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Infectious Diseases in Vulnerable Populations: Interface Between Social and Biological Factors

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Abstract

Infectious and parasitic diseases remain critical public health challenges, presenting a dynamic of transmission and lethality that transcends the biology of the pathogen and is anchored in social vulnerability. This article aimed to analyze, through a systematic review of the literature (2021-2026), the interface between social and biological factors in the context of infectious diseases in marginalized populations. The methodology followed the PRISMA protocol, with exhaustive searches in the PubMed, SciELO, and LILACS databases. The results demonstrate that structural deprivation, food insecurity and chronic stress induce a state of "biological incorporation of the social", manifested through early immunosenescence and epigenetic alterations that facilitate the replication of agents such as HIV, M. tuberculosis and arboviruses. It was concluded that the effective control of these pathologies requires overcoming the isolated biomedical model in favor of a "Social Biomedicine", integrating laboratory monitoring with intersectoral social protection policies. Equity in access and the mitigation of structural determinants emerge as the only strategies capable of breaking the cycle of investigation between poverty and infection in contemporary times.

Keywords: Infectious Diseases; Social Vulnerability; Biosocial Interface; Biomedicine; Social Work

Introduction

Infectious and parasitic diseases, although historically associated with underdevelopment, remain one of the main global health challenges, exacerbated by the persistence of structural inequities. Unlike chronic pathologies, infections in vulnerable populations have an accelerated propagation dynamic, where the etiological agent finds in the deprivation environment the ideal substrate for its replication and dissemination. Contemporary literature defines this scenario as the "biosocial interface", where the biology of the pathogen is inseparable from the conditions of existence of the host [1,2]. Social vulnerability, characterized by precarious housing, lack of basic sanitation, and food insecurity, acts as a primary determinant of immunological susceptibility. Recent studies (2021-2026) indicate that protein-energy malnutrition, common in peripheral areas, compromises the epithelial barrier and the T lymphocyte response, making socially excluded individuals' easy targets for opportunistic pathogens. In this sense, infection ceases to be a purely microbiological event to become a manifestation of state negligence [3,4].

In Brazil, diseases such as tuberculosis and leprosy are sensitive indicators of the "social question", maintaining alarming incidence coefficients in subnormal agglomerations and homeless populations. The literature indicates that confinement in environments with low ventilation and high population density enhances the bacillary load, making epidemiological control

difficult even with the availability of free chemotherapy by the SUS. The interface between the bacillus and poverty creates a cycle of reinfection that challenges purely biomedical elimination strategies [5,6].

Arboviruses, such as Dengue, Zika and Chikungunya, also reveal the biological face of urban inequality. Deficiencies in solid waste management and intermittent water supply in vulnerable areas create permanent breeding grounds for the Aedes aegypti vector. Studies from 2025 reinforce that the risk of serious complications and deaths from arboviruses is inversely proportional to per capita income, showing that individual protection is a class privilege that the State fails to universalize [7,8].

The performance of the biomedical professional in this context transcends the laboratory bench, requiring a vision of health surveillance based on the territory. The laboratory diagnosis of an infectious disease in a vulnerable population should be understood as a "sentinel event" that points to failures in housing and sanitation policies. Molecular biology and serology, therefore, provide the technical data that support the need for urgent intersectoral interventions [9,10]. At the same time, Social Work plays a decisive role in adherence to treatment and in breaking the chain of transmission. Patients in vulnerable situations often face the dilemma between the rest necessary for recovery and the need for immediate subsistence in the informal market. The intervention of the social worker in guaranteeing aid and humanized reception is what prevents therapeutic abandonment, the main factor for the emergence of multidrug-resistant strains of bacteria and fungi [11,12].

Internationally, the "health of mobile populations" (migrants and refugees) has been a central focus of biological and social research. Forced displacement imposes poor hygiene conditions and extreme psychosocial stress, which alters the commensal microbiota and reduces resilience to pathogens endemic to the target regions. The integration of social reception policies with infectious screening protocols is pointed out as the most effective global strategy to prevent outbreaks in contexts of humanitarian crisis [13,14].

Antimicrobial resistance (AMR) emerges as a global threat that disproportionately affects the impoverished. The inappropriate use of antibiotics, often motivated by the lack of access to medical consultations and self-medication in popular pharmacies, creates a reservoir of resistance genes in areas with low sanitary infrastructure. The academic literature from 2025 warns that the "post-antibiotic era" may begin in the peripheries, where the interface between open sewage and multidrug-resistant pathogens is an everyday reality [15,16].

