

Malaria, HIV and TB in Nigeria: Epidemiology and disease control challenges

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Question

What is the evidence on epidemiology (including demographic and geographic inequalities) and disease control challenges of malaria, HIV and TB in Nigeria?

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1. Summary

Nigeria has the world's highest number of people affected by malaria and the world's second largest human immunodeficiency virus (HIV)/AIDS burden. There is a high occurrence of co-infection of malaria in HIV patients (Gumel et al., 2021). Nigeria is also ranked as one of the thirty high tuberculosis (TB) and TB-HIV co-infection burden countries in the world (Odume et al., 2020, 8). Co-infection can make each disease more severe and potentially more infectious (Gumel et al., 2021; Jemikalajah et al., 2021; Chukwuocha et al., 2019). This rapid literature review highlights key aspects of the epidemiology of malaria, HIV and TB in Nigeria, in addition to challenges in controlling the three diseases, in terms of prevention, detection and treatment.

Part I: Epidemiology

Demographic variation: Malaria, HIV and TB in Nigeria are considered to be poverty-related, with the poorest segment of the population most vulnerable, due in part to lower access to quality education and healthcare – and in the case of malaria, to quality housing. There is also a higher rate of HIV infection among women in Nigeria (Odimegwu et al., 2018, 1). Pregnant women in Nigeria are highly vulnerable to malaria-HIV and TB-HIV co-infection, which are associated with various adverse pregnancy outcomes (Chukwuocha et al., 2019; Olusi et al., 2019; Atilola et al., 2018). Older adults (50 years and over) are also vulnerable to HIV as they are rarely targeted by community and health services and rarely seek out counselling themselves (Akinyemi et al., 2017). The proportion of older adults with HIV has increased steadily, shown in a study based in South-west Nigeria (Akinyemi et al., 2017). Adolescents are also at risk of HIV due to early sexual initiation, early marriage, and unsafe sexual practices (Aduh et al., 2021). They tend also to have poorer rates of TB screening and treatment than adults (Aduh et al., 2021).

Geographic variation: The northern region of Nigeria, which accounts for 53.4 percent of the population, is reported to have the highest prevalence of HIV/AIDS (49.5 percent) and malaria (over 50 percent) in the country (Semiu, 2017). Reductions in malaria infection in children under-five have occurred in most individual states in Nigeria, but prevalence has decreased substantially more in the southern geo-political zones and the North-central zone (Oyibo et al., 2021). Prevalence rates for malaria and HIV also vary by states. Internally displaced populations (IDPs) and host communities in Northern Nigeria are at increased risk for transmission of TB and malaria, with much higher rates of incidence and disease notification among IDPs (Abdullah et al., 2020, 3). It is difficult for those diagnosed with TB, HIV or malaria to receive treatment due to the destruction and closure of clinics. The risk of malaria infection and malaria-HIV co-infection is also greater in rural areas, due in part to less access to health facilities and less household wealth than in urban areas (Gumel et al., 2021; Ugwu & Zewotir, 2020; Bassey & Izah, 2017).

Part II: Disease control challenges

Socio-economic challenges: Nigeria's high under-five malaria mortality is largely due to the high amount of out-of-pocket medical expenditure required, which discourages care-seeking behaviour, particularly among the poorest households (Dasgupta et al., 2021). Even where treatment is free, as in the case of TB, payment of transport to clinics and other hidden out-of-pocket costs for patients may render treatment prohibitive (Oyfabí et al., 2017).

Surveillance challenges: Under-reporting and double counting in Nigeria indicate a weak surveillance system, which undermines programmatic responses for disease control (Kusimo et al., 2020). Many people with TB remain undiagnosed and thus untreated (Abdullahi et al., 2020,

14; Kusimo et al., 2020, 200-201). The policy framework is weak on mandatory notification of TB by all health facilities, which results in under-reporting by facilities that are not engaged by the National TB programme (Kusimo et al., 2020). In the case of malaria, surveillance systems lack the ability to produce generalisable data as private health facilities do not submit data to the Health Management Information System (HMIS) (Joseph et al., 2017).

The Integrated Disease Surveillance and Response (IDSR) is a surveillance system designed to curb the inefficiency associated with vertical (disease-specific) programmes (Onwe et al., 2021). Despite the adoption of IDSR in Nigeria, vertical programmes on malaria, TB and HIV persist, which have led to duplication of efforts, inequitable funding, and inefficiencies in surveillance (Onwe et al., 2021). The integration of existing vertical programmes into a strengthened IDSR system could result in more effective disease control for individual diseases and for co-infection, allowing for integrated care (Onwe et al., 2021; Kusimo et al., 2020; Chukwuocha et al., 2019).

Capacity challenges: The effectiveness of the IDSR strategy depends not only on the structures, but also on the actions of those responsible for making diagnoses and handling health records (Osagiede et al., 2020). Despite training given to healthcare workers (HCW) on the IDSR, studies reveal a poor understanding of the system and how it works (Kusimo et al., 2020; Osagiede et al., 2020). In addition, non-adherence to diagnosis guidelines by primary HCW can result in missed diagnoses (Iluyomade et al., 2021). Job aid posters (e.g. signs, diagrams, flow charts or a summary of instruction) can help to enhance adherence to guidelines for malaria and other diseases, yet their use by HCW has been found in some instances to be low (Iluyomade et al., 2021). Poor capacity of HCWs in reporting adverse drug reactions (ADRs) in relation to HIV, TB and malaria is a key challenge to drug safety surveillance (Avong et al., 2018). Training workshops have been found to increase knowledge significantly among participants, improving detection and actual reporting of ADRs (Avong et al., 2018). Capacity building of community informants on all notifiable diseases is also important to surveillance (Kusimo et al., 2020). Informal service providers should also be the target of capacity building as many people in Nigeria rely on them for treatment of malaria and HIV (Chukwuocha et al., 2019).

