medicines and those from numerous pharmaceutical companies (foreign and local) are allowed by governments to market their wares without hindrance. Local patent medicine stores are also allowed to proliferate and are therefore accessible to Nigerians within trekable distances.

There are also other government activities which focus on healthcare generally. Such programmes ultimately benefit malaria sufferers or indirectly assist malaria/mosquito control. The National Agency for Food Drug Administration and Control (NAFDAC) is one of such agency of the Federal Ministry of Health (**Figure 1**). The agency did a lot work to create awareness on the issue of fake, substandard, expired and adulterated drugs [25]. The agency does more work beyond the foregoing. She also monitors feedback from consumers the effects or adverse drug reactions of the drugs she permitted to be in circulation [26]. **Table 2** shows other indirect ways the governments enhance malaria/mosquito control. Most importantly, the agency had upgraded the people's knowledge that ordinary peasants must look for the "NAFDAC number" before they could pay for any medicine from the drug store or "Chemist" as they are popularly known here. All the measures above prove that government in principle is desirous of affordable, accessible and sustainable malaria/mosquito control.

We have seen that government erect physical buildings for health care services including malaria treatment. It has been observed that every successive government builds more and more houses. No incoming administration wants to build on the foundation left by his predecessor [21, 30]. The reason is for showmanship – so that the peasants would point at structures built by x's government. Such buildings soon after commissioning become just prescription houses where even aspirin could not be dispensed as at when due. Such building soon get underutilized, abandoned or become overgrown with grass. Closer enquiries show that those in governments use the opportunities for awarding building contracts as avenue for looting public funds and extorting cutback from contractors.

Government control most local radio stations and citizens are inundated with the usual copious jingles of her activities ad nauseam. During the Roll Back Malaria episode, government jingles saturated the air waves that nearly everyone became aware that free mosquito nets were being distributed. So when interested persons flock to the so called centre of distribution, only a hand full of bednets would be

| S/no | Government Control programmes | Period | Activities executed | Observations | References |
|------|--|--------------|---|---|------------|
| 1 | National Malaria control Programme (NMCP) Strategic plan 2009–2013 | 2009–2013 | About 17 million ITNs were distributed during 2005–2007, | Only enough for 23% population | [20] |
| 2 | Procurement of artesunate combination therapy (ACT) | 2006 2007 | 4.5 million courses distributed. 9 million courses distributed | Far below total requirement | [20] |
| 3 | Roll Back Malaria (RBM) Initiative | 2000–2005 | Case management, promotion of intermittent preventive treatment (IPT), and promotion of the use of ITNs/vector management | Resistance to Chloroquine, and subsequently Sulphadoxine-Pyrimethamine (SP) | [20] |
| 4 | Topical Disease Research (TDR) | in 2006 | Home management and community directed models for malaria treatment | | [20] |
| 5 | Agencies like UNICEF and the Federal Ministry of Health | | Propagating the distribution of these effective and long lasting ITNs to primary health centers | | [20] |
| 6 | Closing up community land ponds and borrow pits | | | | [20] |
| 7 | Spraying oil over stagnant water bodies | | | | [20] |
| 8 | National Malaria Elimination Programme (NMEP) | | NMEP) is responsible for policy making and articulating broader strategies and coordination at the country level | Implementation done by state governments | [22] |

Table 1.
Some malaria control programmes.

given to the selected few after prolonged delays and excuses. The reality was that the “*oga* at the top” had compromised the programme by diverting allocated mosquito nets to their accomplices who would now sell them unhindered in local market at exorbitant prices thereby making the nets unavailable to target population [31]. This may account for why some respondents in several studies angrily antagonize poor nurses at their duty post in such distribution centres without comprehending

| S/no. | Activities of government | References |
|-------|--|------------------|
| 1 | The enactment of the National Health Act, 2014. for the regulation, development and management of a National Health System, and to put in place a standard for rendering health services in Nigeria. | [27, 28] |
| 2 | The National Health Financing Policy and National Health Policy are designed to ensure universal access to health by stating mode of raising fund for the different levels of governments and to ensure fund allocation to the health sector increased up to 15% of total budget and support to primary health care (PHC). | [27, 29] |
| 3 | Creation of NAFDAC to regulate the production, distribution, sale, use of drugs and ancillary products as well as monitoring of adverse reactions. | [21, 25, 26] |
| 4 | The National Health insurance scheme (NHIS) promotes openness and more access to health to privileged minority who secure employment in the organized sector. | [21, 27, 29, 30] |
| 5 | Former president Obasanjo introduced the health sector reform to make health care accessible, equitable and congenial. | [21] |

Table 2.
Indirect ways government improves malaria control.

the underhand deals that made nets not to reach those they were made for [31, 32]. If government was serious, they have all the tools at their disposal that can be put in place to ensure that pilfering of bednets cannot happen anywhere in Nigeria.

Sometimes in the past, adverts relating to health care in Nigeria were aired in American or European based media. This makes one wonder what the government or relevant institution was up to. How could such prestitution benefit Nigerians who do not have access to electricity or television sets? Even if they had, why were such adverts not placed in local media to save cost? The showmanship accompanying simple public health programme as launching a public health campaign in remote communities attracting a governor with scores of exotic jeeps and retinue of state officials, security men and politicians are simply avenue for pilfering scarce government funds because everyone who attended such fanfare would be “mobilized,” euphemism for buying/bribing participants, and core civil servants who participated would be paid handsome allowances. Fraudulent commissioning programmes by government have come to be an innovative mass deception method which deepens the corruption in the system. There was an incident when a borehole was “commissioned” in a community in Udenu Local Government Area where the water seen gushing out was actually from a hidden tank somewhere! Another such “commission” was made in 2001 by no less a person than the President of the Federal Republic of Nigeria of a bore hole located in Ozalla Ezimo, a nearby community close to Obollo Afor town, that was already operational before his regime. Obasanjo, the then president came with more than 5 hundred security men and more than a thousand politicians and hangers on. Their coming arrested most economic activities in Nsukka Senatorial Zone during the period. The money spent on such frivolous visit could have been spent to prosecute the war against mosquitoes and the diseases they hawk.