Sexually transmitted infections (STIs), with emphasis on Syphilis and HIV/AIDS, remain critical challenges that expose gender and race vulnerability. In Brazil, the increase in congenital syphilis is a direct reflection of the precariousness of prenatal care in peripheral territories, where geographical and social barriers prevent the timely diagnosis and treatment of pregnant women and their partners. The biological interface of vertical transmission is, in fact, a failure in the social protection and primary care network [6,17].

The global climate crisis acts as a risk multiplier for infectious diseases in vulnerable populations. Rising temperatures and the occurrence of extreme events (floods) alter the habitat of vectors and favor the spillover of zoonotic pathogens into precarious human settlements. Recent studies indicate that populations with less capacity for economic adaptation are the first to suffer from the reemergence of diseases considered controlled, such as malaria and leptospirosis [18,19].

The rationale for this systematic review lies in the urgency of synthesizing the evidence that connects social determinism to infectious pathology. The gap identified in the literature refers to the need for protocols that unify the biological response (clinical treatment) with the social response (improvement of living conditions). This work seeks to provide subsidies so that interprofessionality is the basis of new endemic disease control policies in Brazil and in the world [20,21].

Finally, the objective of this study is to analyze scientific publications between 2021 and 2026 that discuss the interface between social and biological factors in infectious diseases in vulnerable populations. It is hoped that the critical analysis of these data will contribute to a more equitable health practice, where the technical knowledge of Biomedicine and the social sensitivity of Social Work act in a symbiotic way in the fight against diseases of negligence [22,23].

Definition of Infectious Diseases and the Dynamics of Affectation in Contexts of Vulnerability

Infectious diseases are pathologies caused by specific biological agents' viruses, bacteria, fungi, protozoa or helminths or by their toxic products, which manifest themselves through the transmission of the agent (or its products) from an infected reservoir to a susceptible host. In contemporary academic rigor, infection transcends the agent-host binomial, being understood as an ecological and social process where the virulence of the pathogen interacts with the immunological resilience and sanitary barriers of the environment. In vulnerable populations, this dynamic is altered, as the "window of opportunity" for the pathogen is widened by the absence of basic infrastructure, making infection an endemic and sometimes neglected event [1,3].

The affectation of vulnerable populations by infectious diseases occurs through a synergistic effect between the biology of transmission and the geography of exclusion. Factors such as high population density in precarious settlements and the sharing of reduced spaces without adequate ventilation facilitate the dispersion of pathogens by air, such as Mycobacterium tuberculosis. In addition, the lack of access to drinking water and inadequate sanitary sewage transform the territory into a permanent reservoir for waterborne diseases and intestinal parasitosis, perpetuating conditions of nutrient malabsorption and anemia that, in turn, further weaken the individual's immune response [4,5].

The current scientific literature highlights that the impact of

these diseases on these populations is not only acute, but generates chronic sequelae that deepen the cycle of poverty. Infectious diseases in vulnerable contexts tend to present more severe clinical courses due to late diagnosis and the presence of co-infections. The biosocial interface reveals that the pathogen does not choose the host by genetics, but by the fragility of its social protection networks, causing diseases such as leprosy and malaria to be remain stigmas of historically marginalized groups, challenging public health equity in Brazil and in the world [6,24].

HIV and Aids in Brazil: From Genesis to Chronicity and the Challenges of Vulnerability

The genesis of the HIV/AIDS epidemic in Brazil in the early 1980s was marked by a scenario of high lethality and stigma, initially concentrated in specific social groups in large urban centers. However, the advance of the epidemic revealed a phenomenon of "pauperization" and "interiorization", where the transmission dynamics began to disproportionately affect populations with less access to information and health services. The contemporary literature (2021-2026) highlights that AIDS is no longer a biological death sentence to become a marker of social vulnerability, where the barrier to control is no longer the absence of drugs, but the persistence of structural exclusion [5,6].

The emergence of Combined Antiretroviral Therapy (ART) in the 1990s, and the subsequent Brazilian policy of universal and free access through the SUS, represented a revolutionary milestone in global public health. From a biomedical point of view, ART acts to suppress the viral load to undetectable levels, which not only restores the individual's immune function (CD4+ T lymphocytes), but also interrupts the chain of transmission (Undetectable = Untransmittable - U = I). Studies from 2024 reinforce that the effectiveness of ART has transformed HIV infection into a manageable chronic condition, similar to diabetes or hypertension, as long as there is strict adherence to the therapeutic protocol [3,4].

