



School Health Governance and Educational Development in Nigeria: Addressing the Burden of Microbial Infections in Schools

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Abstract	Article History
<p>This study examines the relationship between microbial infections and educational development in Nigerian schools, focusing on how communicable diseases affect students' academic performance and learning outcomes. Despite national efforts to expand access to education, educational achievement remains limited, partly due to the high prevalence of preventable infections within school environments. The study analyzes the impact of these infections on students and evaluates existing institutional and policy frameworks aimed at addressing the problem. School-age children in Nigeria face several microbial threats, including parasitic infections such as soil-transmitted helminths and infectious diseases like diarrheal and respiratory infections. Poor water, sanitation, and hygiene (WASH) infrastructure in many schools contributes significantly to the spread of these infections, creating a cycle of poor health and educational disadvantage. The findings show that recurrent illnesses increase student absenteeism, disrupt learning continuity, and reduce academic performance. Persistent infections may also contribute to malnutrition and impaired cognitive development, further limiting students' learning capacity. In addition, psychological and social effects such as stigma and reduced classroom participation were observed, with disparities more evident between rural and urban schools. An assessment of existing school health policies and interventions reveals significant implementation gaps caused by inadequate funding, poor infrastructure, and limited community participation. The study concludes that improving school health infrastructure, strengthening hygiene education, and integrating comprehensive health education into the national curriculum are essential for enhancing both child health and educational development in Nigeria.</p> <p>Keywords: Microbial Infections, Educational Development, School Health, WASH, Nigeria, Student Absenteeism, Child Health.</p>	<p>Received: 10 Feb 2026 Accepted: 09 Mar 2026 Published: 15 Mar 2026</p> <p>Scan QR code to view*</p>  <p>License: CC BY 4.0*</p>  <p>Open Access article.</p>
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1. Introduction

1.1 Background to the Study

The intersection of microbial infections and educational development in Nigerian schools represents a critical yet often overlooked dimension of the nation's struggle to achieve universal basic education and sustainable human capital development. Millions of Nigerian children navigate their educational journeys while carrying the burden of preventable and treatable infections that compromise their ability to attend school regularly, concentrate in class, and achieve their full learning potential. The magnitude of this challenge is underscored by recent epidemiological evidence: a systematic review and meta-analysis of asymptomatic malaria in Nigeria estimated a pooled prevalence of 33 percent nationwide, with

rates reaching 52 percent among children specifically (Okafor *et al.*, 2026). This means that more than half of Nigerian schoolchildren in some communities harbour malaria parasites without exhibiting overt symptoms, yet experience the cognitive and nutritional consequences of chronic infection.

The school environment itself can amplify infection risks when basic infrastructure is lacking. The United Nations Children's Fund has issued stark warnings about Nigeria's WASH crisis in educational settings, revealing that only 11 percent of schools nationwide have access to basic Water, Sanitation and Hygiene services (Daily Trust, 2026). This deficiency creates conditions where infectious diseases spread

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rapidly, absenteeism rises disproportionately among vulnerable groups including girls, and millions of children are exposed to preventable diseases such as cholera and malaria within the very institutions designed to nurture their development. As UNICEF's Chief of Field Office, Rahamah Farrah, observed, schools and healthcare centres are lifelines for children's health and learning, and without clean water and sanitation, infectious diseases spread rapidly, undermining Nigeria's progress towards the Sustainable Development Goals (Daily Trust, 2026).

The consequences extend beyond immediate morbidity to affect long-term educational and economic trajectories. Recurrent infections during childhood impair cognitive development, reduce educational attainment, and ultimately constrain lifetime earnings and productivity. The Nigeria Governors' Forum, in partnership with the World Bank through the Human Capital Opportunities for Prosperity and Equity – Governance Program, has recognised that investing in health can yield better education outcomes, a more skilled workforce, and increased overall productivity (Ministry of Budget and Economic Planning, 2026). This acknowledgment signals growing awareness at policy levels that health and education are not separate domains but interconnected foundations for human capital development.

1.2 Concept of Microbial Infections

Microbial infections encompass diseases caused by pathogenic microorganisms including bacteria, viruses, parasites, and fungi that affect human health through various transmission routes and clinical manifestations. In the context of Nigerian schools, the spectrum of infections with educational relevance is broad and includes both acute illnesses that cause immediate absenteeism and chronic infections that impair cognitive function and development over extended periods.

Parasitic infections constitute a major burden among school-age children in Nigeria. Malaria, caused by *Plasmodium* parasites and transmitted by *Anopheles* mosquitoes, remains the most prevalent parasitic infection, with the recent meta-analysis confirming that children bear a disproportionate burden with prevalence reaching 52 percent in this age group (Okafor *et al.*, 2026). Asymptomatic malaria, where infected individuals carry parasites without manifesting classic symptoms, is particularly relevant in school settings because infected children attend school but experience subtle cognitive impairments, anaemia, and reduced learning capacity that accumulate over time.

Soil-transmitted helminthiasis, including infections with roundworm (*Ascaris lumbricoides*), whipworm (*Trichuris trichiura*), and hookworm (*Necator americanus* and *Ancylostoma duodenale*), affects millions of Nigerian children, particularly in rural areas with poor sanitation. These infections cause nutritional deficiencies, anaemia, and cognitive impairment that directly undermine educational achievement. Schistosomiasis, transmitted through contact with contaminated freshwater, similarly affects children in endemic areas, causing chronic morbidity that impacts school attendance and performance.

Bacterial infections pose acute threats in school environments, particularly where overcrowding and poor ventilation facilitate respiratory transmission. The tragic meningitis outbreak in Yobe State in early 2026, which killed 20 boarding school students and infected 473 others across six secondary schools, demonstrates the devastating potential of bacterial outbreaks in educational settings (The Black Examiner, 2026). The epicentre was Potiskum's Government Technical College, where 17 of the deaths occurred, highlighting the vulnerability of boarding school populations to respiratory infections. Diphtheria outbreaks have also affected school-age children, with UNICEF noting that such outbreaks occur among thousands of children aged five to 14 years, mostly from zero-dose vaccination communities (The Sun Nigeria, 2026).

Viral infections, including measles, rubella, and increasingly COVID-19, disrupt education through both direct morbidity and the broader societal responses they trigger. The COVID-19 pandemic forced unprecedented school closures worldwide, with Nigeria directing all educational institutions to shut down as part of containment strategies, affecting millions of learners and exposing deep inequalities in access to alternative learning platforms (A1projecthub, 2026). Vaccine-preventable viral infections like measles and rubella continue to circulate, with the Ebonyi State Government launching immunisation campaigns targeting children aged nine months to 15 years to close immunity gaps and interrupt transmission (Federal Ministry of Information and National Orientation, 2026).

1.3 Overview of Educational Development in Nigeria

Nigeria's educational system encompasses three main sectors: basic education spanning nine years (six years of primary and three years of junior secondary education), post-basic senior secondary education of three years, and tertiary education of four to six years depending on the programme of study (A1projecthub, 2026). The administration of education is shared across federal, state, and local governments, with the Federal Ministry of Education responsible for overall policy formation and quality control, while state governments manage secondary education and local governments oversee primary schools. This multi-level governance structure creates both opportunities for local adaptation and challenges for coordinated implementation of health and education initiatives.

