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Vicious Cycle of Fever Phobia and the One Health Nexus: A Review

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Abstract

Fever is a biological phenomenon experienced by both humans and animals with environmental (like infectious agents), iatrogenic factors (like vaccines, drugs) as culprits. However, in spite of the availability of national and international clinical practice guidelines on childhood fever management, fever phobia or fever anxiety persists globally till date. This enduring phenomenon leads to non-evidence based behaviours that are practiced by parents/caregivers, healthcare providers, all races and countries globally. Presumptive use of antimicrobial drug products to manage fever is a type of non-evidence based behaviour that drives antimicrobial resistance (AMR), which is a leading global cause of mortality with data-driven, well-coordinated One Health programs capable of stemming its tide. This review clarifies the nexus between fever phobia, its vicious cycle and One Health concept. First, this review was to draw attention to the perpetuity of fever phobia by illustrating (and briefly explaining) four nexuses with the expectation that it may contribute to the global re-awakening efforts towards addressing this important topic of global public health importance. Second, it draws strength by attempting to illustrate the nexus that exists between infectious diseases and childhood fever and One Health concept. Third, since the beneficial roles of fever are poorly understood and lack of harmonization/standardization of clinical practice guidelines for fever management could be partly responsible; we hereby recommend the development of a universally accepted, culturally-sensitive, harmonized Clinical Practice Guideline on childhood fever management that clearly spells out what constitute "good" and "bad" fevers. We further recommend that childhood fever, pain, infectious (including zoonotic) disease management and application of One Health framework should be incorporated into the academic curricula of healthcare students and be taught to a multidisciplinary class with the possibility of conducting

interdisciplinary research on the subject matters. Additionally, promoting fever literacy among parents as such parents will neither engage in inappropriate practice/behaviour nor transmit same to their children/wards; was also recommended.

Introduction

Fever and One Health Nexus

Fever is as old as existence itself (Gensini & Conti, 2004; Wright & Auwaerter, 2020). It refers to a biological phenomenon experienced by both humans and animals with environmental (like infectious agents, stress) and iatrogenic factors (like vaccines, drugs) as culprits (Oka, 2015; Ogunyinka et al., 2023; Chiappini et al., 2024). It also describes a biological process that seeks a new equilibrium, between the temperatures of the hypothalamus (core) and periphery (skin), which is often outside their regular daily variations in response to a physiological or pathological state.

Childhood fever, a prevalent indicator of pathology among the paediatric population (Chiappini et al., 2024; Milani et al., 2024) is poorly understood and thus, often overtreated (Ogunyinka et al., 2023). This is applicable to both parents/caregivers and healthcare providers (HCPs)-hence, fever overtreatment can result from either the activities of the parents/caregivers of the febrile child(ren) or their HCPs (Ogunyinka et al., 2023; Arias et al., 2024). Childhood fever overtreatment is a half-century old and perpetuating global phenomenon also known as *fever phobia* or *fever anxiety* and may be subsequently classified as parent-induced fever phobia and HCP-induced fever phobia respectively (Ng et al., 2023; Arias et al., 2024). Consequences of this perpetuating phenomenon include non-evidence based practices from HCPs, parents and caregivers that might harm the febrile child and often lead to poor quality of lives of both caregivers and febrile children, waste of scarce resources, parental/caregivers' distrust of orthodox healthcare systems due to their less-than satisfactory experiences (Purssell & Collin, 2016; Ng et al., 2023; Ogunyinka et al., 2023).

Conversely, the partner of childhood fever-childhood pain, is often undertreated (Ogunyinka et al., 2021). Both fever and pain are semiology of infectious diseases providing a nexus with antimicrobial resistance (AMR) as the fulcrum, which further complicates the scenario as AMR is a One Health issue on the one hand, and a tripartite global crisis (comprising health, economic and security crises) on the other hand (Ferraz, 2024; Tesema et al., 2024) (Figure 1).