At the present time, Brazil faces the challenge of the "cascade of care", where the success of treatment is conditioned by social determinants. Although pharmaceutical technology has advanced towards simplified therapeutic regimens and Pre-Exposure Prophylaxis (PrEP) has expanded, AIDS incidence and mortality remain high in homeless populations, drug users, and young black people from the periphery. The 2026 literature points out that the interface between Social Work and Biomedicine is the determining factor for

the "current moment": while the biomedical monitors viral resistance and immune recovery, the social worker acts to mitigate stigma and enable food and housing security, without which adherence to ART becomes unfeasible [9,24].

Tuberculosis and Leprosy: Biological Markers of Exclusion and the Challenges of Treatment in the Territory

Tuberculosis (TB) and leprosy remain serious public health problems in Brazil, acting as true biological markers of social exclusion. Although they have distinct bacterial etiologies (Mycobacterium tuberculosis and Mycobacterium leprae), both share a common determinant: dependence on precarious housing and nutritional conditions for its endemic spread. The scientific literature (2021-2026) reinforces that the control of these diseases does not depend exclusively on the effectiveness of polychemotherapy regimens, but on the capacity of the health system to mitigate the environmental factors that favor the high bacillary load in subnormal urban agglomerations [3,5].

In the case of Tuberculosis, the interface between the biology of airborne transmission and social vulnerability is evidenced by the high incidence in populations deprived of liberty and living on the streets. Confinement and the absence of natural ventilation are catalysts that potentiate the virulence of the pathogen, while malnutrition compromises the cellular immune response, facilitating the transition from latent infection to active disease. Studies from 2024 indicate that food insecurity is the main predictor of treatment abandonment, since the adverse effects of medication are exacerbated in debilitated organisms, requiring Social Services to act in the feasibility of nutritional baskets as part of the clinical protocol [4,6].

Leprosy, on the other hand, marked by a chronic course and disabling potential, reveals the face of stigma and late diagnosis in neglected territories. The detection of new cases with grade 2 physical disability is a direct indicator that the primary care network fails to reach the most vulnerable individuals before the neural damage is irreversible. The 2026 literature highlights that the "biology of leprosy" in contemporary Brazil requires contact surveillance that goes beyond clinical examination, demanding an active search led by interprofessional teams. The interface between biomedical monitoring of leprosy reactions and care support for the socioeconomic rehabilitation of patients is, therefore, the only strategy capable of interrupting the chain of transmission and reducing the prejudice associated with the [9,25].

Antimicrobial Resistance and Vulnerability: The New Frontier of Biological Inequality

Antimicrobial Resistance (AMR) has consolidated itself in the last five years as one of the greatest threats to global health security, presenting a perverse face in vulnerable populations. Although the biological mechanism of resistance lies in genetic mutations and horizontal gene transfer between pathogens, its spread is accelerated by critical social determinants, such as poor sanitation and limited access to structured medical consultations. In contexts of exclusion, self-medication and the use of inadequate spectrum antibiotics, often acquired informally due to barriers to access to the SUS, create an environment of selective pressure that favors the emergence of superbugs in peripheral territories [25,26].

The interface between clinical microbiology and urban infrastructure reveals that open sewage and incorrect disposal of pharmaceutical waste in vulnerable areas function as "reactors" of resistance. Studies published in 2023 and 2024 indicate that the load of resistance genes in communities with a low human development index is significantly higher than that observed in sanitated areas, which transforms the domestic environment into

a reservoir of infections that are difficult to control. This reality requires that the biomedical professional work in environmental surveillance and population antibiogram, understanding that the pathogen's sensitivity profile is a direct reflection of the health of the territory [22,27].

The fight against AMR in these populations requires an intervention that integrates pharmaceutical support with the reception of the Social Service to ensure the completeness of the therapeutic scheme. The 2025 literature reinforces that "treatment failure" in contexts of poverty is not only a matter of patient negligence, but of lack of logistical and nutritional support to withstand the toxicity of drugs in the long term. Antimicrobial stewardship policies that ignore social barriers to access are doomed to failure, making it essential to create intersectoral protocols that ensure that the correct treatment arrives and is completed by the vulnerable individual [28,29].

Methodology

The present investigation is characterized as a systematic review of the literature, of a qualitative and descriptive nature, based on the PRISMA protocol [23]. The methodological design sought to answer the following guiding question, structured under the PICO (Population, Intervention, Comparison, and Outcome) strategy: "How does the interface between social and biological factors determine the prevalence and management of infectious diseases in vulnerable populations, according to scientific production between 2021 and 2026?".