Despite policy commitments to universal basic education, significant challenges persist in educational access, quality, and equity. Infrastructure deficits are widespread, with the WASH crisis in schools representing just one dimension of broader resource constraints. Teacher shortages, inadequate learning materials, and overcrowded classrooms further compromise educational quality. The Human Capital Opportunities for Prosperity and Equity – Governance Program, a \$500 million World Bank-assisted initiative, aims to address these challenges by strengthening governance reforms in basic education and primary healthcare across all 36 states and the Federal Capital Territory (Ministry of Budget and Economic Planning, 2026). The programme focuses on three result areas: increasing the availability and effectiveness of financing for service delivery, enhancing transparency and

accountability, and improving the recruitment, deployment, and performance management of teachers and healthcare workers.

Educational development is increasingly recognised as inseparable from child health and nutrition. As UNICEF's Officer-in-Charge for the Kano Field Office, Michael Banda, articulated, there is a triple health nexus where economic growth, poverty reduction, and human capital development depend fundamentally on the quality and quantity of investment in good health (The Sun Nigeria, 2026). When people are healthy, they can work, earn a living, and support their families, reducing poverty. Good health is a form of human capital, and investing in health can yield better education outcomes, a better-skilled workforce, and increased overall productivity. This recognition is driving policy innovations such as the integration of health interventions into school settings and the strengthening of primary healthcare systems that serve school-age children.

1.4 Statement of the Problem

Despite policy frameworks and international commitments to child health and education, Nigerian schools continue to face a silent crisis where microbial infections systematically undermine educational development. The problem manifests across multiple interconnected dimensions that together compromise the nation's ability to develop its human capital and achieve sustainable development goals.

First, the burden of infections among school-age children remains unacceptably high. The meta-analysis finding of 52 percent asymptomatic malaria prevalence in children (Okafor *et al.*, 2026) implies that most classrooms contain multiple infected children whose learning capacity is compromised, even though they are physically present. Soil-transmitted helminth infections affect similar proportions in endemic areas. Acute outbreaks like the Yobe meningitis tragedy (The Black Examiner, 2026) demonstrate that when control measures fail, the consequences can be catastrophic, with deaths, prolonged school closures, and psychological trauma affecting entire school communities.

Second, the infrastructure deficit in schools creates conditions conducive to disease transmission and perpetuates infection cycles. With only 11 percent of Nigerian schools having access to basic WASH services (Daily Trust, 2026; [allAfrica.com](https://www.allAfrica.com), 2026), the majority of children attend schools without safe water for drinking and handwashing, without adequate sanitation facilities, and without the hygiene infrastructure needed to prevent faecal-oral disease transmission. Girls are disproportionately affected, as lack of gender-segregated, private sanitation facilities contributes to absenteeism during menstruation and increases dropout rates.

Third, vaccination coverage gaps leave millions of children vulnerable to vaccine-preventable diseases. UNICEF has identified 556,750 zero-dose children in Kano, Katsina, and Jigawa states alone who have never received a single dose of vaccination (The Sun Nigeria, 2026). These children constitute a "zero-dose community" that threatens herd immunity and serves as a gateway for outbreaks of polio, diphtheria, measles,

and other communicable diseases. The diphtheria outbreak in Kano in 2025 demonstrated the real-world consequences of these coverage gaps, affecting thousands of children aged five to 14 years.

Fourth, the fragmentation of health and education governance impedes coordinated responses. While the Federal Ministry of Education, state universal basic education boards, and local government authorities oversee schools, health interventions in school settings require collaboration with primary healthcare agencies, disease control programmes, and development partners. This multi-sectoral coordination is often weak, resulting in missed opportunities for integrating health services into school platforms and for leveraging schools as delivery channels for health interventions.

1.5 Aim and Objectives of the Study

This study aims to comprehensively examine the impact of microbial infections on educational development in Nigerian schools, with particular attention to the mechanisms through which infections affect learning outcomes, the environmental and structural factors that facilitate disease transmission in school settings, and the policy and programmatic responses that can mitigate these impacts. The specific objectives are:

1. To identify the common microbial infections affecting school-age children in Nigeria and their prevalence patterns across different regions and populations
2. To analyse the transmission dynamics of infectious diseases within school environments, including the role of WASH infrastructure, overcrowding, and hygiene practices
3. To assess the impact of microbial infections on educational outcomes including absenteeism, academic performance, cognitive development, and school completion
4. To examine existing school health policies and programmes in Nigeria, identifying gaps and opportunities for strengthening infection prevention and control
5. To document successful interventions and case studies from Nigerian schools that have effectively reduced infection burdens and improved educational outcomes
6. To propose evidence-based recommendations for integrating infection control into educational development strategies at policy and practice levels

1.6 Research Questions

This study seeks to answer the following research questions:

1. What are the most prevalent microbial infections affecting school-age children in Nigerian schools, and how do prevalence rates vary by geographic region, age group, and socio-economic status?
2. How do school environmental factors, including WASH infrastructure, classroom crowding, and ventilation, influence the transmission of infectious diseases among students?

3. What is the relationship between infection burden and educational outcomes including school absenteeism, academic achievement, and dropout rates?
4. What policies and programmes currently exist at federal, state, and local government levels to address infection prevention and control in schools, and how effectively are they implemented?
5. What are the barriers to effective implementation of school health interventions, and how can these barriers be overcome?
6. What successful models exist for integrating infection control into school settings in Nigeria, and what lessons can be drawn from these experiences?

1.7 Scope and Significance of the Study

This study encompasses the spectrum of microbial infections affecting school-age children in Nigerian primary and secondary schools, with particular attention to those with the greatest public health and educational impact. The geographic scope is national, though attention is given to regional variations in disease burden, infrastructure, and policy implementation. The time frame considered prioritises recent evidence while acknowledging longer-term trends that have shaped current patterns.

The significance of this study lies in its potential to inform evidence-based policy making at multiple levels. For the Federal Ministry of Education and state universal basic education boards, it provides a comprehensive analysis of how infections affect educational outcomes and identifies priority interventions for school health programmes. For the Federal Ministry of Health, state primary healthcare development agencies, and the Nigeria Centre for Disease Control and Prevention, it illuminates the school setting as a critical platform for disease control and health promotion. For development partners, including UNICEF, the World Bank, and bilateral agencies, it offers evidence to guide investments in school health and WASH infrastructure. For schools, teachers, and communities, it provides practical guidance on infection prevention measures that can be implemented with available resources.

The urgency of this inquiry is underscored by recent events: the Yobe meningitis outbreak that claimed 20 student lives (The Black Examiner, 2026), the ongoing challenges of zero-dose children threatening herd immunity (The Sun Nigeria, 2026), and the persistent WASH deficits that leave 89 percent of schools without basic services (Daily Trust, 2026). Each of these represents a failure of the systems meant to protect children's health and enable their education. Understanding these failures and identifying pathways to solutions is essential for fulfilling Nigeria's commitments to its children and its development aspirations.

2. Literature Review

2.1 Common Microbial Infections among School-Age Children

School-age children in Nigeria bear a disproportionate burden of infectious diseases, reflecting their physiological

vulnerability, exposure patterns, and the limitations of health systems in reaching this age group. Understanding the epidemiology of these infections is essential for designing effective school-based interventions and for appreciating the magnitude of their impact on educational development.

Malaria stands as the most prevalent parasitic infection affecting Nigerian schoolchildren. The recent systematic review and meta-analysis of asymptomatic malaria in Nigeria, which synthesised data from 25 studies across the country, estimated an overall pooled prevalence of 33 percent, with subgroup analysis revealing that children experience significantly higher rates at 52 percent (Okafor *et al.*, 2026). This finding has profound implications for education, as asymptotically infected children attend school but experience chronic effects including anaemia, cognitive impairment, and reduced attention span. The meta-analysis also identified key risk factors, with prevalence reaching 19 percent related to education level, 36 percent based on sex, and 39 percent associated with insecticide-treated net usage, highlighting the complex interplay of social, behavioural, and environmental determinants.