Education and communication: Lack of awareness and knowledge of malaria, TB and HIV and their symptoms among the community and patients contributes to poor prevention, infection, delayed diagnosis and treatment (Gumel et al., 2021; Ogbo et al., 2018). Education interventions in Ebonyi state were successful in increasing the number of children aged five years and older and adults (excluding pregnant women) who requested and received a malaria rapid diagnostic test availability (MRDT) (Omale et al., 2021). A study on HIV-related knowledge among men who have sex with men (MSM) and transgender women (TGW) in Nigeria finds that knowledge about HIV and its transmission among those who attended health centre services improved modestly over time (Faust et al., 2017). Lack of knowledge among the general population can contribute to stigma and discrimination against people with TB and HIV, which can discourage them from getting tested, diagnosed and treated in a timely manner (Junaid et al., 2021; Odimegwu et al., 2018). Women tend to experience a higher degree of stigma and discrimination than men for HIV status (Odimegwu et al., 2018). Stigmatising attitudes can be countered through education and information based approaches (Junaid et al., 2021).

Competing priorities – COVID-19: The effects of the COVID-19 pandemic are likely to intensify the burden of HIV, malaria and TB in Nigeria – through resource re-allocations toward COVID-19; delays in receiving medicines due to supply chain issues; lockdowns that deter infected persons from seeking treatment; and severe complications from co-infection with COVID-19 (Velaven et al., 2021; Oladele et al., 2020).

Part I: Epidemiology

2. Incidence of disease

Malaria: Nigeria has the world's highest total number of people affected by malaria. With over 50 million cases reported each year, Nigeria accounts for 27 percent of the malaria global burden and 23 percent of global deaths (WHO, 2020; Oyeyemi & Etim, 2020; Chukwuocha et al., 2019; Onyiah et al., 2018, 1). Malaria is most severe among pregnant women and children under-five in Nigeria, accounting for 95,000 annual child deaths - the leading cause of child mortality (Dasgupta et al., 2021). There is a much higher prevalence of malaria among anaemic children under-five than non-anaemic children (Ugwu & Zewotir, 2020; Morakinyo et al., 2018). There have been notable reductions in malaria infection prevalence in children under-five over the past decade in all the major geopolitical zones of Nigeria, and in most of the individual states – but with substantial subnational variation (Oyibo et al., 2021).

HIV: Nigeria has the world's second largest total HIV/AIDS burden (second to South Africa), with an estimated 1.9 million people (1.4 percent of Nigeria's total population) living with HIV (Abdullahi et al., 2020, 3-4; Chukwuocha et al., 2019; Atilola et al., 2018). It has the highest population of orphans due to AIDS in sub-Saharan Africa (Chukwuocha et al., 2019; Atilola et al., 2018). In 2019, adolescent girls and young women were estimated to represent 10 percent of the population in Sub-Saharan-Africa, but are disproportionately affected with 59 percent of new HIV infections (see Velaven et al., 2020).

TB: Nigeria is also one of the world's highest TB burden countries, accounting annually for about 4 percent of the world's incident TB cases with an estimated incidence rate of 219/100,000 people (Abdullahi et al., 2020, 3-4; Kusimo et al., 2020, 20). The prevalence of TB among HIV-negative people in 2016 was 27 percent, with the total number of TB mortality amounting to 39,933 (Ogbo et al., 2018, 6). A recent study finds that TB incidence in Nigeria has declined between 2000 and 2016 and the number of deaths from TB mortality has dropped substantially over time (Ogbo et al., 2018, 6). At the same time, however, TB incidence has remained unchanged in many communities (Ogbo et al., 2018). Consistent with prior studies, the study showed that the prevalence and incidence of TB among HIV-negative people were higher in adults (highest in those aged 15-49 years) compared to children in Nigeria (Ogbo et al., 2018).

Co-infection

Malaria-HIV: Recent research finds a high occurrence of co-infection of malaria in HIV patients (Gumel et al., 2021). HIV and malaria co-infection may occur in any area that has high prevalence of the two infections. In Imo State, South-Eastern Nigeria, an area reported to be holoendemic¹ for malaria, the HIV prevalence rate is now 7.5 percent, higher than the national average of 3.0 percent (Chukwuocha et al., 2019).

There are many studies examining the interaction of HIV and malaria in Nigeria. Co-infection can make each disease more severe and potentially more infectious (Gumel et al., 2021; Jemikalajah et al., 2021; Chukwuocha et al., 2019). A study conducted in Zaria found that malaria co-infected HIV subjects have higher levels of HIV viral load and that malaria parasite density increases with greater viral load, suggesting interaction between malaria parasite and the virus (Gumel et al.,

¹ Essentially all inhabitants in the particular area are infected by the disease.

2021). Individuals in malaria-endemic areas who are considered semi-immune to malaria are still more likely to develop malaria if they are infected with HIV (Chukwuocha et al., 2019). A study based in the Ikeja area of Lagos State finds a link between HIV infection and predisposition to more frequent episodes of symptomatic and severe malaria (Oyeyemi & Etim, 2020). A study looking at the holoendemic malaria region of Southern Nigeria finds significantly higher malaria parasitaemia² among HIV-infected children-under five compared with uninfected children (Okonkwo et al., 2018). An experimental study, based in Warri community in the south finds not only that HIV facilitates the rate of malaria transmission, but also that malaria can cause faster progression of HIV disease (Jemikalajah et al., 2021).

Co-infection can affect, in particular, pregnant women and infants born to HIV infected mothers (Gumel et al., 2021; Chukwuocha et al., 2019). Malaria-specific immunity development can be impaired in HIV-infected children, resulting in increased predisposition to malaria infection (Okonkwo et al., 2018). HIV and malaria are leading causes of morbidity and mortality among under-fives in sub-Saharan Africa (Okonkwo et al., 2018). Complications, such as anaemia, common to HIV and malaria, are also likely to be worse with co-infection (Gumel et al., 2021).