Databases and Analysis Period

Data collection was carried out exhaustively in the first quarter of 2026, covering the electronic databases PubMed/MEDLINE, SciELO (Scientific Electronic Library Online) and LILACS (Latin American and Caribbean Literature on Health Sciences). The time frame was established strictly between January 2021 and March 2026, aiming to capture the most recent evidence in the post-global health crisis scenario and advances in social immunology [3].

Search Method and Descriptors

To operationalize the searches, controlled descriptors extracted from DeCS (Health Sciences Descriptors) and MeSH (Medical Subject Headings) were used, combined by the Boolean operators AND and OR. The terms used in Portuguese and English included: "Communicable Diseases", "Social Vulnerability", "Social Determinants of Health" and "Biomedicine". Filters were applied for "Original Articles", "Clinical Trials" and "Systematic Reviews", ensuring the high scientific density of the corpus analyzed [5].

Inclusion and Exclusion Criteria

The inclusion criteria included:

a. Fully published and peer-reviewed articles;

b. Studies that directly address the biosocial interface of infectious diseases;

c. Research focused on vulnerable populations (homeless, peripheral, deprived of liberty and migrants).

The exclusion criteria were: editorials, letters to the editor, conference abstracts, studies in animal models, and articles that focused exclusively on molecular pathophysiology without correlation with the social context [4,29].

Analysis Selection and Structure

The selection of articles occurred in three stages:

a. Screening: Reading of titles and summaries to exclude duplicates and irrelevancies;

b. Eligibility: Full reading of the pre-selected texts to verify compliance with the criteria;

c. Inclusion: Data extraction and qualitative synthesis.

The structure of the review classified the studies into qualitative (analysis of therapeutic itineraries and social perceptions) and quantitative (epidemiological data and biomarkers of resistance), allowing a holistic analysis of the interface between pathogen biology and host vulnerability [23,11].

Social Factors in Vulnerable Populations: The Genesis of Exposure

The definition of vulnerable populations in contemporary literature transcends mere financial need, being understood as the result of exclusion processes that weaken the individual's biopsychosocial response capacity. Vulnerability is multidimensional, encompassing structural poverty, ethnicity (marked by institutional racism), age (extremes of life with immune dependence), gender, and sexual orientation. These markers do not operate in isolation, but in an intersectional way, creating layers of invisibility that make it difficult to reach epidemiological surveillance and social protection policies [11,17].

Social determinants exert a direct influence on health and the spread of infectious diseases by shaping the "contact opportunities" between pathogen and host. Housing precariousness and the absence of basic sanitation are not only scenarios of poverty, but biological variables that determine the burden of exposure to vectors and microorganisms of waterborne transport. Studies from 2024 reinforce that the spread of pathogens in vulnerable communities is accelerated by "forced immobility", where the lack of resources for physical distancing or proper hygiene transforms the households in a focus of persistent intrafamilial transmission [26,30].

Socioeconomic conditions impact access to health through geographical, economic, and symbolic barriers. In contexts of vulnerability, the indirect cost of medical care (transportation, missed informal workdays) often outweighs the perceived risk of early-stage infection, resulting in late diagnoses and greater community spread. The 2026 literature points out that the lack of access to basic diagnostic technologies in peripheral territories creates "care gaps", where curable diseases evolve into deaths due to the system's inability to break the barrier of territorial inequality [9,12].

Living in contexts of vulnerability establishes an intrinsic

relationship with exposure to chronic and acute infectious risks. Continuous psychosocial stress, derived from food insecurity and violence, induces a state of immunosuppression mediated by cortisol, which reduces the effectiveness of the body's natural barriers. Thus, the vulnerable individual is not only "more exposed" to the microorganism; he is biologically "more susceptible", showing that the interface between cell biology and the sociology of the territory is the point where the infection is established with greater aggressiveness [31,23].

Specific case studies demonstrate the strength of these social factors in the dynamics of infectious diseases in Brazil. The reemergence of Yellow Fever and outbreaks of Leptospirosis after extreme weather events in areas of irregular occupation exemplifies how the lack of urban infrastructure dictates the pace of the pathology. In the case of STIs, the increase in congenital syphilis in neighborhoods with a low human development index reveals that failure in prenatal care is essentially a failure in the social care network, confirming that biological cure depends primarily on social justice [34,32].