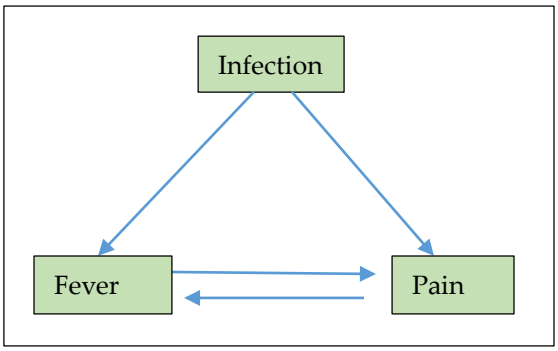

Figure 1: The relationship between infection, fever and pain

Childhood fever, childhood pain and infectious diseases are inherently linked and interdependent. Childhood fever and childhood pain sometimes lead to inappropriate antimicrobial use which in turn may lead to AMR making fever, pain and infectious diseases/AMR become interconnected One Health domains. This suggests that management of these symptoms (that is, fever and pain) require antimicrobial stewardship to curtail the resulting AMR. AMR is a palpable danger that threatens global health security and thus requires a multifaceted, multisectoral and multidisciplinary measure, which the One Health approach provides (Aslam et al., 2024; Ferraz, 2024; Tesema et al., 2024). One Health approach provides the perfect platform for tackling AMR, which disproportionately affects developing countries, spreads resistant microbes and genes through

healthcare facilities, animals, food and the environment (soil and water), and thus increases the risk of disease spread, severe illness and death (Aslam et al., 2024; Ferraz, 2024; Tesema et al., 2024). The One Health approach leveraging on its three main interdependent niches-human, animal and environmental health; offers opportunities for countries to meet their Universal Health Coverage or Sustainable Development Goals targets (Aslam et al., 2024; Ferraz, 2024; Tesema et al., 2024). Consequently, One Health approach becomes intertwined with global health security making the former an invaluable strategy for all countries seeking optimal health for all her citizens.

The nexus between fever literacy, fever anxiety and behaviours of paediatric care providers

Fever is a raised body temperature experience (≥ 38.0°C) that is primarily beneficial on the one hand (and may require only evidence-based non-pharmacological measures like increased fluid intake or with symptomatic management as a last resort) but harmful in situations like hyperthermia (and always requires both drug and non-drug interventions like antipyretic use), on the other hand. Consequently, childhood fever literacy refers to the knowledge and understanding of childhood fever concepts and processes.

Fever anxiety describes the needless/excessive worrying over fever and its perceived harmful consequences which include the fear that untreated fever could cause seizure, brain damage and death (Purssell & Collin, 2016; Ogunyinka et al., 2023). However, research has shown that childhood fever exhibits a *glass ceiling effect* indicating that the core (hypothalamic) body temperature rarely exceeds 42°C during a fever episode and unlikely to be harmful to the febrile child(ren) but very *bacteriostatic* at this temperature (Tilanus & Villamil, 2025).

Paediatric care providers are those who may come in contact with febrile children and include parents/caregivers, HCPs, school teachers and crèche workers.

From the foregoing, there is a nexus between childhood fever literacy/knowledge, fever anxiety and behaviours/practices of paediatric care providers (Figure 2). Childhood fever literacy has an inverse bidirectional relationship with fever anxiety (Merlo et al., 2023; Ogunyinka et al., 2023). This suggests that paediatric care providers with low fever literacy exhibit high fever anxiety and the converse also applies. The above statements align with established theory that health literacy is associated with life style behaviours and that both have a direct relationship with each other (de Buhr & Tannen, 2020).

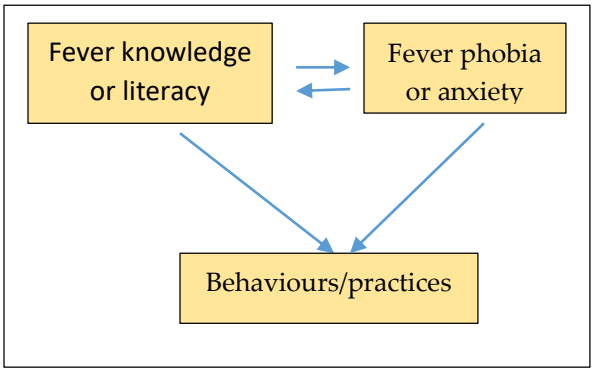

Figure 2: The relationship between childhood fever literacy, healthcare provider's/ caregiver's fever anxiety and their practices