3. Government as albatross stampeding mosquito/malaria control

Malaria/mosquito control can stand as the best project for health that any government in Nigeria and the rest of Sub Sahara Africa should prosecute for national/global health [33]. Governor William MacGegor embraced that concept

profoundly and embarked on mosquito control with all his might. Unfortunately, his approach was abandoned soon after he took ill a few years from the time he built the canal [11]. In the past 20 years, the regime of Olushegun Obasanjo (1999–2007) was pro education and pro malaria control. His immediate successor, Musa Yaradua (2007–2010) was not healthy enough to manifest his inclination. The subsequent government of Goodluck Jonathan (2010–2015) appeared to boost education more but less so for malaria control than that of Obasanjo. The regime of Buhari (2015 – date) is a disaster for both education and mosquito/malaria control. Pregnant women and under five years children are predisposed to malaria and they suffer high mortality rate also [2, 3]. However, only 1% increase in budgetary allocation to the health sector could engender reduction of 10% of infant mortality and generally improve health outcome [34]. His government consistently scored below the mark in attaining universal health coverage provision to allocate 15% of budget to the health sector. Even when compared to other less endowed countries in west Africa such as Ghana, Gambia, Gabon and Niger, she is at the bottom [35]. Facilities at primary, secondary and tertiary hospitals are derelict; about 700 medical facilities are said to be destroyed in conflict zone. This may explain why medical tourism, even to neighbouring West African countries, is vast developing [28].

One would have expected an upsurge in malaria as a result of this gaping neglect of mosquito/malaria control during his presidency but it seems that act of God – weather conditions, willingness to survive with the residual knowledge of malaria control (use of herbs, clearing bushes, etc) may have come to the rescue of Nigerians. This is reflected in the slowing down of malaria according to WHO's record [3]. This implies that citizens are willing to contain malaria if only there is effective government support/leadership. Every government ought to be targeting malaria elimination; and according to Campbell and Steketee [33], such government must make supervision, diagnostic capacity, monitoring, and evaluation systems that is accessible and of high quality to provide timely information as cardinal requirements. So long as governments refuse to implement accepted practices of mosquito/malaria control or ignore morale boosting programmes like Roll Back Malaria, so long we would have malaria with us.

The poor performance of vector control in Nigeria is squarely attributable to whosoever is on the driver's seat. This brings the ball on the table of our leaders. It does appear that when you consider how they go about acquisition and execution of power, you would shudder. Regarding animal herder (among sheep), the Catholic Bishop of Nsukka, Fr Bishop Onah Godfrey, in a popular metaphor, said that a sheep at the rear was asked where it was being led to and it replied that the leader (herder) knows where. In the case of Nigerians, no one can vouch for our political leaders in government who used *mago-mago* (morally reprehensible means) to attain power. This author had considered their behavior like fixing their own salaries, which range between 25–30 million Naira a month, but refusing to pay 18,000 Naira minimum wage, as the pacemaker of the imbroglio raging in the country today. It is also the root of all labour unrest in the country since 1999. As at the end of November 2020, federal universities still remained closed since March 2020 to students because of mode of payment of academic staff salaries and underfunding university education. The health sector is always embroiled in strikes over payment of salaries or allowances. There would be no industrial action if there is no significant difference in the pay packet of the President and a cleaner with all other professions/workers adjusted in between accordingly. Nigerian leaders designed Nigeria for corruption so the endless catastrophe citizens suffer is the outcome of the design. In this context, mosquito and malaria control cannot be detached from all other sectors crying for attention.

The present Nigerian government-citizen relationship is not different from that between the *Sarcoptes scabiei* and the dog. No matter how loud or long one shouted at the dog parasite, it will continue to suck life out of its dog host. Clearly, our leaders in government are not different from the dog parasite. In trying to rationalize why our leaders behave that way, this author was stunned by the fact that the same malaria parasites may be the remote cause why our leaders outdo parasites in exacting maximal pressure on hapless Nigerian citizens while they themselves are well ensconced in Abuja and state capitals or junketing across the globe with their families. We know that malaria parasite is a multi system parasite and it also inhabits the brain and do cause cerebral malaria. It could also camouflage itself from immune surveillance. In simple terms, it seems to enjoy some high degree of immunity that it could remain arrested in man for a long period – the same way Nigerian politicians are immuned from being accountable. It is not preposterous to suggest that it could trade genes with the host to hijack some of the host's physiological processes. Hijacking has been reported in a number of host-parasite relationships and it