TB-HIV: It is well documented that HIV increases the risk of TB infection and vice versa (Gumel et al., 2021). Some studies suggest, however, a higher probability of HIV acquisition in TB patients than observed rate of tuberculosis in HIV infected patients (see Atilola et al., 2018). Nigeria is among one of the thirty high TB and TB-HIV co-infection burden countries in the world (Odume et al., 2020). Fourteen percent of TB patients in Nigeria are diagnosed with HIV (Odume et al., 2020). TB remains the most common opportunistic infection among HIV-positive people, with 35,000 HIV-positive patients dying from TB annually (Odume et al., 2020). While current estimates of HIV and TB burden in Nigeria varies between 5-10 percent, emerging prevalence patterns suggest that significant variation persists across the six geopolitical zones of Nigeria. The highest rate (10.3 percent of co-infection) was reported in the south-east region of the country followed by south-west region at 8.3 percent (see Atilola et al., 2018, 827). Infection with TB can also weaken the immune system, increasing vulnerability to malaria (Gumel et al., 2021).

3. Demographic variation

Socio-economic status

Malaria and HIV/AIDS in Nigeria are both considered to be poverty-related, with the poorest segment of the population most vulnerable due to lower access to information, quality education, and good health facilities (Oyeyemi & Etim, 2020; Bassey & Izah, 2017). The persistence of the TB epidemic in Nigeria is also associated with poverty, low social class, HIV and population growth (Junaid et al., 2021; Ahmad et al., 2018).

A study of malaria in children under-five in Nigeria finds that infections are more common among children living in low-income households (see Ugwu & Zewotir, 2020). The odds of malaria in this age group increase with family poverty, non-availability and non-usage of long-lasting insecticidal nets (LLINs), low education of the mother, family size, age of the child (greater prevalence in children aged 37-59 months), presence of anaemia, and increased age of the head of household (greater prevalence when over 60 years old) (Ugwu & Zewotir, 2020).

² A condition in which parasites are present in the blood.

The inverse relationship observed between under-five malaria infection and degree of wealth may be mediated through housing, as people with greater wealth are more likely to be able to afford improved houses (Morakinyo et al., 2018). A study of households in Nigeria finds that the odds of malaria infection was significantly higher among children who lived in partially improved and non-improved housing compared with those living in improved housing (Morakinyo et al., 2018). Another study on pregnant women and malarial status in Nigeria finds that those living in wood and mud houses recorded more positive cases of malaria and are at greater risk of infection (Onyemaechi & Malann, 2020). People with greater wealth are also more likely to live in urban areas, to be educated and have better access to knowledge about steps to prevent malaria infection. They are also more likely to be able to afford nets and insecticides (Morakinyo et al., 2018). Populations living in rural areas are considered instead to be at greater risk of malaria infection (Bassey & Izah, 2017).

Socio-demographic factors, such as poverty, are also considered responsible for differences in HIV prevalence in different geographic areas (Oyeyemi & Etim, 2020; Ibrahim et al., 2019). A recent study compares socio-demographic factors associated with HIV infection in a high HIV prevalence area in Nigeria (Federal Capital Territory – FCT @ 6.5 percent) and a low prevalence area (Jigawa @1.9 percent). It finds that unemployment and age less than 30 years were key determining factors in HIV infection in the high prevalence area; whereas lack of education was a key predictor of HIV infection in the low prevalence state (Ibrahim et al., 2019). The study also shows that those who were employed were less likely to have HIV infection in the low prevalence state (Ibrahim et al., 2019). These variations indicate the need to tailor interventions in different prevalence areas, such as focusing on mandatory universal basic education in low prevalence states and targeting youth and employment in high prevalence areas (Ibrahim et al., 2019).

A study of peri-urban secondary hospital facilities in the North Central Zone, Nigeria, finds a strong association between attainment of education and decrease in HIV/malaria co-infection rates (Alaofin et al., 2020). In particular, HIV-malaria co-infection is more dominant among HIV positive patients with secondary education and least frequent in participants with tertiary education (Alaofin et al., 2020). There tended to be a high level of awareness among patients with formal education, which is likely to increase implementation of malaria and HIV preventive and protective measures (Alaofin et al., 2020). The least co-infected patients also have the highest income (Alaofin et al., 2020).

Gender

The prevalence of malaria based on gender have been discussed in various literature, with some researchers reporting a higher prevalence in males and others in females (see Bassey & Izah, 2017, 53). A study based in Nassarawa State, Nigeria, finds that female patients were found to be more infected with malaria (67.2 percent) as compared to male patients (61.5 percent) (Bassey & Izah, 2017, 4). This could be attributed to women's late evening cooking, which could expose them more to mosquito bites and transmission of malaria (Bassey & Izah, 2017).

Pregnant women are at greater risk of malaria infection due to pregnancy-induced suppressed immunity. Research conducted in Lugbe and Gosa, Nigeria, finds a high prevalence of malaria in pregnancy (70.5 percent). Malaria is also reported to account for 70 percent of morbidity in pregnant women in Nigeria, 15 percent of maternal anaemia, and 5-14 percent of low birth weight (Onyemaechi & Malann, 2020, 8).

There is also a higher rate of HIV infection among women in Nigeria, although prevalence varies by region (see Odimegwu et al., 2018, 1). Women also tend to experience a higher degree of stigma and discrimination than men for HIV status (Odimegwu et al., 2018). Research also indicates that pregnant women living with HIV have between a 2-10 times greater risk of mortality than uninfected pregnant women in Nigeria, with additional risk for pregnant women in low-resourced settings (Atilola et al., 2018). A study based in two South-western states in Nigeria finds that there is a possible strong epidemiological link between HIV infection and recent blood transfusion among pregnant women attending ante-natal clinics (Atilola et al., 2018).