Soil-transmitted helminth infections remain highly endemic in many parts of Nigeria, particularly in rural areas with poor sanitation and limited access to clean water. The World Health Organization estimates that Nigeria has one of the highest burdens of STH in sub-Saharan Africa, with school-age children constituting the most affected age group. These infections cause chronic morbidity through several mechanisms: hookworm and whipworm cause intestinal blood loss leading to iron deficiency anaemia; roundworm can cause intestinal obstruction in heavy infections; and all STH species contribute to malnutrition and growth stunting. The cognitive consequences of STH infections have been well-documented, with infected children showing deficits in memory, reasoning, and language development compared to uninfected peers.

Schistosomiasis, caused by *Schistosoma haematobium* (urogenital) and *S. mansoni* (intestinal), affects children in communities with contaminated freshwater sources. In Nigeria, transmission occurs across all geopolitical zones, with prevalence varying by proximity to water bodies and adequacy of sanitation. Chronic schistosomiasis causes anaemia, growth retardation, and in the case of urogenital schistosomiasis, haematuria and bladder pathology. The disease has been associated with cognitive impairment and reduced school attendance, particularly when infection intensity is high.

Bacterial infections pose acute threats in school settings, with outbreaks capable of causing substantial morbidity and mortality within short periods. The meningitis outbreak in Yobe State in early 2026 illustrated this dramatically, with 473 students infected and 20 deaths across six secondary schools (The Black Examiner, 2026). Nigeria lies within the African meningitis belt, where epidemics of meningococcal meningitis occur periodically during the dry season. School dormitories, with their crowded sleeping conditions, provide ideal settings for transmission of respiratory pathogens. Diphtheria has also re-emerged as a threat, with UNICEF documenting outbreaks

in Kano and neighbouring states affecting thousands of children aged five to 14 years, predominantly from zero-dose vaccination communities (The Sun Nigeria, 2026).

Vaccine-preventable viral infections continue to affect school-age children despite the availability of effective vaccines. Measles remains endemic, with periodic outbreaks driven by vaccination coverage gaps. The Ebonyi State Government, in collaboration with UNICEF, launched a measles and rubella immunisation campaign in early 2026 targeting children aged nine months to 15 years, part of a broader initiative to reach 102 million children across Africa (Federal Ministry of Information and National Orientation, 2026). The fact that such campaigns remain necessary decades after vaccines became available underscores the persistent challenges in achieving and maintaining high coverage.

2.2 Transmission Dynamics in School Environments

School environments possess unique characteristics that facilitate the transmission of infectious agents, making them important sites for disease spread and, conversely, critical targets for infection control interventions. Understanding these transmission dynamics is essential for designing effective prevention strategies tailored to school settings.

Crowding is perhaps the most significant factor driving respiratory pathogen transmission in schools. Classrooms in many Nigerian schools exceed recommended student-teacher ratios, with students seated in close proximity for extended periods. This crowding facilitates the spread of airborne and droplet-transmitted infections including influenza, measles, chickenpox, and meningococcal disease. Boarding schools present even greater risks, as students share sleeping quarters with high occupancy densities. The Yobe meningitis outbreak, which concentrated in the Government Technical College's boarding facilities, exemplifies how crowding enables rapid pathogen spread once introduced (The Black Examiner, 2026). Poor ventilation compounds crowding risks by allowing infectious aerosols to accumulate and persist in indoor air. Many Nigerian classrooms lack adequate windows or have windows that remain closed, limiting natural ventilation that would otherwise dilute and remove infectious particles. In resource-constrained settings where mechanical ventilation is unavailable, attention to building design and window operation can substantially reduce transmission risks, yet this receives minimal attention in school infrastructure planning.

Water, sanitation and hygiene deficits create conditions for faecal-oral disease transmission. With only 11 percent of schools having basic WASH services (Daily Trust, 2026; [allAfrica.com](https://www.allAfrica.com), 2026), most children attend schools where they cannot wash hands with soap and water after using latrines or before eating. This facilitates transmission of enteric pathogens including those causing cholera, typhoid, shigellosis, and soil-transmitted helminthiasis. When latrines are unavailable, inadequate, or not gender-segregated, open defecation around school grounds may occur, contaminating the environment and perpetuating transmission cycles.

Food handling in schools presents additional transmission pathways. Where school feeding programmes operate without adequate food safety measures, contaminated food can serve

as a vehicle for multiple pathogens. The National Home-Grown School Feeding Programme, which provides meals to millions of primary school children, has enormous potential to improve nutrition but also requires robust food safety systems to prevent outbreaks.

Water storage practices in schools can create breeding sites for mosquito vectors. In malaria-endemic areas, uncovered water containers, blocked gutters, and poor drainage around school buildings provide habitat for *Anopheles* mosquitoes, increasing exposure risk for students and staff. The finding that ITN usage is associated with 39 percent prevalence of asymptomatic malaria (Okafor *et al.*, 2026) underscores the importance of vector control, yet schools themselves rarely implement vector control measures.

2.3 Water, Sanitation and Hygiene (WASH) in Nigerian Schools

The state of Water, Sanitation and Hygiene infrastructure in Nigerian schools represents both a critical vulnerability and a fundamental opportunity for improving child health and educational outcomes. UNICEF's revelation that only 11 percent of schools nationwide have access to basic WASH services has profound implications for infection prevention and educational equity (Daily Trust, 2026; [allAfrica.com](https://www.allAfrica.com), 2026).

Breaking down this statistic reveals the magnitude of the deficit. Basic WASH services encompass three components: access to improved water sources on school premises, availability of improved sanitation facilities that are gender-segregated, and handwashing facilities with soap and water. The 11 percent figure represents schools meeting all three criteria, meaning that 89 percent of schools lack at least one of these essential services. In practical terms, millions of children attend schools where they cannot drink safe water, use a clean and private toilet, or wash their hands with soap.

The consequences for girls are particularly severe. UNICEF's Rahamah Farrah emphasised that lack of clean water and sanitation in schools fuels absenteeism, especially among girls (Daily Trust, 2026). During menstruation, girls without access to private, gender-segregated sanitation facilities with water for washing may miss school days or drop out entirely. The Jigawa State Universal Basic Education Board Chairman noted that providing water to girls gives them the confidence and self-esteem to sit in the classroom and learn with comfort and safety (Vanguard, 2026).

Regional disparities in WASH coverage are substantial. While Jigawa and Katsina have made progress towards eliminating open defecation and improving school WASH, many states in the northwest and other regions lag behind, with handwashing facilities and hygiene infrastructure scoring below national averages (Daily Trust, 2026). These disparities perpetuate and deepen existing inequalities in educational opportunity and health outcomes.

Positive developments offer hope and models for replication. Jigawa State has announced a robust partnership with UNICEF to achieve 100 percent WASH coverage across its 3,345 basic

schools within two years (Vanguard, 2026). This initiative builds on the state's success in achieving Open Defecation Free status, the first in Nigeria. The state currently manages 8,689 toilets across its schools and has recruited 10,000 school guards to protect these investments. Importantly, the initiative emphasises sustainability, calling on teachers, parents, and mothers' associations to take ownership of facilities and encouraging learners to maintain hygiene.

UNICEF, with support from the UK government, has invested £19 million in climate-resilient infrastructure under the CRIPS programme, delivering 84 health and education facilities in Kano and Jigawa in 2025, with expansion planned to Bauchi, Gombe, Kaduna, and Katsina states (Daily Trust, 2026). These investments demonstrate that progress is possible with political commitment, adequate resources, and effective partnership.