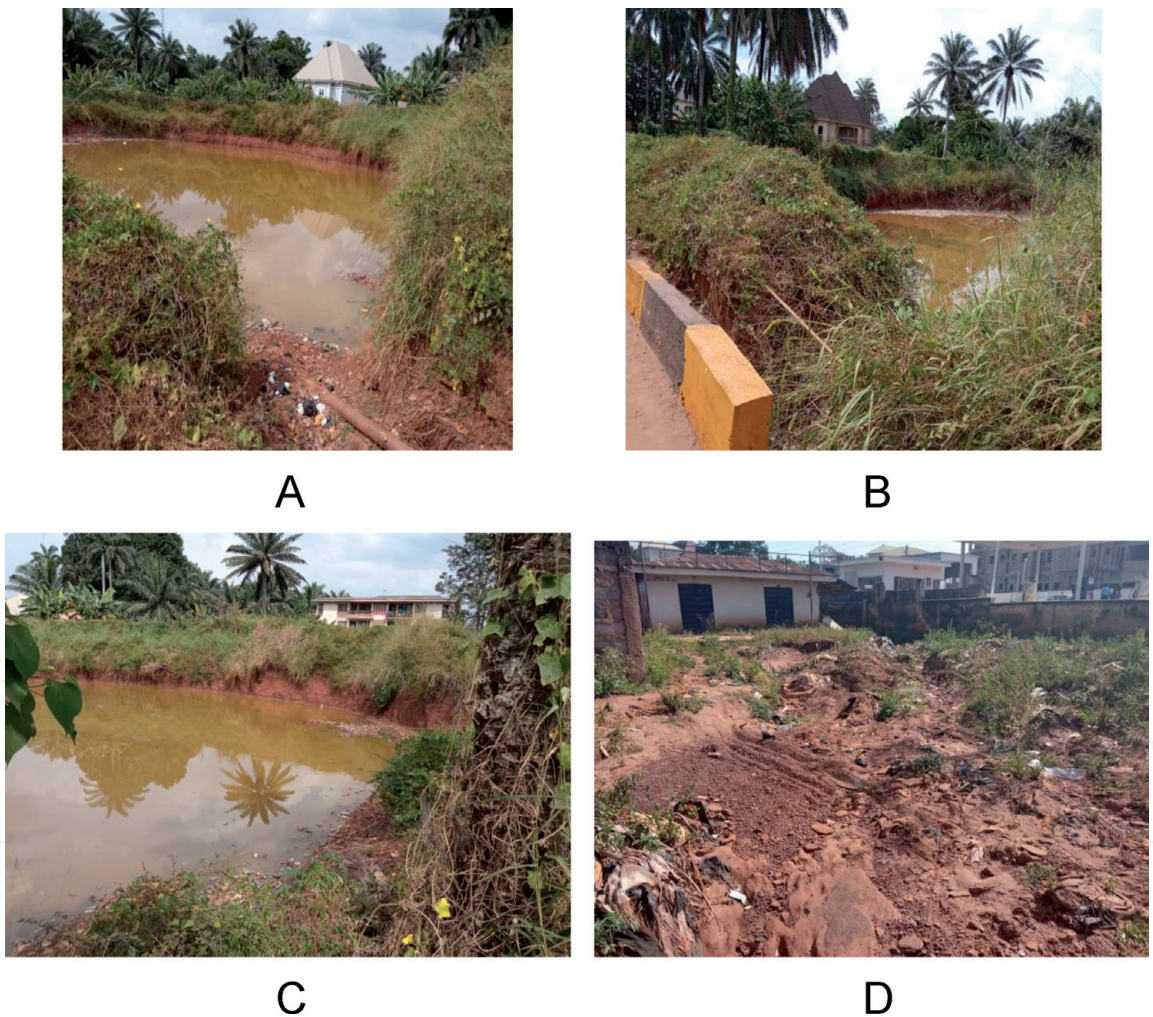


Figure 2.
Unintended consequences of flood control. (A–C) shows a pond in a residential area with houses around it. Closer look will show plastic containers as well as vegetation which provide perfect mosquito breeding milieu. The back ground story was that more than 25 years ago, the borrow pit was dug to drain Ugwuoye part of Enugu Road, Nsukka by the Local Government. Years later, the borrow pit could no longer drain the area because the government could not supervise builders who blocked the natural water ways. When that part of Enugu Road became impassable, the Enugu State Government came to the rescue by building a tunnel to drain the water which flooded the road and the rest of Ugwuoye. The deluge from the tunnel eventually sacked all the people living in the houses shown in (D). Whenever it rained, the University Road, which receives water from the place shown eroded in (D) become impassable such that cars, motor cycles and their riders were carried away. About 5 persons were said to have lost their lives to the flood since the tunnel was completed.



Figure 3. A section of Enugu – Port-Harcourt Express Road, Lokpanta, Imo State. This section of the road reveal typical South Eastern Nigerian road that is supposed to be maintained by the Federal Government headed by President Mohammed Buhari. The failure of government to be functional created the observed collection of water, blocked drain, mud, solid wastes, grass, stuck vehicles, used tyres and squalid environment all of which provide perfect environment for mosquito breeding and optimized malaria transmission (A–D).

may not be different in man. Thus our leaders’ have been modified to behave like parasites. And in our case, the bad policies of our leaders in governments ultimately assist parasites like *P. falciparum* to thrive.

The generation of solid waste is another albatross of malaria control. Tons of solid waste from plastics significantly impact on preponderance of mosquitoes in our country. These plastics are indiscriminately dumped in the streets, roads and into drains [36] and as shown in **Figures 2 and 3**. Solid wastes provide thousand of micro water bodies ideal for the breeding for *Anopheles*, *Aedes* and other pathogenic species of mosquitoes. When these materials are dumped on drainage they block drains and larger water bodies are formed where more mosquitoes and other pathogens would profusely breed. It is reported that when weed accompany plastics and solid wastes that malaria and its vector increase significantly [36]. What does it take to deal with solid wastes as thin sheet polyethylene? Legislation: ban them! Kenya did it [37, 38]. Large population in urban and cities throughout Nigeria is related to development of slum areas that quickly generate heaps of garbage ideal

for mosquito breeding, though Nwani and Ozegbe [39] indicate that per capita/kg/ annum generation is low at 204 when compared to South Africa at 730 and Ghana at 33. Such large populations not matched by increased health spending spell doom for Nigerians [34]. Given the present circumstances of funding health system, attaining competence, equity, quality and sustainable health care, financial risk security for all citizens cannot be accomplished [30].

Governments encourage trading of blames among health workers and between health workers and patients. The perennial problem in the health sector where one group of health care provider is over elevated beyond the others is a divide and rule tactics that truly undermine health care services generally and mosquito/malaria control in particular. The problems in health sector seem to be the typical fruits of corruption. The resulting very poor performances are reflected in the compendium of indicators of an ailing health sector that has nothing positive to show [40]. This sector is rife with strikes [41–43], inter-professional rivalry [44], arrogance [45], etc. All these impose unnecessary man made burden on citizens. **Table 3** shows a compendium of governments’ activities which ultimately stampede malaria/mosquito control.

| S/No. | Action/inaction exacerbating malaria/mosquito control | References |
|-------|---|-----------------------|
| 1 | Poor allocation to healthcare: far less than the 13–15% of total budget recommended is routinely disbursed to the Federal Ministry of Health* | [20, 21, 28, 34, 35] |
| 2 | Very low health expenditure per capita: In 2017 it was US \$74 less than what is recommended. | [20] |
| 3 | Neglect of primary health care (PHC) [†] The healthcare facilities at the Primary Health Care (PHC) level are inadequate and poorly maintained. | [20, 21, 27–29] |
| 5 | Lack of water, road, electricity, etc. Poor access roads (especially in the South East Nigeria), for example, make it difficult for patients to obtain even the paltry health care available at the nearest health care centre whether it is primary, secondary or tertiary. | [28] |
| 6 | The average health facility to population ratio is low and worse in rural areas: doctor to patient ratio, for example, is much lower than the WHO minimum standard of 1:600. | [21, 27, 34] |
| 7 | Over concentration of health facilities in cities and urban areas as a result of skewed budgetary allocation/implementation. | [21, 27, 34] |
| 8 | Government policies induce poverty: Nigeria has the highest population of extreme poverty worldwide. This was not so during pre-independence and up to early 1980s. | [21, 27, 34] |
| 9 | Not using supportive/multidisciplinary/ demand-driven models such as those of TDR to do/mirror/translate research findings of local researchers to interventions. Not strengthening research capacity in critical areas. | [46, 47] |
| 10 | Environmental/public health inspector disappearance since the 1960s. [‡] | Personal observation. |
| 11 | Government appears to be deceiving her citizens, the International Community and international institutions such as WHO: Government abdicates related convention she is signatory to: Nigeria allocated, between 2009–2013, as little as 3.7–5.7% of national budget instead of the 13% recommended by WHO. | [27, 29] |
| 12 | Lack of continuity, consistency and commitment (3Cs) to laid down policies, programmes and projects thereby leading to poor access to health, unemployment and poverty. | [21, 30] |
| 13 | Lack of harnessing low cost health facility from native doctors, traditional healers, etc. | [21] |