Co-infection of malaria and HIV in pregnancy has been associated with various adverse pregnancy outcomes, including life-threatening anaemia, placental malarial infection, low birth weight, premature birth, maternal and neonatal death (Chukwuocha et al., 2019; Olusi et al., 2019). A study conducted in Ondo city, Nigeria, finds that the prevalence of malaria was high among HIV infected pregnant women, with HIV infected women in their first trimester reported as having the highest prevalence (Olushi et al., 2019, 1). Pregnant women in Nigeria are also the most vulnerable high-risk population to HIV-TB co-infection (Atilola et al., 2018).

Age-based variations

Older populations: A study examining HIV infections in Ibadan, South-west Nigeria finds that the proportion of persons aged 50 years and over ('older adults') with HIV has increased steadily between 2009 and 2014, mirroring a global trend in the HIV epidemic in the past decade (Akinyemi et al., 2017). This could be due to new infections in this population or recent diagnosis of persons who have been infected long before they reached older adulthood (Akinyemi et al., 2017). The gender distribution among older adults tends to be balanced between males (47 percent) and females (53 percent), unlike the younger age group in which females comprised about two-thirds (Akinyemi et al., 2017). Older adults can be a particularly vulnerable group as they are rarely diagnosed with HIV via routine counselling and testing because of their unwillingness to test voluntarily (Akinyemi et al., 2017). Further, testing facilities are used primarily by youth and women of reproductive age since HIV prevention activities are concentrated among them (Akinyemi et al., 2017).

Adolescents: Adolescents and young adults aged 15-24 years old accounted for approximately 18 percent of people globally who developed active TB in 2019 (Aduh et al., 2021). There is, however, relatively less programme, research and policy focus on TB for adolescents aged 10-19 years. Adolescents in Nigeria tend to have poorer rates of TB screening, treatment initiation and completion compared to adults (Aduh et al., 2021). Adolescents are also at risk of HIV/AIDS and other sexually transmitted infections due to the challenges of early sexual initiation, early marriage, and unsafe sexual practices (Aduh et al., 2021).

4. Geographic variation

Regional and state variation

The northern region of Nigeria, which accounts for 53.4 percent of the population, is reported to have the highest prevalence of HIV/AIDS (49.5 percent) and malaria (over 50 percent) in the country (Semiu, 2017). Reductions in malaria infection in children under-five have occurred in most individual states in Nigeria, but prevalence has decreased substantially more in the southern geo-political zones and the North-central zone. Changes in the south occurred primarily

between 2010 and 2015, with the absence of further reduction since 2018 (Oyibo et al., 2021). While changes have been less notable in the north and more gradual, they were still significant, indicating an overall reduction of more than 20 percent (Oyibo et al., 2021). Research finds, however, that six of the states in northern Nigeria with malaria burdens that are among the highest globally still had a similar prevalence in 2018 compared with 2010 (Oyibo et al., 2021).

HIV prevalence rates also varies by regions and states, with prevalence as low as 0.9 percent in Zamfara state (North-west) and as high as 15.4 percent in Benue state (North-central) (Odimegwu et al., 2018, 1). The North-central zone had HIV prevalence of 5.8 percent while North-west had 1.9 percent; and in the southern region, South-south and South-east had prevalence rates of 4.9 percent while South-west had 2.4 percent (see Odimegwu et al., 2018, 1). There is also variation within regions. Although the North-west had a lower prevalence rate overall, Kaduna state in the North-west reported a prevalence rate of 9.2 percent in 2016, ranking third among states with the highest HIV burden in Nigeria (Gumel et al., 2021).

The prevalence of malaria co-infection among individuals with HIV infection also varies across regions. A recently study finds that prevalence across the zones of the country is 22.9 percent - slightly higher than 18.9 percent in Anambra, South-east Nigeria and 21 percent in Jos, North-central Nigeria (Gumel et al., 2021). The slight difference could be due to differing malaria burden between the three geo-political zones (Gumel et al., 2021).

Areas of displacement

The impacts of crisis and migration on the increased risk and transmission of TB are well documented (see Abdullah et al., 2020). Overcrowding, malnutrition, migration stresses, and the trauma of conflict combine with Nigeria's overall high TB burden to put IDPs and host communities at imminent risk for TB (Abdullah et al., 2020). IDPs tend to live in camps or in host communities, often in 'camp-like' conditions (Abdullah et al., 2020; Ajakaye & Ibukunoluwa, 2020, 2). They lack access to basic health service and suffer from poor hygiene and malnutrition (Abdullah et al., 2020). Infectious diseases like TB and HIV are especially difficult to address under such conditions (Abdullah et al., 2020). In 2017, only half of the individuals living with HIV in the North-east states were receiving treatment, largely due to the closure of clinics (Abdullah et al., 2020, 3). A recent study of IDPs in Boko Haram-affected areas of Nigeria in the north finds that they are disproportionately affected by TB and HIV (Abdullah et al., 2020). The burden of TB among IDPs screened was over twice the estimated incidence in Nigeria and 10 times the national notification rates (Abdullah et al., 2020, 3).

Malaria has also been documented in IDP sites in Nigeria due to the high concentration of vulnerable populations, with over 56 percent of IDPs reported to be children (Ajakaye & Ibukunoluwa, 2020, 2). (Ajakaye & Ibukunoluwa, 2020, 2). A recent study of children in the IDP camp in Edo state finds high rates of malaria infection (55.2 percent) and anaemia (54 percent) (Ajakaye & Ibukunoluwa, 2020, 1). Age was a key risk factor, with higher rates of infection in children 6–10 years of age than in younger children (Ajakaye & Ibukunoluwa, 2020, 1).

Rural-urban hot spots

The risk of malaria infection and malaria-HIV co-infection is found to be greater in rural areas (Gumel et al., 2021; Basse & Izah, 2017). Research on malaria in children under-five in Nigeria finds that children in rural areas were at greater risk of malaria than their urban counterparts (Ugwu & Zewotir, 2020). This may be due in part to the much lower accessibility of health

facilities in remote rural areas (Ugwu & Zewotir, 2020), and/or to inadequate materials for malaria prevention in rural areas compared to urban areas (Gumel et al., 2021; Bassey & Izah, 2017).