Vicious Cycle of Fever Phobia

Perhaps the most intriguing nexus of all is the one that perpetuates fever anxiety among HCPs (including future HCPs) and parents/caregivers (and their children/offspring, who are future parents/caregivers) (Figure 3). HCPs with inadequate fever literacy practice by counseling parents/caregivers of febrile children and teaching healthcare students, creating a vicious cycle where non-evidence based health-related information (including tepid sponging, presumptive use of antimicrobial agents, alternating/combining antipyretics, etc) is passed on from one generation to another. Other contributing factors include the cultural dimension to both HCP's and parental fever phobia, inconsistencies among clinical practice guidelines (CPGs) and strong (emotional)

relationship between HCPs and febrile children/parents (Purssell & Collin, 2016; de Buhr & Tannen, 2020; Ng et al., 2023; Ogunyinka et al., 2023). This nexus alone has five (often overlooked) intervention points for breaking the ensuing vicious cycle (Figure 3) which if carefully studied with its findings strategically implemented could be a game changer in the 'war' against fever phobia/anxiety. For any intervention to be impactful, it should be a combination of strategies targeting HCPs, healthcare students and parents/caregivers using appropriate languages, considering culture and contexts (Ng et al., 2023; Ogunyinka et al., 2023; Arias et al., 2024).

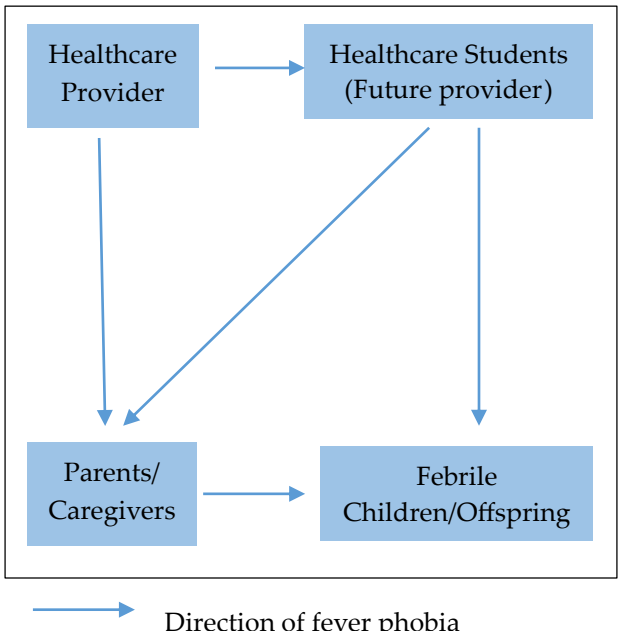

Figure 3: Vicious cycle of both parental and healthcare provider's anxiety

Vicious Cycle of Fever Phobia and the One Health nexus

The purpose of administering antipyretic agents should be to relief discomfort in a febrile child and not to lower the body temperature *per se*. Such discomforts include anorexia, crying, irritability, lethargy and malaise (Ogunyinka et al., 2023). Consequently, antipyresis may be initiated in a febrile child with discomfort and at a body temperature of ≥ 39.5°C (Ogunyinka et al., 2023). Additionally, irrational antipyretic use could interfere with the body's (host's) microbial defense mechanism of containing pathogenic insults. Most pyrogenic microbes are mesophiles and suffer considerable growth inhibition at body temperatures beyond 40°C. This is one of the physiological bases for the beneficial effect of fever to the febrile and septic individuals (Tilanus & Villamil, 2025). Consequently, the presumptive use of antimicrobial agents to quell fever may not only lead to AMR, but also antibiotic-associated diarrhoea and late-onset dysbiosis-associated atopic and inflammatory diseases including diabetes (Ogunyinka et al., 2023). Interestingly, the vicious cycle of fever phobia leads to AMR, which in turn invite the One Health framework for a rescue mission. The ensuing nexus is noteworthy (Figure 4).