| S/No. | Action/inaction exacerbating malaria/mosquito control | References |
|-------|---|------------|
| 14 | Not making dialogue an art of governance and very poor crime management: these incapacitate families/communities from fending for themselves.* | [21] |
| 15 | Hospitals/health centres are without safe water, electricity, functioning equipment, adequate supply of drugs, basic diagnosing machines such as scanning and X-ray machines etc. | [28, 30] |
| 16 | Ill motivated and unsupported healthworkers | [28] |
| 17 | Uneven distribution of health care personnel | [28] |
| 18 | General insecurity and attacks on healthworkers especially in conflict zones. | [28] |
| 19 | Condoning dual loyalty of health workers who work for government and use the opportunity to divert patients from public health facilities to their private businesses. | [28] |

[∞]Government here refers to the Nigerian Federal Government. The states and local governments mirror the federal in most of the listed activities.

*The Presidential Summit on Universal Health Coverage made the Abuja declaration that mandates member states to allocate 15% of national budget to the health sector, but the reality is that less than half (7.4%) was available in 2014. The Federal Ministry Health indicated that 40% of health budget is expended on malaria [20].

[†]PHC receive less than 10% of health budget, yet from the little, 84% is spent on non-PHC amenities [27].

Sub-optimal PHC services spell doom for up-coming generation. This negligence is akin to ‘10/90 disequilibrium’ principle where 90% of fund is spent on 10% of less vulnerable people [48].

[‡]Government by condoning insurrection as occasioned by Boko Haram, criminals and Fulani herdsmen (who insist on roaming with their cattle all over the country) engage in countless killings, abductions, ransoms taking, displacing communities, destroying crop farmers and their crops, etc. creates the environment for festering of diseases and their vectors.

[§]This author’s mother told him that before Nigeria’s independence, health inspectors used to visit every compound to access the degree of hygiene and mosquito control compliance. “They used to check every soup pot and every clay pot used as water reservoir to ensure that they were properly covered,” she said. This author had never seen, nor his home visited by such inspector since after the civil war in 1970.

Table 3.
Some activities of government which ultimately stampede malaria/mosquito control[∞].

4. Why international arm-twisting tactics will improve malaria control

The International Community is sometimes perceived as a guard who stands by when a toddler engages in fireworks in a compound full of people living in thatched houses during the harmattan. The toddler lights the first house, second, third and the guard continue to look on until all the houses are completely burnt down. Then, the guard would begin to attend to charred victims and survivors and corpses. Which is cheaper – to arrest the child before he lit the houses or after? The International Community must have to reshuffle her rules that hitherto had relegated her to a passive onlooker when catastrophes come knocking under the guise of “non interference in the internal affair of member nations.” For too long, she had been silent when leaders of third world countries plant strife, nurture them until they mature to genocides resulting in massive drifting of refugees from one part of the world to another. This mass movement of people evading conflicts is the same as mass movement of diseases and vectors across borders.

All the nations of the world, referred to as “The International Community” must by now be amenable to some of the lessons of Covid-19: no nation is isolated from emergent diseases and no nation could predict the spreading dynamics, morbidity and mortality of such diseases. The consequent plunging of both developed and developing nations into losing high numbers of their citizens and severe economic recession inflicted on those who survived the onslaught of Covid-19 is a lesson no one should forget. What if mosquitoes/malaria parasites should mutate and re-establish themselves as the terror they were in the days of William Mac Gregor? So all nations must begin to see health related problem

anywhere in the world as a global problem that must be tackled in unison so that diseases cannot be allowed to spread.

Malaria mortality had been with Sub Sahara Africa for ages. The WHO had been publishing annual reports where numbers of deaths due to malaria are clearly shown. The International Community may have been regarding those figures as mere numbers probably because they revolved mainly in Africa whose primitive leaders unabashedly undermine their own people as it pleased them. Stopping these bad leaders is also stopping the means of generating poverty, diseases and their vectors which are not fixed but highly mobile and could spread like HIV and Covid-19.

5. Knowledge-based measures by citizens and communities to control mosquito/malaria

Knowledge based actions against malaria control is very effective in controlling mosquitoes and managing all infectious and insect borne diseases. It is also vital to controlling the vectors as had been noted and applied by Governor William MacGregor since malaria life cycle became known [11]. According to a report [20], Nigerians are already picking the gauntlet as they paid 87.8% of the 1.7 trillion Naira spent on malaria in 2017 (excluding unquantified amounts expended paying bill from native doctors or purchasing native herbs). This is a veritable proof they could fend for themselves to rid the land of the disease and could do more if the environment is right. Knowledge based control measure evolved following the works of researchers all over the world. In Nigeria, research output in this direction is not deficient. Nigerian Universities, despite all the stumbling blocks erected by governments, continue to look inwards to find solution that will work for us for he who wears the shoe knows where it pains. Local researchers had been able to generate so much for malaria/mosquito control but are hampered by the following:

1. Civil servants follow instructions passed unto them by their superiors who are actually politicians. This author had developed several devices that could be used to control mosquitoes in-house [17–19] which are innovations that ought to attract enthusiasm by those whose responsibility it was to control malaria/mosquitoes in the Ministry of Health but he was told that window screen was not part of their job description: they were paid to disseminate bednet not window net!
2. Nigerian policy makers had been so brainwashed that they do not accept anything being projected by local researchers. Going by some informal anecdotes researchers share among themselves, they greet researchers with skepticism and scorn. They look for those packaged in Europe, China or America. They prefer importing antimalarials from China or India rather than provide the environment that would enable our own people develop them from our own resources which abound. So doing enable them to loot government treasury as they please while citizens are kept below poverty line and too poor to ask for any form of accountability from our leaders.
3. This author checked the website of the National Malaria Elimination Programme (nmcp.gov.ng/integrated-vector-management/). They had beautiful vision and mission statements regarding mosquito/malaria control. Of all the measures enunciated, door screening and window screen are conspicuously absent. Yet this government agency knows that people do not sleep in bednets because of many constraining factors [49] as only 9.7% of households own them [32], and that people misuse them [50]. Only 3.9% of pregnant women

sleep in bednets [32]. They ought to have known that house screens covers all house hold members and protect for other neglected tropical diseases [51] and devoid of all the problems associated with bednets. House screening is enforceable by the state [17]. However, if they allowed home based control devices to thrive, it could block their channel of affluence because they would not be importing nets, drugs, insecticides, etc. massively to checkmate mosquito/malaria. If the National Malaria Elimination Programme really mean to improve the people's knowledge of malaria/vector control, they would have been using their web site to inform people of current publications from local researchers that provide simple accessible, affordable and sustainable solutions that anyone could copy and apply for himself such as the ones provided for house screening [17–19].

4. The refusal by those in authority to accept new information unveiled by researchers on control measures such as insecticides could sometimes be bewildering. They apparently have negative bias against new ideas when confronted with uncertainty [52]. They had hitherto been captivated by old things they know about insecticide that any other unfolding developments are ignored. For instance, if they were initially taught that dichlorodiphenyltrichloroethane (DDT) was very good in controlling insect vector, they would be fixated with that idea and discountenance any other contrary findings that question the status quo. Informing such persons that perceived benefits of insecticides as option to tackle mosquitoes is only short lived would only provoke them to anger or alerting them on increasing reduction of *mosquito* susceptibility to insecticides such as organophosphates, organochlorine and carbamates [2, 53–55] could make them bark at you menacingly. Seriously, mosquitoes quickly acquire resistance to the foregoing insecticide that just after a few years, they would no longer be effective deterrent. Other unpalatable consequences insecticides create are environmental contamination, ecological imbalance, harm to human and animals, environment pollution, non-target organisms being affected [56, 57]. The narrative does not stop just there. As time goes on strains of mosquitoes which would even depend on the insecticide to spread to regions they were not found before would arise [58]. Therefore the best approach to deal with mosquitoes in Sub Sahara Africa is to pressure them to change their habit such that, owing to consistent denial of blood meals to them, they would change habit. Long term denial to access human blood would certainly push them to find an alternative, that is, we could habituate them to be independent of human blood meals.

6. Conclusions and recommendations

This paper, through the number of instances provided, had shown that the beginning and end of malaria/mosquito control lies in the hands of governments and persons in government in Nigeria (and everywhere mosquito/malaria are found and Nigerian-like leaders exist). They, through acts of omission and commission work in both directions, the net result being the abetment of malaria transmission, mosquito endurance and escalation of poverty and economic losses in Sub Sahara Africa, the hub of the duo, *Anopheles* species and *Plasmodium falciparum*. Looking at the Tables (1, 2 & 3), it can be inferred that what had been done to cage malaria/mosquitoes is little compared to what is yet to be done. However, we now know that some interventions can be done at various levels including the individual, community, government, collaborators and the International Community.

Now that Covid-19 has changed the game, the time has come when the International Community should focus her lenses on Sub-Sahara Africa where emerging leaders from the region must be given mosquito/malaria reduction targets which they must attain to remain in power. That is to say that who remains in power must be that leader who places global public health first among all other needs. The community must do something serious about impunity of seating governments such as the Buhari's government in Nigeria where killings is the order of the day for years and culprits are not brought to book despite the aphorism credited to the former military leader (General Abacha) that the government herself must be complicit in any insurrection that exceeds 48 hours. The International Community should make an enactment that would compel seating presidents face trial in the Hague when laid down expectations are not met anywhere in the world.

The usual practice where governments in developing countries beg for more grants, loans, assistance, donations, etc. ad nauseam, which the International Community obliges them, should be re-examined. In the case of Nigeria, the earlier all the foregoing are denied her, the better. This is because all those kind gestures are misused and only end up beefing up the pockets of greedy men in governments. Those helps do not make way for sustainable long term mosquito/malaria control [24]. Our penchants for begging do bore down donor and fatigue them [33]. Sometimes it is morally wrong to give. This applies to Nigeria because she has all the resources she needs to control malaria and pathogenic mosquitoes, be it intellectual, manpower, fiscal, natural or learned capacity. There are thus required changes that must be made to turn things over to improve health financing if Nigeria must come under the universal health coverage. Such changes must include legal and regulatory frameworks, efficient use of resources through carefully planned purchasing provisions and stringent supervision [30].

Doctors claim they own the patients [45] and they must control all health institution and determine who gets what in the health sector; whereas the other health workers claim it is a team work. Government could have decided this issue long ago: either the health sector is turned to a single profession through redesigning their education and training or the health sector is organized strictly as in the game of football where the captain can be anyone in the team who has something to show as a leader. To root out mosquito/malaria, all health care professionals must work optimally and there must be no industrial action for whatever reason. There should also be no half measures in managing conflict in the health sector. According to the 2014 National Health Law, 14 days was to be allowed to resolve labour related issues resulting in strikes [28]. However, it must be borne in mind that a minute is too long to strike in the sector because, as small as the interval may seem, many lives could be lost within that interval in a country with large population such as Nigeria. So government must enable such environment by creating it using all the tools at her disposal. She could foster congenial relationships among all health workers by training them to imbue them with appropriate communication skills to be motivators rather than inhibitors [32]. There is the need for government to begin seriously to fashion two professions – lawyers and doctors to work entirely for the public by disallowing them any form of private practice. This will engender justice, peace and health, the ingredients required for sustainability development.

We indicated earlier that Buhari's government, initially voted in to fight corruption, is a disaster for education and malaria control. Under his watch, corruption grew wings and began to "fight back" ferociously such that the government has become the undisputed global gold medalist for accumulating corruption since 2015. The children of corruption under Buhari's watch in the health sector include but not limited to unmaintained utilities, infrastructures, equipment; fake, adulterated, substandard, expensive drugs; supply of "made in China" equipment and

consumables; stealing government time/money by subterfuge or outright stealing/diversion of materials and drugs; contract inflation; selective justice; cash-based instead of qualification and proficiency-based recruitment etc. [21, 28].