Socio-economic status also places a role. Children living in rural areas in poor households constitute a particular vulnerable group; whereas children residing in more wealthy households in urban areas were significantly less prone to malaria infection (Ugwu & Zewotir, 2020). A study on housing finds that populations in rural areas were more likely to have factors that promote malaria transmission generally, including non-improved housing, the presence of bushes and inappropriate waste disposal (which present excellent breeding spaces for mosquitos), reduced access to nets, indoor sprays, and lack of knowledge of steps to prevent malaria infection (Morakinyo et al., 2018). In contrast, persons living in urban environments have a greater likelihood of having improved houses, higher socioeconomic status and limited number of breeding sites (Morakinyo et al, 2018).

Part II: Disease control challenges

5. Socio-economic challenges

The prevalence rate of malaria, HIV and TB infection is influenced by socio-economic demographics (see section above on Demographic variation – socio-economic factors). The diseases are poverty-related, with the poorest populations most vulnerable due to inadequate health facilities, lack of access to information and to quality education (Oyeyemi & Etim, 2020). In addition, lack of financial resources can undermine treatment. Nigeria's high under-five malaria mortality is largely due to high out-of-pocket medical expenses, which discourages care-seeking behaviour, particularly among the poorest households (Dasgupta et al., 2021). Even when care is sought, the most effective treatments are prohibitively costly (Dasgupta et al., 2021).

Even where treatment is free, such as in the case of TB, payment of transport to clinics and other hidden out-of-pocket costs for patients may render treatment prohibitive (Oyefabi et al., 2017). A case study of the TB Directly Observed Treatment Short-course (DOTS) facilities demonstrates that they are disproportionately located in urban settings, rather than rural communities. Some patients had to travel over 30 km away from their homes in rural areas to access TB services, which can be unaffordable for many, who may avoid diagnosis or default on treatment (Oyefabi et al., 2017). It is necessary to locate more facilities in rural areas; and to involve community members in the trainings conducted on TB for early presumptive diagnosis in the community and quick referral to the nearest DOTS centres. Given high rates of co-infection, patients presumed to have TB should also have access to HIV treatment and counselling (Oyefabi et al., 2017).

TB testing and test results also need to be accessible to IDPs in camps and host communities, alongside community engagement (Abdullahi et al., 2020). This can be challenging for IDP communities due to persistent stigma, poor understanding about TB, and other challenges including a lack of trust in healthcare providers. Addressing HIV is similarly complex, due to trauma and exposure of IDPs to sexual violence in conflict (Abdullahi et al., 2020).

6. Surveillance challenges

Disease surveillance is needed to identify outbreaks and epidemics, to monitor the effectiveness of a specific control programme, and to assist in health resource allocation (Osagiede et al., 2020). Effective surveillance requires a robust health information system that can facilitate

comprehensive, accurate and timely collation, collection and analysis of information at all levels (Kusimo et al., 2020). Surveillance and response to outbreaks has been a significant public health challenge in Nigeria, given its rapid population growth, increasing movement of people, and destruction of infrastructure during conflict (Onwe et al., 2021). Under-reporting and double counting in Nigeria indicate a weak surveillance system, which and can impact negatively on programmatic responses for disease control (Kusimo et al., 2020).

Many people with TB in Nigeria remain undiagnosed and thus untreated (Abdullahi et al, 2020, 14; Kusimo et al., 2020, 200-201). In 2019, the country notified only 120,266 of the estimated 420,000 incident cases of TB, leaving a gap of 300,000 undiagnosed cases who remain infectious in the population with one case potentially infecting 10 to 15 others annually (Kusimo et al., 2020, 201). Case detection in Nigeria is undermined by poor laboratory support in DOTs services and certain tests for detection³ conducted primarily only at regional and national reference laboratories (Oyefabi et al., 2017).

TB notification is also weak due to a poor policy framework on mandatory notification of TB by all health facilities. This results in under-reporting of TB cases, especially in health facilities not connected to the data management system of the National TB control programme (NTP), which amount to 80 of facilities (Kusimo et al., 2020). This is a major challenge for TB surveillance, which is exacerbated by a weak community surveillance (Kusimo et al., 2020).

A study on malaria surveillance systems in Ebonyi state, in the South-east zone, finds that the systems are viewed by stakeholders as simple, flexible, acceptable and useful – and there is a willingness to continue to use the systems (Joseph et al., 2017). The reporting process has been fairly successful in delivering quality data to stakeholders on time on a monthly basis, critical to significant reductions of malaria morbidity and mortality in Ebonyi state (Joseph et al., 2017). The systems lack the ability to produce generalisable data, however, as the private health facilities do not submit data to the HMIS. Further, while the paper-based data reporting process has been fairly successful in delivering quality data, the reliance on paper has slowed the process. The integration of electronic based data reporting process and weekly SMS reporting could greatly improve the timeliness of the surveillance system (Joseph et al., 2017).

Vertical versus integrated systems

Integrated Disease Surveillance and Response (IDSR) is a cost-effective surveillance system designed to curb the inefficiency associated with vertical (disease-specific) programs and to improve a country's disease control (Onwe et al., 2021). While TB data, for example, is mainly reported through National Tuberculosis Control, the IDSR system provides a platform for TB data collation through the local government areas and state disease surveillance and notification officers, which can allow for a coordinated national and global TB response (Kusimo et al., 2020).