Apart from the mortality-associated sequelae of AMR and its attendant economic costs, it also causes the emergence and spread/outbreak of critical-priority pathobionts such as *Acinetobacter baumanii* which has been identified in Nigerian patients and hospital ward milieu (Mohammed et al., 2024). These pathobionts, also known as Global Antimicrobial Resistance and Use Surveillance System (GLASS) pathogens put immense pressure on the pharmacotherapy of existing and new antimicrobial agents, creating microbial selection pressure that drives survival and proliferation of drug-resistant microbes and eventually driving AMR incidence and prevalence (Ferraz, 2024; Tesema, & Birhanu, 2024).

Other drivers of AMR include indiscriminate use of antimicrobials in the agricultural sector for prophylactic, metaphylactic, therapeutic and growth promotion purposes; raw wastewater disposal practices in the communities and hospitals; sub-optimal water, sanitation and hygiene (WASH) practices; inadequate infection prevention and control (IPC) programs in health facilities, international travels involving people and animals infected with resistant microbes and inadequate healthcare funding, surveillance completeness and regulatory oversight by relevant Government Ministries, Departments and Agencies (Velazquez-Meza et al., 2022;

Wahnou et al., 2026). These practices/behaviours and programs lead to the contamination of the environment with drug-resistant microbes which are carried downstream and then carried back to humans, animals and crops, recirculates and amplifies the spread of AMR across all the one-health sectors (Altevogt et al., 2025; Nazir et al., 2025). Perhaps the most underappreciated AMR driver is the syndemic of low socioeconomic class and fragile or weak healthcare systems whose burden rests squarely on the shoulders of Governments making low-and middle-income countries to be the worst hit by the adverse impacts of AMR (Global antibiotic resistance surveillance report 2025).

AMR is a one-health challenge requiring a one-health framework encompassing evidence-based stewardship activities aimed at preserving both existing and new antimicrobial agents for the optimal prevention and management of infections in humans, animals and plants while protecting the environment (Altevogt et al., 2025). The one-health nexus is a framework that seeks to root out AMR across the one health niches of humans, animals, plants and the environment. It begins with regular behaviour change education using research findings to root out ignorance and dispel myths followed by provision of uninterrupted and equitable access to information, resources needed to address febrile episodes and provision of evidence-based care to those with fever in order to promote their quantity and quality of life. The One Health nexus describes three interconnected stewardship activities encompassing education, access and care that should be jointly applied at each of the four intervention points in Figure 4.

Education: Provision of behaviour change information in the form of education requires multifaceted approach that include print and electronic media, social media, workshops, seminars, etc. Governments at all levels must be at the forefront commencing with implementable policies and guidance that was developed after substantial engagement with all stakeholders-parents/guardians, teachers, caregivers, authorized prescribers of antimicrobials, media and Ministries, Departments and Agencies-especially Federal Ministry of Communication, Innovation and Digital Economy; Federal Ministry of Health and Social Welfare; Federal Ministry of Agriculture and Food Security; Federal Ministry of Livestock Developments**;** Federal Ministry of Environment; Federal Ministry of Water Resources; National Primary Health Care Development Agency and National Agency for Food and Drug Administration and Control.

The information should target different demographics, socioeconomic classes, schools, etc. It should be delivered in English, local Pidgin English, Hausa, Igbo and Yoruba languages. Data-driven approach is the global-best practice and this should involve those at the academia and research institutes such as Nigeria Centre for Disease Control and Prevention and National Veterinary Research Institute. This would ensure that the behaviour change information is evidence-based using surveillance data reports of National Action Plans (NAP), World Health Organization's AWaRe antibiotic classification system, WHO Global Antimicrobial Resistance and Use Surveillance System (GLASS), Tracking AMR Country Self-Assessment Survey (TrACSS), etc. This would ensure translation of evidence into policy, programmes and regulation in the AMR governance landscape (Drake et al., 2026).