It is acknowledged that bills from medical tourism amounted to 359.2 billion Naira in 2018 expended mostly by public office holders and their families, clear 18.75 billion Naira higher than the health budget [28]. It is clear from the foregoing that the health budget is deliberately kept low to pave way for politicians and their collaborators. Beyond the foregoing is the shocking finding by research that every health funding apparatus in Nigeria are performing far below what is expected and that funds are not equitably allocated nor used to significantly reduce wastage, meaning that only inferior/substandard facilities/services could be what await most Nigerians thereby exposing them to unbridled high cost of health expenditures [30]. The implication is that very little is generated and that little is misused, mismanaged, stolen or wasted thus aggravating the already very bad access to health care facilities and services.

It is possible to solve Nigeria's corruption problem. One of the ways of solving problems could sometimes be to approach them from an absurd perspective. This is what this author refers to as "Sir Peter Egbo's solution." Peter, a reputable choirmaster, known throughout Igboland, would advice that one who does not know what to sing should simply wait at "amen," the end of the song. However, in this author's opinion, which can be experimented upon, adoption of Sir Peter Egbo's solution is the simplest formula to end corruption. There is no need for carving x or y agency to fight corruption as experience has shown us that such option end up aggravating corruption. Through legislative means, government can take over all lands, houses and cars. All corrupt practices in Nigeria end up being used to acquire these three. If the first two are taken over completely by government, and cars are partially taken over by governments, stolen money in private pockets would only have one way to go – investment in agriculture, manufacturing and service industries which will benefit the people because it would create infinite employment, feed the people and create congenial environment for peaceful coexistence. If this happens, no one would dare to steal government money because you cannot steal what you cannot hide or use. Only then would government and her officials take responsibility for mosquito/malaria control. Only then could the health sector follow suit, transforming our hospitals into friendly environment for health workers and their clients [32]. Only in congenial environment would people see malaria control as one deserving all hands being on deck and willingness to insist on malaria elimination programmes [33].

In this part of the world, we cannot talk of eliminating malaria without bringing in those traditional medicine practitioners. This is necessary because the average Igbo man/woman when confronted with the first sign of malaria uses the nearest plant based anti-malaria therapy he can find, particularly in the rural areas [21]. If the condition persisted, he would go for orthodox treatment in hospital. When discharged from hospital, he still goes back to the plant based treatment he started with. This means that they are somehow attached to traditional medicine. It would be a milestone if our primary, secondary and tertiary health centres are restructured to accommodate traditional medicine. The implication is that traditional health care providers would need retraining and integration so that they and the orthodox health care providers could do their work from different perspective but with one mission: elimination of malaria in our clime. There will be many benefits derivable from such integrated health care: it will build bridges and partnership among orthodox and traditional practitioners, bring traditional medicine closer to the laboratory [59]. Orthodox drugs are perceived as chemicals with higher toxic contents, so people must be treated according to their preferences, which in our case, is natural products which must be refined to deliver optimally to fast track the control of mosquitoes and elimination of malaria.

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References

- [1] WHO: World malaria report (2014). WHO Press, World Health Organization, 20 Avenue Appia, 1211 Geneva 27, Switzerland. www.who.int
- [2] WHO. (2018). World Malaria Report 2018. WHO Press, World Health Organization, 20 Avenue Appia, 1211 Geneva 27, Switzerland. www.who.int
- [3] WHO. (2019). World Malaria Report 2018. WHO Press, World Health Organization, 20 Avenue Appia, 1211 Geneva 27, Switzerland. www.who.int
- [4] Sharma, V. P. (2012). Battling malaria iceberg incorporating strategic reforms in achieving Millennium Development Goals & malaria elimination in India. *The Indian journal of medical research*, 136(6), 907.
- [5] Idris, Z. M., Chan, C. W., Kongere, J., Gitaka, J., Logedi, J., Omar, A., ... & Kimura, M. (2016). High and heterogeneous prevalence of asymptomatic and sub-microscopic malaria infections on islands in Lake Victoria, Kenya. *Scientific reports*, 6, 36958.
- [6] Zimmerman, P. A., Mehlotra, R. K., Kasehagen, L. J., & Kazura, J. W. (2004). Knowledge gaps underlying the mixed Plasmodium species infection debate. *Trends in Parasitology*, 9(20), 440-447.
- [7] Sachs, J. D., Andrew D. Mellinger D. A., & Gallup, J. L. (2001). The geography of poverty and wealth. *Scientific American*, 284 (3), 70-75 (Published by: Scientific American, a division of Nature America, Inc.) Stable URL: <http://www.jstor.org/stable/26059132>
- [8] Murphy S. C. & Breman J. G. (2001). Gaps in the childhood malaria burden in Africa: cerebral malaria, neurological sequelae, anemia, respiratory distress, hypoglycemia, and complications of pregnancy. *Am. J. Trop. Med. Hyg.*, 64(1,2) S, 57-67.
- [9] Tatem, A. J., Smith, D. L., Gething, P. W., Kabaria, C. W., Snow, R. W., & Hay, S. I. (2010). Ranking of elimination feasibility between malaria-endemic countries. *The Lancet*, 376(9752), 1579-1591.
- [10] Coleman M, Al-Zahrani MH, Coleman M, Hemingway J, Omar A, et al. (2014) A Country on the Verge of Malaria Elimination – The Kingdom of Saudi Arabia. *PLoS ONE* 9(9): e105980. doi:10.1371/journal.pone.0105980
- [11] Oluwasegun, J. M. (2017). The British mosquito eradication campaign in colonial Lagos, 1902-1950. *Canadian Journal of African Studies/Revue canadienne des études africaines*, 51(2), 217-236.
- [12] Musa, S., & Goni, A. N. (2018). Modelling the effect of education-based intervention in the control of malaria. *Science World Journal*, 13(4), 1-7.
- [13] Usman I.G., Abubakar T.U., Muhammad A.H., Usman B.T. & Nagwari A.U. (2020). Mathematical model for the transmission dynamics and control of malaria by incorporating behavioural change. *Dutse Journal of Pure and Applied Sciences (DUJOPAS)*, 6 (3), 2635-3490.
- [14] Atieli, H., Menya, D., Githeko, A., & Scott, T. (2009). House design modifications reduce indoor resting malaria vector densities in rice irrigation scheme area in western Kenya. *Malaria Journal*, 8(1), 108.
- [15] Ayi, I., Nonaka, D., Adjovu, J. K., Hanafusa, S., Jimba, M., Bosompem, K. M., ... & Kobayashi, J. (2010). School-based participatory health education for malaria control in Ghana: engaging children as health messengers. *Malaria Journal*, 9(1), 98.