Despite the implementation process of IDSR in Nigeria since 2000, research finds that vertical programmes on malaria, TB and HIV persist, which have led to duplication of efforts, inequitable funding, and inefficiencies in surveillance (Onwe et al., 2021). Vertical programmes and a poorly implemented regulatory framework have resulted in a multiplicity of data management systems and data collection tools, different to the IDSR tools. This can be chaotic and counterproductive,

³ TB detection is largely performed by sputum Acid Fast Bacilli (AFB) microscopy test in Nigeria. The isolation of the TB pathogen by culture only exists at regional and national reference laboratories, although the molecular diagnosis gene Xpert tests are now available in some tertiary and reference centres in the country. (Oyefabi et al., 2017)

resulting in ineffective utilization of data harmonization and poor response to outbreaks (Onwe et al., 2021; Kusimo et al., 2020). For example, the multiple electronic TB data capture systems deployed at community and health facility levels by different implementing partners has created an inefficient duplicity of functions (Kusimo et al., 2020). The integration of existing vertical programmes into the IDSR system, increased resource allocation, and political support to improve IDSR can result in more effective disease control for individual diseases and for co-infection, allowing for greater integrated care (Onwe et al., 2021; Kusimo et al., 2020; Chukwuocha et al., 2019). This should also be supported by capacity building of community informants on all notifiable diseases and the integration of reporting and risk communication for all health issues at the community level (Kusimo et al., 2020).

Research finds, however, that developmental partners have provided more funding to vertical programmes than to IDSR (Onwe et al., 2021) or to addressing general weaknesses in Nigeria's health system, such as shortages of human resources, fragmentation of services, and decaying infrastructure (Oladele et al., 2020). Collaboration between the different health-related ministries also remains a key issue. Nationally, there is little integration between the Epidemiology Unit of the Federal Ministry of Health (FMoH) (now metamorphosed into the National Centre for Disease Control) and various disease control programmes (Kusimo et al., 2020).

7. Capacity challenges

IDSR: The effectiveness of the IDSR strategy depends not only on having the governance structures in place, but also on the actions of those responsible for making diagnosis and handling health records (Osagiede et al., 2020). A key challenge is inadequate human resource and technical capacities at the lower levels of the health system in various parts of Nigeria (Kusimo et al., 2020). Despite training given to HCW in the IDSR, studies reveal a poor understanding of the reporting requirements of the IDSR structure among HCW, including physicians, which has negatively impacted the quality of public health surveillance data (Kusimo et al., 2020; Osagiede et al., 2020). In particular, many HCW have inadequate knowledge of the persons or authorities to whom they are expected to report notifiable diseases and limited knowledge of the use of forms; while those who have knowledge are hindered by inadequate infrastructure and logistics (Kusimo et al., 2020). A recent study of HCW at public health facilities in Edo State, South-south Nigeria, finds that the level of knowledge of IDSR among HCWs in public facilities was barely above average. Approximately 62 percent of respondents had poor knowledge of IDSR, 24.5 percent had fair knowledge and 13.2 percent had good knowledge (Osagiede et al., 2020, 15).

Diagnostic issues: Non-adherence to diagnosis guidelines by primary HCW can result in missed diagnoses, negatively affecting quality healthcare provisions (Iluyomade et al., 2021). Job aid posters can help to enhance adherence to guidelines, designed to reduce reliance on recall and reference to papers (Iluyomade et al., 2021). A study of the use of job aid posters in diagnosing malaria in Ibadan, Oyo State, Nigeria, finds that HCW's knowledge and adherence to malaria diagnosis guidelines were inadequate; and that less than half of respondents always use them while conducting a malaria diagnosis test (Iluyomade et al., 2021). The study also found that the physical state (damaged/torn) and comprehensiveness of the posters significantly predicted its use by HCW (Iluyomade et al., 2021). Thus, the provision of comprehensive job aid posters on malaria diagnosis, replacement of damaged ones, and strategic display of the job aid posters is recommended to enhance use and adherence (Iluyomade et al., 2021).

Under-reporting of ADRs: A recent study on the pharmacovigilance (PV) training model, designed to improve the reporting of ADRs in public health programmes treating HIV, TB and malaria, finds that Nigeria is facing a major crisis of under-reporting of ADRs (Avong et al., 2018). This greatly undermines drug safety surveillance and regulation. Factors undermining the reporting of ADRs include lack of knowledge, inaccurate description of ADRs, poor quality reports and poor compliance with the pharmacovigilance processes (data collection, storage, management, risk assessment and communication) (Avong et al., 2018).

The study also reports on an awareness raising and training workshop on ADRs conducted in the Federal Capital Territory with participants from health facilities and institutions in the six geo-political regions of Nigeria. It observed a significant gain in knowledge after the participants completed a six-day training, improving the ability to detect and to report ADRs - with reporting increasing by 273 percent (Avong et al., 2018). Participants were also able to train their peers (Avong et al., 2018). Training alone, however, is insufficient to eliminate under-reporting of ADRs. Ongoing problems may include: poor mobilisation of healthcare providers, lack of feedback mechanisms when reports of ADRs are submitted to central regulatory authorities, lack of a clear, practical way of submitting reports, and inadequate private-public collaboration (Avong et al., 2018).

Informal service providers: Research on co-infection with malaria and HIV in Nigeria finds that there is a heavy reliance on informal sources, such as informal drug sellers and home-care for immediate treatment on suspicion of malaria⁴ (Chukwuocha et al., 2019). This is consistent with the pattern of care revealed among HIV-infected pregnant women in the country, which showed that half of the women self-prescribed anti-malaria drugs (Chukwuocha et al., 2019). Another study on malaria in Nigeria finds that the majority of febrile patients seek care from patent medicine vendors in the informal, private health sector, who are considered to engage in over-diagnosis and over-treatment of malaria (Omale et al., 2021). Many parents also seek malaria treatment for their children from patent medicine vendors (Morakinyo et al., 2018). As such, capacity building and training of such informal service providers is a pressing concern (Morakinyo et al., 2018).