The education should also lay emphasis on the importance of adhering to the World Health Organization's AWaRe (Access, Watch and Reserve) classification of antibiotics among authorized prescribers so that the antimicrobial stewardship activities can promote rational antibiotic/antimicrobial use, curb AMR and ultimately preserve the efficacy and effectiveness of both existing and new antimicrobial agents as AMR is outpacing the supply of new/novel antimicrobial molecules (Nazir et al., 2025; Tiwana et al., 2025). The classification also provides surveillance data for antibiotic/antimicrobial use, AMR and monitoring its impact (WHO, 2025). Access group of antibiotics are narrow-spectrum first-

line drugs for empirical treatment of common infectious diseases with low potential to cause AMR, should be of lower cost, widely available and their consumption should be at least 60% of total antibiotic consumption rate in a country/region. Watch group of antibiotics are broader-spectrum drugs to be used for sicker patients within the health facility with its use monitored due to its higher potential to cause AMR.

The Reserve group of antibiotics are last resort or new antibiotics that should be used for those with life-threatening or severe infections due to multidrug-resistant pathogens so that their effectiveness can be preserved (Zanichelli et al., 2023; Bou-Antoun et al., 2025). The awareness generation/campaign should be carried out in the urban and rural contexts in equal measure and the format could also involve jingles, role playing, films/movies, etc. Effective multisectoral engagement of all stakeholders and implementation of antimicrobial use surveillance reports have been found to reduce AMR incidence and prevalence (Chen et al., 2026). Education about hygiene measures will prevent infection, reducing the demand for antimicrobial agents and risk of emergence of drug-resistant strains (Velazquez-Meza et al., 2022). Agricultural extension service should be promoted so that farmers get timely and accurate advice which include planting of resistant crop varieties, use of pre-treated irrigation water and other phytosanitation practices, practicing the use of blending or alternating chemicals (Altevogt et al., 2025]. The information required are those related to practices/behaviours that drive AMR incidence and prevalence.

Access: Equitable and uninterrupted access to affordable quality-assured products (medicines, vaccines) and laboratory reagents through data-driven supply chain logistics and cost-reduction models/schemes. Effective monitoring to avoid over-the-counter sale of antimicrobials, substandard and falsified medicines. Equitable access to best-available technology to assure optimal wastewater treatment and management of agricultural runoffs. Government investments on diagnostics will ensure access to new, rapid and accurate (clinical) diagnoses so that misdiagnoses leading to irrational use of antimicrobial agents will reduce (Velazquez-Meza et al., 2022). Governments should also invest in the development and use of vaccines and its alternatives so that there can be increased access to vaccines directed at drug-resistant microbes reducing the number of those needing antimicrobial agents and eventually reducing AMR incidence and prevalence.

These investments could be through funding research (throughout the drug's life cycle), implementing and monitoring of the findings and subsidizing the cost of the findings. For instance, development of alternatives to antimicrobial agents could be funded so that there may be increased access to repurposed approved non-antibacterial drugs with activity against AMR pathogens, phage and enzyme-based therapeutics, antivirulence and non-bactericidal therapies, artificial intelligence–driven molecular discovery and host-directed immunomodulatory strategies or even on novel antimicrobial agents such as constrained ribosomal inhibitors e.g. lariocidin; DNA gyrase and topoisomerase IV dual inhibitor e.g. gepotidacin; new β-lactam/ β-lactamase combinations e.g. sulbactam/durlobactam, aztreonam/avibactam and cefepime-based pairs e.g. cefepime/ emtazobactam/ zidebactam/ taniburbactam combination (Nazir et al., 2025; Tiwana et al., 2025; Wahnou et al., 2026).

Care: Rational care of febrile patients using antibiogram-/rapid diagnostic test-/diagnostic-driven pharmacotherapeutic decisions. Utilization patterns and disposal practices are major components of care and rational pharmacotherapy of antimicrobials involves of the right drug is given at the right dose in the right dosage form/route with timely de-escalation for the right duration (Doron & Davidson, 2011). For the veterinary sector, prudent and responsible use of antimicrobials should be ensured by adhering to the CODEX Guidelines for foodborne AMR and antimicrobial use (CODEX, 2021]. Optimal care of the aquatic

and land environments should be assured through their minimal contamination, education (as discussed previously) and legislation such as having emission limits for healthcare facilities, farms and manufacturing plants (World Health Organization 2024). Regarding use of agrochemicals, ensure triple rinsing and proper collection of empty containers to avoid concentrated chemicals leaching into groundwater (Altevogt et al., 2025).