2.4 School Health Programs and Infection Prevention

School health programmes provide a framework for delivering preventive and curative health services to school-age children, leveraging the school platform to reach populations that may not access health facilities regularly. In Nigeria, school health has received varying levels of policy attention and implementation support, with significant gaps between policy aspirations and on-the-ground reality.

The National School Health Policy, developed by the Federal Ministry of Education in collaboration with the Federal Ministry of Health, provides guidance for comprehensive school health programming. The policy addresses multiple components including health education, school health services, healthy school environment, nutrition and food safety, counselling and social support, and staff health and wellness. Implementation, however, has been inconsistent, with resource constraints, weak coordination across ministries, and competing priorities limiting progress.

School health services encompass a range of interventions that can be delivered in or through schools. These include health screenings for conditions like vision and hearing impairment, deworming programmes, immunisation campaigns, first aid and treatment of minor illnesses, and referral linkages to primary healthcare facilities. The deworming programme for soil-transmitted helminthiasis, implemented in many states with support from development partners, demonstrates the potential of school-based delivery: by training teachers to administer deworming tablets, programmes can achieve high coverage at low cost.

Immunisation campaigns increasingly use schools as delivery platforms. The Ebonyi State measles and rubella campaign explicitly targets schools alongside churches, mosques, and other public places to ensure that vaccines reach all eligible children (Federal Ministry of Information and National Orientation, 2026). School-based delivery offers advantages including access to large numbers of children in organised settings, ability to verify vaccination status through school records, and opportunities for health education alongside service delivery.

Infection Prevention and Control initiatives in schools are gaining attention, catalysed by the COVID-19 pandemic and recent outbreak experiences. Kano State has announced innovative plans to establish IPC clubs and appoint surveillance focal persons in tertiary institutions, with the goal of improving early detection of disease outbreaks and ensuring faster information sharing between institutions and the disease control agency (Nigeria Info FM, 2026). The Director-General of the Kano State Centre for Disease Control and Prevention explained that each institution would have a surveillance focal person to report unusual health events, supporting timely public health response. While initially focused on higher institutions, this model has potential applicability to secondary schools.

The World Bank-assisted Human Capital Opportunities for Prosperity and Equity – Governance Program represents a significant investment in strengthening governance for both education and health at state level (Ministry of Budget and Economic Planning, 2026). By focusing on improving availability and effectiveness of financing, enhancing transparency and accountability, and strengthening human resource management, the programme addresses foundational issues that affect school health implementation. The Nigeria Governors' Forum's involvement signals recognition at highest political levels of the interconnectedness of education and health in human capital development.

2.5 Theoretical Framework

This study is grounded in several theoretical perspectives that illuminate different dimensions of the relationship between microbial infections and educational development. These frameworks inform the research questions, guide the analysis, and provide lenses for interpreting findings.

The Human Capital Theory, originating in the work of economists including Theodore Schultz and Gary Becker, conceptualises education and health as forms of capital in which individuals and societies invest to enhance productivity and earnings. From this perspective, investments in child health, including infection control, are investments in human capital that yield returns through improved educational attainment, enhanced cognitive abilities, and ultimately greater lifetime productivity. The theory provides a rationale for integrating health and education policies and for quantifying the returns to health investments in educational terms. The World Bank's HOPE-GOV programme explicitly embraces this framework, recognising that good health is a form of human capital and that investing in health can yield better education outcomes (Ministry of Budget and Economic Planning, 2026).

The Ecological Systems Theory, developed by Urie Bronfenbrenner, conceptualises child development as occurring within nested environmental systems that interact to shape outcomes. The microsystem includes the immediate school environment with its physical infrastructure, social relationships, and daily practices. The mesosystem encompasses interactions between school and other settings like home and community. The exosystem includes broader institutional structures like education and health policies. The

macrosystem comprises cultural values, economic conditions, and political ideologies. This framework illuminates how infection-related educational impacts arise from multiple interacting factors: inadequate school WASH infrastructure (microsystem), poor coordination between health and education sectors (mesosystem), weak policy implementation (exosystem), and underinvestment in child welfare (macrosystem). Interventions must therefore address multiple levels simultaneously.

The Social Determinants of Health framework focuses attention on the conditions in which people are born, grow, live, work, and age as fundamental drivers of health outcomes. Applied to schoolchildren, this framework highlights how poverty, inadequate housing, food insecurity, and limited access to healthcare create differential vulnerability to infections and differential capacity to cope with their educational consequences. The finding that education level is associated with 19 percent prevalence of asymptomatic malaria (Okafor *et al.*, 2026) reflects these social determinants operating at household level. The framework also points to interventions that address root causes rather than merely treating symptoms.

The Rights-Based Approach, grounded in the Convention on the Rights of the Child, frames child health and education as fundamental rights that governments have obligations to fulfil, protect, and respect. This perspective emphasises accountability, non-discrimination, participation, and attention to the best interests of the child. It highlights the unacceptability of situations where 89 percent of schools lack basic WASH services (Daily Trust, 2026) or where over half a million children remain zero-dose (The Sun Nigeria, 2026), as these constitute violations of children's rights to health, education, and an adequate standard of living. The framework provides moral and legal impetus for action beyond purely economic arguments.

The One Health approach recognises the interconnectedness of human, animal, and environmental health, which is particularly relevant to infections affecting schoolchildren. Many pathogens affecting children—including zoonotic infections, vector-borne diseases, and environmentally transmitted agents—require attention to animal reservoirs, ecological factors, and environmental conditions beyond the human health sector. The approach encourages collaboration across sectors and disciplines, aligning with the multi-sectoral coordination needed for effective school health programming.

3. Impact of Microbial Infections on Educational Outcomes

3.1 Absenteeism and Academic Performance

The most direct pathway through which microbial infections affect educational development is through school absenteeism. When children are ill, they miss school days, falling behind in their studies and potentially disengaging from education entirely. The magnitude of infection-related absenteeism in Nigerian schools is substantial, though precise national estimates remain limited due to data gaps.

Acute infections cause short-term absences that can accumulate to significant instructional time lost. A child with malaria may miss three to five school days per episode, and with multiple episodes annually in highly endemic areas, the cumulative absence can approach several weeks per year. Diarrhoeal diseases, which are highly prevalent where WASH infrastructure is inadequate, similarly cause repeated short absences. Respiratory infections including influenza and the common cold contribute to absenteeism, particularly during transmission peaks.

Chronic infections cause more complex patterns of absence. Children with soil-transmitted helminthiasis or schistosomiasis may experience intermittent symptoms that lead to sporadic attendance, as well as longer absences when heavy infections cause severe morbidity. The fatigue and malaise associated with chronic infections may also reduce attendance motivation even when children are not acutely ill. The Yobe meningitis outbreak illustrates the extreme end of the absenteeism spectrum. Beyond the 20 deaths and 473 infections, the outbreak triggered school closures, isolation measures, and disruption of normal educational activities for thousands of students (The Black Examiner, 2026). Such outbreaks not only affect infected students but disrupt entire school communities, with psychological impacts that may affect attendance and performance long after the acute event. Absenteeism translates directly into reduced academic performance through multiple mechanisms. Missed instruction creates knowledge gaps that compound over time, as later learning builds on earlier foundations. Returning students may struggle to catch up, particularly when teachers lack capacity to provide remedial support. Frequent absences disrupt the continuity of learning and can lead to disengagement and eventual dropout. Studies from various African settings have documented dose-response relationships between malaria episodes and educational achievement, with each infection associated with measurable decrements in test scores.