Reliance on informal sources is attributed in large part to the high costs of formal care and drugs; desensitisation due to the high prevalence of malaria; shortages of drugs; perceived low-quality care at formal facilities; and (in)convenience factors (Chukwuocha et al., 2019). This heavy reliance on the informal system underscores the continued importance of targeting and engaging private health-care providers, alongside the public sector, in HIV/AIDS and malaria programme development and of pursuing community-based treatment strategies to improve access to appropriate treatment (Omale et al., 2021; Chukwuocha et al., 2019).

8. Education and communication

Efforts to curb malaria, HIV and TB in Nigeria are articulated in national strategic frameworks that centre in large part around advocacy, behaviour change communication and social mobilisation (Okpoko & Aniwada, 2018). Delayed testing and care seeking for TB in Nigeria is attributed to factors such as a lack of awareness of TB symptoms by primary health professionals, lack of knowledge about TB in the community and patients preference for private health practitioners (Ogbo et al., 2018; Okpoko & Aniwada, 2018). Poor knowledge of malaria infection and poor

⁴ A recent Nigerian study reported that the private sector took care of more than 43 percent of malaria cases (see Chukwuocha et al., 2019).

practice of malaria prevention are also considered to be significant risk factors to malaria co-infection in HIV patients (Gumel et al., 2021). Misconceptions due to certain cultural norms or unsubstantiated knowledge of certain interventions, such as use of LLIN or artemisinin-based combination therapy or insecticides, are considered to undermine research and effective disease control (Onyiah et al., 2018). Lack of awareness among parents about the high prevalence of severe anaemia among children with malaria has resulted in high levels of mortality among children under-five, which could be countered with communication initiatives, alongside training of patent medicine sellers (Morakinyo et al., 2018).

Communication and education programmes can raise knowledge and awareness and, in turn, improve testing and care seeking. Diagnostic testing for malaria remains low in Nigeria, despite the scale-up of malaria rapid diagnostic test availability (Omale et al., 2021). Among malaria high-burden countries, Nigeria has one of the lowest malaria testing rates among febrile children under five-years who were brought for care (Omale et al., 2021). A study of sensitisation and education interventions to raise demand for MRDTs among community members in Ebonyi state, Nigeria, finds that they significantly increased the number of children aged 5 years and older and adults (excluding pregnant women) who received an MRDT (Omale et al., 2021). This was achieved by increasing knowledge about and preference for MRDT use, which in turn resulted in requests by community members for testing (Omale et al., 2021).

A recent study of TB and its symptoms within a rural community in South-east Nigeria and among newly diagnosed TB patients in South-west Nigeria finds that there was a poor understanding among these populations of the cause of TB and its symptoms⁵ (Balogun et al., 2019). In turn, wrong beliefs about the cause of TB are considered to responsible for TB stigma and delayed health-seeking behaviours in underserved communities (Balogun et al., 2019). In contrast, good knowledge of TB was a predictor of positive attitudes and good preventive practices, which can ultimately lead to higher rates of TB detection and treatment. The high level of higher TB awareness (97.3 percent) within a rural community in South-east Nigeria is due possibly to TB workshops, seminars and public lectures given within that community, in addition to regular health talks on TB at primary health care centres (Balogun et al., 2019).

Knowledge of HIV risk factors and reduction strategies is also essential for prevention in key populations such as MSM and TGW (Faust et al., 2017). A study on HIV-related knowledge among MSM and TGW in Nigeria and the impact of engagement finds that knowledge about HIV and its transmission among those who attended health centres improved modestly over time (Faust et al., 2017). This is an essential step to achieving behavioural change and uptake of prevention interventions (Faust et al., 2017). The study also finds that internet use is associated with improved knowledge, suggesting that internet-based educational interventions (e.g. websites, online forums etc.) may allow access to a larger breadth of HIV preventive education in spaces with minimal shame, stigma and marginalisation (Faust et al., 2017). Thus, interventions centred on the provision of internet access and web-based delivery of HIV educational materials may be useful counterparts to direct counselling at health care centres in Nigeria (Faust et al., 2017). A study of HIV infected pregnant women in Ondo town and Akure city finds that women who attended routine antenatal clinics in the former location had a lower prevalence rate of

⁵ Less than two-thirds of the respondents knew about TB transmission through the air and very few knew of the various means of preventing TB, availability of free diagnosis and treatment for TB, or of facilities for diagnosis and treatment (Balogun et al., 2019).

malaria than those in Akure (Olusi et al., 2019). This is attributed to an increase in awareness and accessibility to malaria control and prevention measures and the routine counselling available for the HIV infected pregnant women in Ondo town (Olusi et al., 2019).

Adolescents are another target group as sex education is not taught in most schools in Nigeria and other stakeholders tend to withhold such information due to traditional, socio-cultural beliefs (Aduh et al., 2021). Lack of accurate information and limited access to adolescent-friendly health services are key risks to adolescents' sexual and reproductive health status (Aduh et al., 2021).

Forms of health communication

Health communication interventions can include non-formal avenues of communication (e.g. billboards, posters, text messaging, workshops and schools), mass media and interpersonal forms of communication (Okpoko & Aniwada, 2018). A recent study of malaria prevention and curative campaigns finds that modern media channels and their communication techniques (e.g. dramatisation) have achieved limited effects in Cross River State and in Nigeria as a whole, with malaria infections continuing to surge (Iyorza et al., 2021). It attributes this to reliance on modern media channels (e.g. radio and television) - and neglect of pre-modern media (e.g. town criers and town-hall meetings) and of post-modern social media platforms (Iyorza et al., 2021). Other problems include the uses of technical, scientific terms and exaggerated appeals in the communication strategies, which do not appeal to a majority of Nigerians who are less literate and who live in rural areas. Many have a firm belief in herbs as a cure (Iyorza et al., 2021). Instead, messages should involve tailored, simpler words that are related to the respective languages of the target audiences (Iyorza et al., 2021). Another study on malaria control strategies in rural communities of Anambra State, Nigeria, also finds that the adoption of indigenous languages in radio malaria campaigns for rural communities can contribute to greater message comprehension (Nwammuo et al., 2018).