- [16] 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]
- [17] Ugwu, F. S. O. (2011). Novel malaria control by strategic net-hoisting with S/O channel/grip devices. *MalariaWorld J*, 2, 3.
- [18] Ugwu, F. S. O., & Onu, V. C. (2012). Protecting Under-Tree Nomadic Classrooms from Haematophagous Flies with Tree Anchored Net-Tents Based on S/O Channel/Grip Devices. *Nigerian Journal of Parasitology*, 33(1).
- [19] Ugwu, F. S. O. (2015). Mosquito control via inbuilt net hoisting windows: the inverted S/O channel /grip device option. *Malaria World Journal*, 6, (14) www.malariaiworld.org.
- [20] Federal Ministry of Health. National health accounts 2017. *Union Technical Report April 2019*. <https://www.health.gov.ng/doc/FINAL-VERSION-NHA-2017.pdf> (downloaded 16.00 hr, Feb. 24, 2021).
- [21] Nwankwo, I. C., Okofor, N. I. & Olisa A. (Undated). Health Sector Reform Agenda in an Insecure Nigerian State: Issues, Problems and Prospects. *The Nigerian Journal of Sociology and Anthropology*, 11, 57-74. DOI: 10.36108/NJSA/3102/11(0150)
- [22] Chukwuocha, U. M. (2012). Malaria control in Nigeria. *Primary Health Care*, 2(118), 2167-1079.
- [23] Ugwu, E. O., Ezechukwu, P. C., Obi, S. N., Ugwu, A. O., & Okeke, T. C. (2013). Utilization of insecticide treated nets among pregnant women in Enugu, South Eastern Nigeria. *Nigerian journal of clinical practice*, 16(3), 292-296.
- [24] Ukoha, N. K., Ohiri, K., Chima, C. C., Ogundeji, Y. K., Rone, A., Nwangwu, C. W., ... & Reich, M. R. (2016). Influence of organizational structure and administrative processes on the performance of state-level malaria programmes in Nigeria. *Health Systems & Reform*, 2(4), 331-356. *Health Systems & Reform*, 2:4, 331-356, DOI: 10.1080/23288604.2016.1234865
- [25] Amadi, L., & Amadi, M. (2014). Sustainable drug consumption, regulatory dynamics and fake drug repositioning in Nigeria: A case of NAFDAC. *Sci-Afric J Sci Issues Res Essays*, 2, 412-419.
- [26] Awodele, O., Aliu, R., Ali, I., Oni, Y., & Adeyeye, C. M. (2018). Patterns of adverse drug reaction signals in NAFDAC pharmacovigilance activities from January to June 2015: safety of drug use in Nigeria. *Pharmacology research & perspectives*, 6(5), e00427.
- [27] Uzochukwu1, B. S. C., Ughasoro, N. D., Etiaba, E., Okwuosa, C., Envuladu, E. & Onwujekwe, O. E. (2015). Health care financing in Nigeria: Implications for achieving universal health coverage. *Nigerian Journal of Clinical Practice* , 18(4), 437-444.
- [28] Akpoghome, T. U. (2018). Examining the protection of access to and delivery of healthcare by The National Health Act 2014. *Advances in Social Sciences Research Journal*, 5(6), 521-535. DOI:10.14738/assrj.56.4802.
- [29] Omotosho, O. (2017). Socio-economic and policy context of the nigerian health care financing system: a literature review *International Affairs and Global Strategy*, 53, 8-16. www.iiste.org
- [30] Onwujekwe, O., Ezumah, N., Mbachu1, C., Obi, F., Ichoku, H., Uzochukwu, B. & Wang H. (2017). Exploring effectiveness of different health financing mechanisms in Nigeria; what needs to change and how can it happen? *BMC Services Research*, 19, 661. <https://doi.org/10.1186/s12913-019-4512-4>