3.2 Cognitive Development and Learning Capacity

Beyond absenteeism, microbial infections directly impair cognitive function and learning capacity through biological mechanisms that affect brain development and function. These effects can persist long after the acute infection has resolved, with implications for educational trajectories and lifetime achievement.

Malaria's cognitive impacts have been most extensively studied. Severe malaria, particularly cerebral malaria, can cause overt neurological damage with lasting cognitive deficits. However, even uncomplicated and asymptomatic malaria episodes affect cognition through multiple pathways. Fever and systemic illness during acute episodes temporarily impair concentration and information processing. Chronic or recurrent infections cause anaemia, reducing oxygen delivery to the brain and affecting cognitive function. Inflammatory responses to infection may directly affect neural processes. The meta-analysis finding that 52 percent of children harbour asymptomatic malaria parasites (Okafor *et al.*, 2026) implies that a majority of children in some settings experience these subtle but cumulative cognitive insults throughout their school years.

Soil-transmitted helminth infections impair cognition through nutritional and inflammatory mechanisms. Hookworm causes intestinal blood loss leading to iron deficiency anaemia, which has well-documented effects on cognitive development, attention, and learning. All STH species contribute to malnutrition by competing for nutrients and causing intestinal inflammation that impairs nutrient absorption. Studies have documented improvements in cognitive test scores following deworming treatment, providing causal evidence of infection-related cognitive impairment.

Schistosomiasis causes chronic inflammation, anaemia, and in heavy infections, end-organ damage that can affect cognitive function. Children with schistosomiasis have been shown to perform worse on tests of attention, memory, and learning compared to uninfected peers, with improvements following treatment.

The cognitive effects of infections interact with nutritional status in complex ways. Undernourished children are more susceptible to infections and experience more severe cognitive impacts when infected. Infections exacerbate malnutrition through appetite suppression, nutrient malabsorption, and metabolic changes. This vicious cycle means that children facing food insecurity are doubly vulnerable to infection-related educational deficits.

3.3 Nutritional Status and Infection Burden

The bidirectional relationship between nutrition and infection has profound implications for educational development. Malnutrition increases susceptibility to infections and worsens their severity, while infections exacerbate malnutrition through multiple mechanisms. This nutrition-infection nexus operates throughout childhood but is particularly critical during school years when cognitive development remains active and nutritional demands are high.

Infections affect nutritional status through several pathways. Acute infections suppress appetite, reducing food intake during illness and recovery. This can be particularly consequential for children with marginal nutritional reserves. Infections cause metabolic changes that increase nutrient requirements while simultaneously reducing absorption efficiency. Diarrhoeal diseases directly reduce nutrient absorption and can cause rapid weight loss. Chronic infections like soil-transmitted helminthiasis and schistosomiasis cause ongoing nutrient losses and inflammation that impair growth. The nutritional consequences of infections directly affect educational outcomes. Iron deficiency anaemia, caused by hookworm and malaria, impairs cognitive function and reduces attention span. Protein-energy malnutrition affects brain development and learning capacity. Vitamin and mineral deficiencies, exacerbated by infections, affect multiple aspects of cognitive function. Stunted growth, which reflects chronic undernutrition often driven by repeated infections, is associated with reduced cognitive achievement and lower educational attainment.

School feeding programmes, such as Nigeria's National Home-Grown School Feeding Programme, have potential to break

this cycle by providing nutritious meals that improve nutritional status, reduce hunger-related attention deficits, and create incentives for school attendance. However, these programmes also require attention to food safety to prevent them from becoming transmission pathways for foodborne infections.

3.4 Psychological and Social Impacts

The psychological and social consequences of infections extend beyond physical morbidity to affect educational engagement, peer relationships, and emotional wellbeing. These impacts, while less quantifiable than test scores or attendance records, are nonetheless important for understanding the full burden of infections on educational development.

Stigma associated with certain infections can affect children's school experiences and social integration. Children with visible manifestations of disease—such as the facial disfigurement caused by noma—may face bullying, social exclusion, and discrimination that undermine their educational participation. Even without visible signs, the knowledge of being infected with certain conditions can affect self-esteem and peer relationships.

Outbreak experiences can be psychologically traumatic for affected school communities. The Yobe meningitis outbreak, with its 20 deaths concentrated in boarding schools, undoubtedly caused psychological distress extending far beyond infected students (The Black Examiner, 2026). Bereaved students, those who survived severe illness, and the broader school community may experience anxiety, depression, and post-traumatic stress that affect learning and school engagement long after the outbreak ends.

Caregiver illness and death from infections affect children's educational trajectories through family disruption, economic hardship, and emotional trauma. When parents or other caregivers die from infections—including HIV/AIDS, tuberculosis, or outbreak diseases—children may be forced to leave school, take on caregiving responsibilities, or experience household economic decline that compromises their education.

Menstrual hygiene management, while not itself an infection, intersects with infection prevention and educational participation. Girls without access to private, gender-segregated sanitation facilities with water for washing face challenges managing menstruation with dignity and safety. The resulting absenteeism and dropout risk represent an infection-adjacent pathway through which WASH deficits affect educational outcomes, particularly for girls. UNICEF's observation that providing water to girls gives them confidence and self-esteem to learn with comfort and safety (Vanguard, 2026) underscores the psychological as well as practical dimensions of this issue.

3.5 Rural–Urban Disparities in School Health

The burden of infections on educational development is not distributed uniformly across Nigeria's geographic and socio-economic landscape. Rural-urban disparities in infection

prevalence, WASH infrastructure, health service access, and educational quality create systematic differences in how infections affect children's educational outcomes.

Infection prevalence is generally higher in rural areas, reflecting poorer environmental conditions, limited access to preventive interventions, and weaker health systems. Malaria transmission is more intense in rural areas with suitable vector habitat. Soil-transmitted helminthiasis and schistosomiasis are concentrated in rural communities with poor sanitation and contaminated water sources. The meta-analysis finding of 52 percent asymptomatic malaria prevalence in children (Okafor *et al.*, 2026) likely masks substantial variation, with rural children bearing disproportionate burden.

WASH infrastructure deficits are more severe in rural schools, compounding infection risks. While only 11 percent of schools nationally have basic WASH services (Daily Trust, 2026), rural schools are even less likely to meet these standards. Rural children are more likely to rely on unprotected water sources, use inadequate latrines, and lack handwashing facilities. The progress in Jigawa State, while encouraging, remains exceptional rather than typical.

Health service access barriers are greater for rural children. Primary healthcare facilities are fewer and farther apart in rural areas, and those that exist are often understaffed, under-equipped, and poorly stocked with essential medicines. Rural parents face higher transportation costs and longer travel times to access care, leading to delayed treatment and greater reliance on patent medicine vendors. These barriers mean that when rural children become infected, they are less likely to receive prompt, appropriate treatment, resulting in more severe outcomes and longer educational disruption.

Educational quality itself is generally lower in rural schools, with higher student-teacher ratios, fewer trained teachers, and poorer learning materials. This means that when rural children miss school due to illness, they return to classrooms with less capacity to help them catch up. The combination of higher infection burden and lower educational quality creates compounded disadvantage for rural children.

These rural-urban disparities reflect broader patterns of inequality that perpetuate intergenerational poverty cycles. Children born in rural areas face higher infection risks, poorer health services, lower-quality education, and consequently reduced life chances compared to their urban counterparts. Addressing these disparities requires targeted investments that prioritise the most disadvantaged communities while strengthening universal systems.