Publicising information on diseases can help not only to inform the population but also to raise their general profile. A study on the Northern region of Nigeria, which has the highest prevalence of HIV and malaria, finds that greater coverage of health issues in the north in Nigerian newspapers could influence policy makers to focus more attention to the region (Semiu, 2017). This may require basing more papers in the north since the location of newspaper organisations has great influence on the coverage of health issues among Nigerian newspapers (Semiu, 2017).

Behavioural change initiatives can also be targeted not only at the population at risk but at providers and policy makers. A cross-sectional study conducted in Nigeria on malaria operational research finds that lack of positive behavioural change among the community, government and private actors was observed as a bottleneck by stakeholders, hindering the development and effectiveness of new programmes for disease control (Onyiah et al., 2018).

Addressing stigma

Stigma and discrimination is considered to be a key major challenge towards reducing the prevalence of TB and HIV and achieving universal access to prevention, treatment, care and support (Junaid et al., 2021; Odimegwu et al., 2018). TB is stigmatised in large part due to its association with local social class, poverty, and HIV (Junaid et al., 2021). A recent study finds that almost one-fifth of respondents expressed stigmatising attitudes toward people with TB, insisting that they should keep distance from others and should not be employed (Junaid et al., 2021). Such stigma and discrimination discourages people with suspected TB from getting tested

and diagnosed in a timely manner; and undermines their continued care as they fear being identified as being or having been infected with TB (Junaid et al., 2021). Lack of testing and care-seeking further limits changes in behaviour to avoid the spread of TB (Junaid et al., 2021).

Stigma also prevents people from accessing HIV counselling, undermining prevention, testing and treatment uptake (Odimegwu et al., 2018). As the general public becomes more aware of the relationship between TB and HIV, people with TB are at risk of further stigmatisation (Junaid et al., 2021). Such stigma and discrimination can result in low self-esteem, social exclusion and isolation among those with TB and/or HIV (Junaid et al., 2021; Odimegwu et al., 2018). Social exclusion can also reduce the economic capital of people with TB, resulting in less ability to cope with the cost of the illness (Junaid et al., 2021).

Stigmatising attitudes against people with TB was found to be significantly associated with poor TB knowledge, thus requiring interventions that address the knowledge, attitudes, and perceptions of the community (Junaid et al., 2021). Studies have documented that higher levels of education and higher knowledge of HIV were associated with lower level of stigma and discrimination against people living with HIV (Odimegwu et al., 2018). Interventions to reduce HIV stigma and discrimination in Nigeria include information-based approaches (e.g. HIV information in print media, radio jingles/drama etc.), skills building (e.g. group learning sessions to reduce stigma and discrimination), and counselling/support for people living with HIV (Odimegwu et al., 2018). A study of HIV knowledge in Nigeria finds that knowledge is generally high among respondents from all the four ethnic groups studied⁶ (Odimegwu et al., 2018). There are, however, variations in expression of fear accorded to stigma (e.g. wanting HIV infection in the family to remain a secret) based on ethnicity, education and rural-urban residence.⁷ Policies and programmes thus need to be tailored to address these differences across ethnic groups and other socio-economic demographics and factors (Odimegwu et al., 2018).

9. Competing priorities – COVID-19

The indirect effects of the COVID-19 pandemic are likely to severely intensify the burden of malaria, HIV and TB in Nigeria (Velaven et al., 2021; Oladele et al., 2020). While donor have responded to COVID-19 by mobilising additional funding to respond to the pandemic, overseas development assistance flows to HIV have also been redirected to COVID-19 (Oladele et al., 2020). This could result in a weakening of Nigeria's efforts to control HIV infection and undermine the strengthening of the health system as a whole. Funding for vertical transmission of HIV/AIDS in Nigeria, for example has been used to strengthen obstetric services, benefitting the entire health system (Oladele et al., 2020).

COVID-19 lockdown measures have also deterred individuals from visiting healthcare facilities for diagnosis and/or treatment, which can increase incidences of HIV infections and interruption to antiretroviral therapy (Velaven et al., 2020). Global slowdown in drug production lines and flight restrictions affecting logistics services can also result in a shortage of medicines (Oladele et al., 2020). Reduced income at the household level due to the COVID-19 shock can also

⁶ 76.8%, 74.6%, 69.1% and 62.3% among Hausa, Igbo, Yoruba and Fulani respectively.

⁷ Women with secondary education have lower odds of expressing fear of accorded stigma compared to women with no education among Hausa ethnic group while Igbo women with higher level of education have significantly higher odds of expressing fear of accorded stigma than women with no education (Odimegwu et al., 2018). Rural residents in Hausa and Igbo ethnic groups also had significantly higher odds of expressing fear of accorded stigma than their urban counterparts the same ethnic group (Odimegwu et al., 2018).

constrain the ability of people living with HIV to follow up with treatment (Oladele et al., 2020). If there is poor adherence to viral suppression through antiretroviral therapy, the risk of transmission rises, which could worsen the gradual rise in new HIV infections evident since 2016 in Nigeria (Oladele et al., 2020). Shortages of antimalarial drugs and lack of access to healthcare can also produce a significant increase in malaria cases and in malaria mortality. Estimates indicate that reducing case management for six months and delaying the distribution of long-lasting insecticidal bed-net campaigns in Nigeria could lead to 81,000 additional deaths (see Velavan et al., 2021, 29-30).

COVID-19 is also expected to have a significant impact on TB patients, undiagnosed TB patients and TB survivors due to disruption of health services (Velavan et al., 2021). Given the stigma associated with coughing, as one of the major symptoms of COVID-19, individuals with suspected TB may be even more deterred from seeking timely testing and/or treatment (Velavan et al., 2021). In addition, COVID-19 co-infection in TB patients can produce more severe complications of COVID-19 (Velavan et al., 2021). Clinical TB remains a cause of death related to COVID-19 co-infection (Velavan et al., 2021).

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