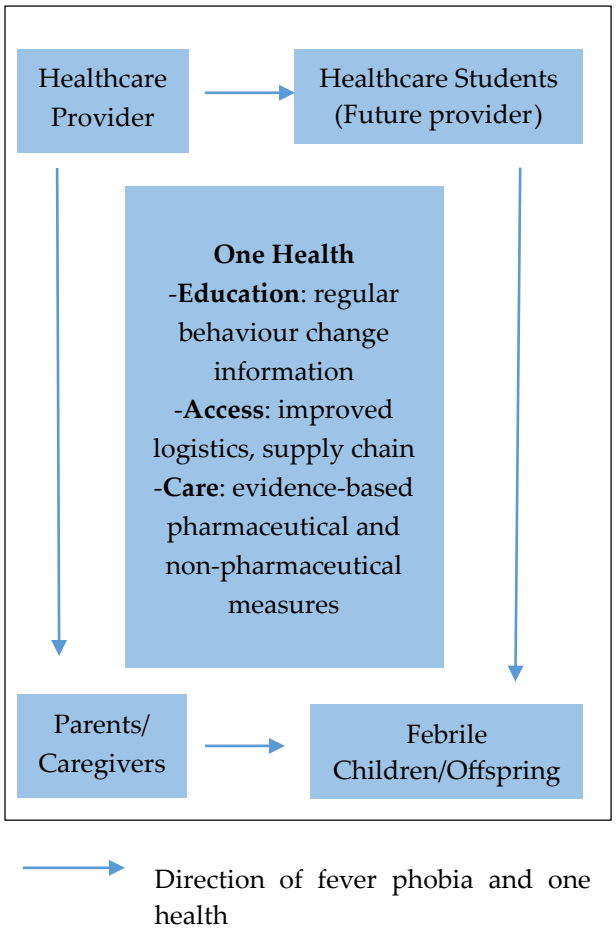

Figure 4: Vicious cycle of fever phobia and the one-health nexus (adapted from Altevogt 2025)

Recommendations

The vicious cycle reveals three main critical intervention points. A universally accepted, culturally-sensitive, harmonized CPG on childhood fever management that clearly spells out what constitute "good" and "bad" fevers will be beneficial to HCPs. Childhood fever, pain, infectious (including zoonotic) disease management and application of One Health framework should be incorporated into the academic curricula of healthcare students and be taught to a multidisciplinary class with the possibility of conducting interdisciplinary research on the subject matters. Promoting fever literacy among parents as such parents will neither engage in inappropriate practice/behaviour nor transmit same to their children/wards. This last recommendation may perhaps be the most impactful if well implemented as it has the enviable opportunity of addressing the perpetuity of fever phobia and hence the vicious cycle of fever phobia and increasing AMR burden. As AMR is *an established* leader in cause for infection-associated deaths worldwide (Wahnou et al., 2026); implementing well-coordinated One Health framework is now an imperative and smarter option of curbing AMR burden. The One Health nexus, a framework encompassing series of interconnected proactive stewardship steps/activities, is a more comprehensive intervention strategy for halting the vicious cycle of fever phobia/anxiety and curbing AMR burden. Alarmingly, the 2025 GLASS Report has shown that one in six laboratory-confirmed infections are *now* drug-resistant (GLASS, 2025); making One Health interventions a topmost priority that should involve global collaboration strategies that marry innovation in drug discovery, diagnostics and alternative therapies with its evidence-based implementation and marry equitable access to existing and new drugs with robust stewardship programs that ensure their rational use (Wahnou et al., 2026).

Conclusion

Fever phobia is an underappreciated driver of AMR burden with a well-coordinated One Health framework having the capacity to curb both fever phobia and AMR. A nexus exists between perpetuity of fever phobia, AMR and One Health framework and we have shown the critical points for intervention in order to curb both perpetuity of fever phobia and then AMR.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of the paper.

Author Contribution

The contribution of each author to the paper is as follows: study design: Ogunyinka. IA; data collection: Bello. J; analysis and interpretation of results: Ogunyinka. IA, Oni. IO, Adeniye. SB, Bello. J; draft manuscript preparation: Ogunyinka. IA; All authors contributed intellectually to improve the content of the manuscript and approved the submitted version of the manuscript.

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