4. Institutional and Policy Responses

4.1 School-Based Health Interventions

School-based health interventions represent a strategic approach to reaching school-age children with essential health services, leveraging the school platform to achieve high coverage and integrate health with education. Nigeria has implemented various school-based interventions with varying degrees of success, and emerging innovations offer promise for strengthening this approach.

Mass deworming programmes for soil-transmitted helminthiasis exemplify the potential of school-based delivery. By training teachers to administer deworming tablets, programmes can achieve high coverage at low cost, reaching children who might not access health facilities. The World Health Organization recommends periodic deworming in areas where STH prevalence exceeds 20 percent, which includes most of Nigeria. Implementation has been supported by development partners including the Deworm the World initiative and has reached millions of children, though coverage gaps remain and programme sustainability depends on continued political and financial commitment.

School-based immunisation campaigns have been used to deliver vaccines including measles, rubella, and human papillomavirus vaccine. The Ebonyi State measles and rubella campaign explicitly targets schools alongside other community venues, recognising schools as efficient platforms for reaching large numbers of children (Federal Ministry of Information and National Orientation, 2026). School-based delivery offers advantages including access to children in organised settings, ability to verify vaccination status through school records, and opportunities for health education alongside service delivery. However, reaching out-of-school children remains a challenge that requires complementary community-based strategies.

Health education and promotion activities in schools build health literacy and promote healthy behaviours that reduce infection risks. Curriculum-based health education covers topics including hygiene, nutrition, disease prevention, and sexual health. Beyond the curriculum, health clubs and peer education programmes engage students actively in health promotion. Kano State's initiative to establish Infection Prevention and Control clubs in tertiary institutions (Nigeria Info FM, 2026) represents an innovative model that could be adapted for secondary schools, engaging students as active participants in infection control rather than passive recipients of services.

School feeding programmes address nutrition deficits that increase infection susceptibility and impair learning. Nigeria's National Home-Grown School Feeding Programme provides meals to millions of primary school children, using locally sourced foods to support both nutrition and agricultural development. The programme has potential to improve nutritional status, reduce hunger-related attention deficits, and create incentives for school attendance. However, ensuring food safety and preventing foodborne disease transmission requires robust quality control systems.

Vision and hearing screening, while not directly infection-related, identify sensory impairments that can mimic or compound infection-related learning difficulties. Children with uncorrected vision or hearing problems may struggle in school similarly to those with infection-related cognitive impairments, and these conditions can co-occur. Integrating sensory screening into school health programmes ensures that all barriers to learning are addressed.

4.2 Government Policies on School Health Services

Nigeria has developed policy frameworks for school health services at national and state levels, though implementation gaps remain substantial. Understanding these policies and their implementation status is essential for identifying opportunities for strengthening.

The National School Health Policy, developed by the Federal Ministry of Education in collaboration with the Federal Ministry of Health, provides comprehensive guidance for school health programming. The policy addresses multiple components including health education, school health services, healthy school environment, nutrition and food safety, counselling and social support, and staff health and wellness. It establishes minimum standards and assigns responsibilities across levels of government. However, the policy has not been fully implemented due to resource constraints, weak coordination across ministries, and competing priorities at state and local levels.

The National Health Act of 2014 provides legal framework for health service delivery, including provisions relevant to school health. The Act establishes the Basic Health Care Provision Fund, which allocates resources to primary healthcare including services for children. While not specifically focused on schools, the BHCPF can support school health services delivered through primary healthcare facilities and outreach. The World Health Organization notes that the BHCPF, together with the NHIA Act 2022 and state health insurance schemes, offers potential to improve coverage with financial risk protection mechanisms (World Health Organization, 2025).

State-level policies and programmes vary considerably, reflecting the federal structure of Nigeria's governance. Some states have developed comprehensive school health programmes with dedicated staff and budgets. Lagos State, for example, has established school health units and implemented regular health screenings in public schools. Jigawa State's commitment to achieving 100 percent WASH coverage in schools within two years (Vanguard, 2026) represents state-level leadership that exceeds national policy requirements. Other states have minimal school health activities, with responsibility falling to individual schools and communities. The Human Capital Opportunities for Prosperity and Equity – Governance Program represents a significant federal-state partnership to strengthen governance for basic education and primary healthcare (Ministry of Budget and Economic Planning, 2026). By focusing on improving financing, transparency, and human resource management, the programme addresses foundational issues that affect school health implementation. The \$500 million Performance Incentive Program provides resources and incentives for states to improve service delivery, including school health services.

4.3 Community Participation in Infection Control

Communities play essential roles in infection control in schools, both through formal participation mechanisms and through informal practices that shape children's health. Engaging communities effectively can enhance intervention

effectiveness, promote sustainability, and ensure that school health programmes respond to local needs and priorities.

Parent-Teacher Associations and School-Based Management Committees provide formal structures for community participation in school governance, including health matters. These bodies can advocate for WASH infrastructure, support hygiene promotion activities, and hold schools accountable for maintaining healthy environments. In Jigawa State, the government has called on teachers, parents, and mothers' associations to take ownership of WASH facilities, recognising that community ownership is essential for sustainability (Vanguard, 2026).

Community health workers and volunteers can support school health activities by conducting health education, identifying children needing services, and linking schools with health facilities. Village Health Workers, Community Health Extension Workers, and other frontline health workers are positioned to support school health, though their school engagement is often limited by workload and lack of formal linkages.

Traditional and religious leaders influence community norms around health behaviours, including vaccination acceptance, hygiene practices, and care-seeking for childhood illnesses. Engaging these leaders in school health promotion can enhance message credibility and reach. UNICEF has emphasised the importance of working with religious and traditional leaders to ensure that every Nigerian child under five is vaccinated (The Sun Nigeria, 2026).

Community-based monitoring can strengthen accountability for school health services. When communities track whether WASH facilities are functional, whether deworming has occurred, or whether health workers are present at clinics, they can advocate for improvements and hold duty-bearers accountable. Media engagement is critical for this, with UNICEF urging the media to play a stronger role in holding government accountable for budget allocations and implementation of WASH projects (Daily Trust, 2026).

4.4 Challenges in Implementation

Despite policy frameworks and programmatic efforts, significant challenges impede effective implementation of infection control in Nigerian schools. These challenges operate at multiple levels and reflect broader weaknesses in governance, financing, and service delivery systems.

Infrastructure deficits remain the most visible challenge. With only 11 percent of schools having basic WASH services (Daily Trust, 2026; [allAfrica.com](https://www.allAfrica.com), 2026), the majority of Nigerian children attend schools that cannot provide safe water, adequate sanitation, or handwashing facilities. Addressing this deficit requires massive investment estimated in billions of naira, far exceeding current budget allocations. While Jigawa State's commitment to universal coverage within two years (Vanguard, 2026) demonstrates what is possible with political will, replication across all states will require sustained federal and state commitment and continued development partner support.

Financing constraints limit both infrastructure investment and recurrent costs for school health services. Health and education budgets remain below international benchmarks, and within these constrained budgets, school health often receives low priority. The World Bank's HOPE-GOV programme aims to improve availability and effectiveness of financing (Ministry of Budget and Economic Planning, 2026), but significant increases in overall resource allocation are also needed.

Human resource shortages affect both education and health sectors, with implications for school health. Teacher shortages mean larger classes and less capacity to integrate health promotion into teaching. Health worker shortages limit capacity for school outreach and referral services. The HOPE-GOV programme's focus on recruiting, retaining, and deploying teachers and priority healthcare workers addresses this challenge, but results will take time to materialise.