- [31] Amadi, A. N. C., Amoke, C. O., & Ganiyu, K. (2017). The status of malaria parasitemia and assessment of the use of long lasting insecticide treated bed net among Umudike Community of Umuahia, Abia State, Nigeria. *Animal Research International*, 14(3), 2876-2882.
- [32] Onyeneho, N. G., Idemili-Aronu, N., Okoye, I., Ugwu, C., & Iremeka, F. U. (2014). Compliance with intermittent presumptive treatment and insecticide treated nets use during pregnancy in Enugu State, Nigeria. *Maternal and Child Health Journal*, 18(5), 1169-1175.
- [33] Campbell, C. C., & Steketee, R. W. (2011). Malaria in Africa can be eliminated. *The American journal of tropical medicine and hygiene*, 85(4), 584-585.
- [34] Onisanwa, I. D., Sunday, B. S. & Adaji, M. O. (2018). Healthcare financing and health status analysis in Nigeria. *Amity Journal of Healthcare Management*, 3(2), 31-42.
- [35] Adebisi, Y. A., Umah, J. O., Olaoye., C. O., Alaran, A. J., Sina-Odunsi, A. B. & Lucero-Prisno, D. E. Assessment of Health Budgetary Allocation and Expenditure Toward Achieving Universal Health Coverage in Nigeria. (2020). *Int J Health Life Sci*, 6(2):e102552. doi: 10.5812/ijhls.102552.0
- [36] Mokuolu, O. A., Coker, A. O., & Sridhar, M. K. C. (2016). Contributions of solid wastes disposal practice to malaria prevalence in Ilorin, Nigeria. *Nigerian Journal of Technological Development*, 13(1), 1-5.
- [37] Horvath, B., Mallinguh, E., & Fogarassy, C. (2018). Designing business solutions for plastic waste management to enhance circular transitions in Kenya. *Sustainability*, 10(5), 1664.
- [38] Nwafor, N., & Walker, T. R. (2020). Plastic Bags Prohibition Bill: A developing story of crass legalism aiming to reduce plastic marine pollution in Nigeria. *Marine Policy*, 120, 104160
- [39] Nwani, S. E., Ozegbe A.E. (Undated). Public Health Expenditure and Health Outcomes in Nigeria. [https://d1wqtxts1xzle7.cloudfront.net/57259966/Public_Health_Expenditure_and_Heath_Status_in_Nigeria.pdf?1535458808=&response-content-\(downloaded 16.00 hr, Feb. 24, 2021\).](https://d1wqtxts1xzle7.cloudfront.net/57259966/Public_Health_Expenditure_and_Heath_Status_in_Nigeria.pdf?1535458808=&response-content-(downloaded%2016.00%20hr,%20Feb.%2024,%202021).)
- [40] Eme O. I., Uche, O. A. & Uche, I. B. (2014). Building a solid health care system in Nigeria: challenges and prospects. *Academic Journal of Interdisciplinary Studies*, 3(6), 501-510.
- [41] Akinyemi, O., & Atilola, O. (2013). Nigerian resident doctors on strike: insights from and policy implications of job satisfaction among resident doctors in a Nigerian teaching hospital. *The International Journal of Health Planning and Management*, 28(1), e46-e61.
- [42] Oleribe, O. O., Ezieme, I. P., Oladipo, O., Akinola, E. P., Udofia, D., & Taylor-Robinson, S. D. (2016). Industrial action by healthcare workers in Nigeria in 2013-2015: an inquiry into causes, consequences and control—a cross-sectional descriptive study. *Human resources for health*, 14(1), 46.
- [43] Okonta, K. E., & Okonta, O. C. (2017). Industrial crises in a Tertiary Health Institution (THI) in Nigeria: The perspective of resident doctors. *International Journal of Healthcare Management*, 1-7. <https://doi.org/10.1080/20479700.2017.1397323>
- [44] Omisore, A. G., Adesoji, R. O., & Abioye-Kuteyi, E. A. (2017). Interprofessional Rivalry in Nigeria's Health Sector: A Comparison of Doctors and Other Health Workers' Views at a Secondary Care Center. *International quarterly of community health education*, 38(1), 9-16.

- [45] McFubara, K. G. (2018). Who Owns the Patient. *An Examination of the Concept of Ownership in Health Care Ethics. J Hosp Health Care Admin: JHHA-110*. DOI: 10.29011/JHHA-110. 00010
- [46] Ogundahunsi, O. A. T., Vahedi, M., Kamau, E. M., Aslanyan, M., Terry, R. F. Zicker, F. & Launois . (2015). Strengthening research capacity—TDR’s evolving - and middle-income countries. *PLoS Negl Trop Dis*, 9(1): e3380. doi:10.1371/journal.pntd.0003380
- [47] TDR. (2017). TDR strategy 2018-2023: building the science of solutions. Geneva: WHO 2017. Licence CC BY-NC-SA 3.0 IGO.
- [48] Morel C.M. (2000). Reaching Maturity – 25 Years of the TDR. *Parasitology Today*; 16, 522-528.
- [49] Pulford, J., Hetzel, M. W., Bryant, M., Siba, P. M., & Mueller, I. (2011). Reported reasons for not using a mosquito net when one is available: a review of the published literature. *Malaria journal*, 10(1), 83.
- [50] McLean, K. A., Byanaku, A., Kubikonse, A., Tshowe, V., Katensi, S., & Lehman, A. G. (2014). Fishing with bed nets on Lake Tanganyika: a randomized survey. *Malaria journal*, 13(1), 1-5.
- [51] Ogoma, S. B., Lweitoijera, D. W., Ngonyani, H., Furer, B., Russell, T. L., Mukabana, W. R., ... & Moore, S. J. (2010). Screening mosquito house entry points as a potential method for integrated control of endophagic filariasis, arbovirus and malaria vectors. *PLoS Negl Trop Dis*, 4(8), e773.
- [52] Mueller, J. S., Melwani, S., & Goncalo, J. A. (2012). The bias against creativity: Why people desire but reject creative ideas. *Psychological science*, 23(1), 13-17.
- [53] Cissel Moussa B. M., Keita C., Keita D., Dengela D., Coleman J., Lucas L., ... & Beach R. (2015). Characterizing the insecticide resistance of *Anopheles gambiae* in Mali. *Malar J*, 14:327. DOI 10.1186/s12936-015-0847-4
- [54] Awolola, T. S., Adeogun, A., Olakiigbe, A. K., Oyeniyi, T., Olukosi, Y. A., Okoh, H., ... & Amajoh, C. N. (2018). Pyrethroids resistance intensity and resistance mechanisms in *Anopheles gambiae* from malaria vector surveillance sites in Nigeria. *PloS one*, 13(12), e0205230.
- [55] Hancock, P. A., Hendriks, C. J., Tangena, J. A., Gibson, H., Hemingway, J., Coleman, M., ... & Moyes, C. L. (2020). Mapping trends in insecticide resistance phenotypes in African malaria vectors. *PLoS biology*, 18(6), e3000633.
- [56] Arivoli, S., & Samuel, T. (2011). Bioefficacy of *Citrullus colocynthis* (L.) Schrad (Cucurbitaceae) whole plant extracts against *Anopheles stephensi*, *Aedes aegypti* and *Culex quinquefasciatus* (Diptera: Culicidae). *International Journal of Current Research*, 3(4), 296-304.
- [57] Khan, S., Uddin, M. N., Rizwan, M., Khan, W., Farooq, M., Shah, A. S., ... & Ali, S. (2020). Mechanism of Insecticide Resistance in Insects/Pests. *Polish Journal of Environmental Studies*, 29(3).
- [58] Wood, O. R., Hanrahan, S., Coetzee, M., Koekemoer, L. L., & Brooke, B. D. (2010). Cuticle thickening associated with pyrethroid resistance in the major malaria vector *Anopheles funestus*. *Parasites & vectors*, 3(1), 1-7.
- [59] Uchenna, A. A., Jalal–Eddeen, O. A. C. D., Saddiq, S. D., Calista, P. U. N., Abonyi, I., Amadi, A. N., ... & Abonyi, D. O. Traditional Healers in Malaria Control Programmeme in Nsukka Zone of Enugu State Nigeria.