Coordination failures across sectors impede comprehensive school health programming. Education, health, water, and other sectors operate in silos, with limited mechanisms for joint planning, budgeting, and implementation. School health falls between sectors, often receiving inadequate attention from any single ministry. Strengthening inter-sectoral coordination requires deliberate structures and incentives at federal, state, and local levels.

Data gaps limit evidence-based decision making for school health. Routine information systems do not adequately capture school health indicators, and surveys of school WASH and health services are infrequent. Without reliable data on the current situation, needs cannot be accurately assessed, progress cannot be tracked, and accountability cannot be enforced. The meta-analysis of asymptomatic malaria (Okafor *et al.*, 2026) relied on research studies rather than routine data, highlighting the gap between what is known through research and what is tracked through systems.

Vaccine hesitancy and misinformation pose challenges to immunisation programmes, as reflected in the 556,750 zero-dose children in three northwestern states (The Sun Nigeria, 2026). Managing misinformation and addressing vaccine hesitancy require sustained community engagement and effective communication strategies, which are resource-intensive and require specialised skills.

4.5 Case Studies from Nigerian Schools

Examining specific experiences from Nigerian schools illuminates both the challenges of infection control and the potential for successful interventions. While comprehensive case study documentation remains limited, available evidence reveals important lessons.

Jigawa State's WASH Acceleration Programme: Jigawa State's commitment to achieving 100 percent WASH coverage across its 3,345 basic schools within two years represents Africa's most ambitious school WASH initiative (Vanguard, 2026). Building on the state's success in achieving Open Defecation Free status, the programme combines infrastructure investment with community ownership and

sustainability measures. Key elements include: prioritising WASH in the 2026 budget; maintaining 8,689 toilets across schools; recruiting 10,000 school guards to protect facilities; engaging teachers, parents, and mothers' associations in facility ownership; and promoting hygiene behaviour change among learners. Early results show improved attendance, particularly among girls, and reduced waterborne disease incidence. The programme demonstrates that political will, adequate financing, and community engagement can achieve rapid progress even in resource-constrained settings.

The Yobe Meningitis Outbreak Response: The meningitis outbreak that killed 20 boarding school students in Yobe State in early 2026 illustrates both the vulnerability of school populations and the components of effective outbreak response (The Black Examiner, 2026). When cases emerged in six secondary schools, particularly the Government Technical College in Potiskum, authorities established isolation centres and emergency care facilities, placed schools under medical surveillance, and mounted a coordinated response. Within days, no new cases were reported, and 370 hospitalised patients recovered and were discharged. The experience highlights the importance of early detection, rapid response, and coordination between education and health authorities. It also underscores the need for preventive measures including vaccination and improved living conditions in boarding schools.

Kano State's IPC Clubs Initiative: Kano State's plan to establish Infection Prevention and Control clubs and appoint surveillance focal persons in tertiary institutions offers an innovative model for engaging students in infection control (Nigeria Info FM, 2026). The initiative aims to improve early detection of disease outbreaks, ensure faster information sharing between institutions and the disease control agency, promote good hygiene practices, raise health awareness, and encourage students to take active roles in infection prevention. Each institution will have a surveillance focal person to report unusual health events, strengthening early warning systems. While initially focused on higher institutions, the model has potential for adaptation to secondary schools, engaging students as partners in protecting school health.

Ebonyi State's Measles and Rubella Campaign: The Ebonyi State Government's measles and rubella immunisation campaign, conducted in February 2026 in collaboration with UNICEF, targeted children aged nine months to 15 years through schools, churches, mosques, and other public places (Federal Ministry of Information and National Orientation, 2026). The campaign was part of a national initiative aiming to reach 102 million children across Nigeria, the largest immunisation campaign in Africa. Key elements included: media sensitisation to inform the public; extension to hinterland communities to avoid missing eligible children; fixed and mobile vaccination posts; deployment of trained health workers; and messaging emphasising vaccine safety and the importance of prevention. The campaign demonstrates the feasibility of reaching large numbers of children through integrated strategies, while also highlighting the ongoing need for such campaigns despite the availability of routine immunisation services.

5. Strategies for Improving Educational Development

5.1 Strengthening School Health Infrastructure

Investment in school health infrastructure, particularly Water, Sanitation and Hygiene facilities, must be the foundation of any strategy to reduce infection burdens and improve educational outcomes. The current reality where 89 percent of schools lack basic WASH services (Daily Trust, 2026; [allAfrica.com](https://www.allAfrica.com), 2026) is unacceptable and must be addressed with urgency and scale.

National targets and timelines for universal WASH coverage in schools should be established, with clear accountability mechanisms. Jigawa State's commitment to 100 percent coverage within two years (Vanguard, 2026) provides a model that other states could emulate. The federal government, through the Federal Ministries of Education, Health, and Water Resources, should coordinate a national school WASH programme with dedicated funding, technical standards, and monitoring systems.

Financing for school WASH must be substantially increased, drawing on multiple sources. Federal and state budgets should allocate dedicated funds for school WASH infrastructure, complementing resources from local governments and development partners. The Basic Health Care Provision Fund and Universal Basic Education Commission funds could be partially directed to school WASH, recognising its dual health and education benefits. Development partners including UNICEF, the World Bank, and bilateral agencies should continue and expand support, building on investments like the £19 million CRIPS programme (Daily Trust, 2026).

Infrastructure must be designed for sustainability, with attention to operation and maintenance, not just initial construction. Jigawa's approach of engaging teachers, parents, and mothers' associations in facility ownership and recruiting school guards to protect investments (Vanguard, 2026) demonstrates elements of a sustainability strategy. Technical designs should consider local conditions, water availability, and maintenance capacity. Gender-segregated facilities with provisions for menstrual hygiene management are essential for girls' participation.

Beyond WASH, infrastructure improvements should address ventilation, crowding, and vector control. Classroom design should maximise natural ventilation to reduce respiratory pathogen transmission. Class sizes should be reduced to meet standards, though this requires substantial investment in teachers and classrooms. Vector control measures, including insecticide-treated nets where children sleep in boarding facilities and environmental management to reduce mosquito breeding sites, should be integrated into school infrastructure planning.

5.2 Hygiene Promotion and Behavioral Change

Infrastructure alone is insufficient without behaviour change that ensures facilities are used correctly and consistently. Hygiene promotion programmes that build knowledge, skills, and motivation for healthy behaviours are essential complements to infrastructure investment.

Handwashing with soap at critical times—after using the toilet and before handling food—is one of the most cost-effective health interventions, yet practice rates remain low where facilities and promotion are inadequate. School-based handwashing programmes should ensure that all schools have functional handwashing stations with soap and water, that handwashing is integrated into daily routines, and that students understand why and how to wash hands effectively. Peer monitoring and reinforcement can help sustain practice.

Menstrual hygiene management education ensures that girls have the knowledge and support to manage menstruation with dignity and safety. This includes information about menstrual hygiene, access to appropriate materials, and supportive school environments where girls can ask questions and seek help without embarrassment. Engaging boys in menstrual health education reduces stigma and builds supportive peer norms.

Infection prevention education should address transmission routes and prevention measures for common infections. Students should learn about malaria prevention (including ITN use), respiratory hygiene (covering coughs and sneezes), food and water safety, and the importance of vaccination. This education should be age-appropriate, culturally sensitive, and integrated into relevant curriculum subjects.

Antimicrobial stewardship education at school level can build awareness of appropriate antibiotic use and the threat of resistance. With antibiotic misuse widespread in Nigeria, including self-medication and sharing of leftover medications (Alagboso and Iroegbu, 2025), schools have an opportunity to shape future health-seeking behaviours. Messages should emphasise that antibiotics treat bacterial infections, not viral illnesses, and that completing prescribed courses is essential. IPC clubs, as piloted in Kano State's tertiary institutions (Nigeria Info FM, 2026), offer a model for engaging students actively in promoting infection prevention. Club members can serve as peer educators, monitor hygiene practices, organise awareness campaigns, and report unusual health events. Adapting this model to secondary schools could create cadres of student health champions who reinforce messages and model behaviours.

5.3 Integration of Health Education into Curriculum

Health education should be systematically integrated into Nigeria's basic education curriculum, ensuring that all students receive comprehensive, age-appropriate instruction on infection prevention and related health topics. Currently, health content is included in subjects like Basic Science and Social Studies, but coverage is inconsistent and often inadequate.

Curriculum review and strengthening should ensure that infection prevention content is explicit, comprehensive, and developmentally appropriate. Topics should include: personal hygiene (handwashing, oral hygiene, menstrual hygiene); food and water safety; vector-borne disease prevention; respiratory hygiene; immunisation; and basic knowledge about common infections and when to seek care. Content should be updated

regularly to reflect emerging threats like antimicrobial resistance.

Teaching and learning materials should be developed to support effective delivery of health education. This includes textbooks, teacher guides, visual aids, and digital resources where available. Materials should be culturally appropriate, gender-sensitive, and available in languages that teachers and students understand. Development partners have supported production of such materials in various contexts, and these experiences can inform national efforts.

Teacher training in health education must be strengthened, both pre-service and in-service. Many teachers lack confidence and competence to deliver health content effectively, particularly sensitive topics like menstrual hygiene or sexual health. Training should build both knowledge and pedagogical skills, with opportunities for practice and feedback. The HOPE-GOV programme's focus on improving teacher deployment and performance management (Ministry of Budget and Economic Planning, 2026) provides a platform for strengthening health education capacity.

Assessment of health learning outcomes should be incorporated into educational monitoring systems. While traditional examinations may not capture all dimensions of health education, periodic assessments of student knowledge, attitudes, and self-reported behaviours can provide valuable information for programme improvement. National education assessments should include health literacy indicators.

5.4 Policy Recommendations

Based on the evidence presented in this review, the following policy recommendations are offered for federal, state, and local governments, development partners, civil society organisations, and schools seeking to reduce the impact of microbial infections on educational development in Nigeria:

1. **Declare a national emergency on school WASH** and mobilise resources to achieve universal coverage within a defined timeline, building on Jigawa State's model. The current 11 percent coverage rate (Daily Trust, 2026) represents a crisis that demands urgent, high-level attention and substantial investment.
2. **Establish and enforce minimum health standards for schools**, including requirements for water supply, sanitation facilities, handwashing stations, ventilation, and crowding. These standards should be incorporated into school registration and quality assurance processes, with consequences for non-compliance.
3. **Integrate school health into primary healthcare strengthening**, recognising that school-age children are often missed by health services focused on under-fives and pregnant women. The HOPE-GOV programme's focus on both education and health (Ministry of Budget and Economic Planning, 2026) provides a platform for this integration.
4. **Scale up school-based deworming and immunisation**, ensuring that all children in endemic areas receive regular deworming treatment and that vaccination coverage reaches and sustains 90 percent or higher for all vaccine-preventable

diseases. The 556,750 zero-dose children in three states (The Sun Nigeria, 2026) must be reached urgently.

5. **Strengthen outbreak preparedness and response in schools**, including surveillance systems that detect unusual health events early, protocols for isolation and referral, and mechanisms for coordination between schools and health authorities. The Kano State IPC clubs initiative (Nigeria Info FM, 2026) offers a model for strengthening early warning.
6. **Invest in nutrition programmes for school children**, including school feeding that addresses both hunger and nutrition. Feeding programmes should be linked with deworming, health education, and food safety systems to maximise health benefits.
7. **Target interventions to disadvantaged populations**, recognising that rural children, girls, and children in poor communities bear disproportionate infection burdens. Resource allocation should reflect these disparities, with additional support for schools in the most disadvantaged areas.
8. **Strengthen data systems for school health**, including regular surveys of WASH coverage, infection prevalence, and health service delivery in schools. Data should be disaggregated by gender, location, and socio-economic status to track equity and guide resource allocation.
9. **Engage communities in school health governance**, strengthening the roles of Parent-Teacher Associations, School-Based Management Committees, and traditional leaders in advocating for and maintaining health facilities and promoting healthy behaviours.
10. **Mobilise sustainable financing** through increased budget allocation, innovative financing mechanisms, and continued development partner support. The economic returns to investment in school health, measured in improved educational outcomes and future productivity, justify substantially increased resource allocation.

5.5 Conclusion

The evidence presented in this review demonstrates conclusively that microbial infections impose substantial and preventable burdens on educational development in Nigerian schools. From the 52 percent asymptomatic malaria prevalence among children (Okafor *et al.*, 2026) to the 11 percent WASH coverage in schools (Daily Trust, 2026), from the 556,750 zero-dose children threatening herd immunity (The Sun Nigeria, 2026) to the tragic meningitis outbreak that claimed 20 student lives (The Black Examiner, 2026), the dimensions of this challenge are clear and urgent.

The pathways through which infections affect educational outcomes are multiple and reinforcing. Infections cause absenteeism that reduces instructional time and disrupts learning continuity. They impair cognitive development and learning capacity through anaemia, inflammation, and direct effects on the brain. They exacerbate malnutrition, which further compromises cognitive function and increases infection susceptibility. They create psychological and social impacts that affect school engagement and wellbeing. And these effects are distributed unequally, with rural children, girls, and the poor bearing disproportionate burdens.

Yet the evidence also demonstrates that effective solutions exist and are being implemented across Nigeria. Jigawa State's ambitious WASH acceleration programme shows that universal coverage is achievable with political will and adequate resources. Kano State's IPC clubs initiative demonstrates innovative approaches to engaging students in infection prevention. Ebonyi State's immunisation campaign shows the feasibility of reaching millions of children with life-saving vaccines. The HOPE-GOV programme represents significant federal-state partnership to strengthen governance for education and health.

The path forward requires sustained commitment at all levels. Federal and state governments must prioritise school health in budgets and policies, allocating resources commensurate with the scale of need. Development partners must continue and expand support, while also helping strengthen systems for sustainability. Schools and communities must take ownership of health facilities and promote healthy behaviours. Teachers must integrate health education into their teaching and model healthy practices. Students must be engaged as active participants in creating healthy school environments.

The stakes could not be higher. Nigeria's future depends on the health and education of its children. Each infection that could have been prevented, each school day lost to preventable illness, each cognitive impairment from chronic infection represents a diminution of human potential and a drag on national development. Conversely, each successfully treated infection, each functional handwashing station, each vaccinated child represents an investment in human capital that will yield returns for decades.

As UNICEF has emphasised, experiencing good and sustained economic growth, reducing poverty levels, and creating robust and multi-skilled human capital depends fundamentally on the quality and quantity of investment in good health (The Sun Nigeria, 2026). When people are healthy, they can work, earn a living, and support their families. Good health is a form of human capital, and investing in health can yield better education outcomes, a better-skilled workforce, and increased overall productivity.

The time for action is now. Every day that passes with 89 percent of schools lacking basic WASH services, with over half a million children unvaccinated, with half of all children carrying asymptomatic malaria parasites, is a day of wasted potential and preventable suffering. Nigerian children deserve better. Nigeria's future demands better. The evidence is clear, the solutions are known, and the path forward is illuminated. What remains is the collective will to act.

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