Biological Factors in Infectious Diseases: The Microbiology of Vulnerability

The biology of infectious diseases is based on the interaction between etiological agents bacteria, viruses, parasites and fungi and the biological system of the host. Each group of pathogens has distinct mechanisms of invasion and immune evasion: while bacteria (such as M. tuberculosis) use intracellular survival in macrophages, viruses (such as HIV) hijack the cellular machinery for replication and destruction of defense cells. In vulnerable populations, the burden of exposure to these agents is persistently high due to environmental factors, which overloads biological homeostasis and facilitates the establishment of severe infections [1,20].

Genetic and immunological factors play a determining role in susceptibility to infections, being epigenetically modulated by the social environment. Populations in vulnerable situations often present the phenomenon of early immunosenescence, where chronic stress and poor nutrition accelerate the wear and tear of the immune system. Genetics does not act in isolation; the 2025 literature points out that extreme deprivation alters the methylation of genes responsible for the production of inflammatory cytokines, making the individual biologically more "fragile" to invasion by pathogens that would be controlled in nourished and stable organisms [31,33].

The role of the immune system in at-risk populations is marked by an inefficient and sometimes exacerbated response (cytokine storm). Protein-energy malnutrition, common in contexts of poverty, results in atrophy of the thymus and a reduction in the count of helper T lymphocytes, mimicking, at certain levels, a secondary immunodeficiency. This systemic immune fragility explains why infectious diseases have more lethal outcomes in the peripheries: the defense system does not have the metabolic substrate to sustain an efficient memory response, allowing successive reinfections [3,34].

HIV/AIDS: The Biology of Exclusion and Immune Breakdown

In the context of HIV/AIDS, the biological interface reaches its peak of complexity in vulnerable populations. The HIV virus has a specific tropism for CD4+ T lymphocytes, the "master" cells of the immune system. In individuals under extreme social stress, the progression of infection to the AIDS phase is accelerated by the presence of co-infections (such as tuberculosis and hepatitis) that keep the immune system in a state of chronic activation, facilitating viral replication. The biology of HIV in contexts of exclusion reveals that therapeutic failure is often not virological (drug resistance), but metabolic and social, where immunosuppression is fueled by hunger and stigma that prevents access to laboratory monitoring [35,6].

Infectious diseases prevalent in vulnerable populations function as indicators of biosocial failure. Tuberculosis takes advantage of pulmonary weakness; Malaria and Hepatitis exploit the lack of physical and sanitary barriers; and HIV uses the fragility of protection networks to spread. What unites all these pathologies in risk contexts is the ability of the etiological agent to exploit the "immunological gap" opened by inequality, transforming human biology into a direct reflection of social precariousness [8,34].

This fifth chapter represents the theoretical and empirical synthesis of our article. As researchers with a decade of academic experience, we will use the concept of Inquiry to demonstrate that the interface between the social and the biological is not just a sum of factors, but a synergistic interaction that alters the natural history of infectious diseases.

Interface Between Social and Biological Factors: Biosocial Convergence

The interface between social and biological factors in the context of infectious diseases is characterized by a bidirectional flow of causality. While the biological component provides the etiological agent and the mechanisms of pathogenicity, the social component dictates the probability of exposure, the burden of the inoculum, and the competence of the host immune response. Recent literature (2023-2026) defines this interaction as "biological incorporation of the social", where structural inequalities are translated into measurable pathophysiological processes, such as changes in defense cell counts and viral replication speed [18,31].

The synergy between socioeconomic and biological conditions is manifested in the worsening of infections through a negative feedback phenomenon. Extreme poverty not only facilitates the transmission of pathogens, but also induces nutritional deficiencies that compromise the integrity of mucous membranes and the production of antibodies. Studies conducted in databases such as PubMed indicate that, in contexts of high vulnerability, the "biology of infection" is more aggressive: pathogens that would be self-limiting in stable individuals evolve to sepsis or chronicity due to the inability of the weakened organism to contain the initial microbial replication [14,16].

Mechanisms of Impact on Immune Response

Practical examples demonstrate how the environment "shapes" the biology of the host:

a. Social Stress and Cortisol: Continuous exposure to violence and financial insecurity raises the levels of glucocorticoids, which have a direct immunosuppressive effect, inhibiting the proliferation of helper T lymphocytes, essential in the fight against HIV and Tuberculosis.

b. Food Insecurity: Hypoproteininemia reduces the synthesis of complement proteins and cytokines, which are essential for chemotaxis and destruction of invading bacteria.

c. Housing Conditions: Housing overcrowding (cohabitation) increases the secondary attack rate of respiratory diseases by overwhelming the immune system with repeated exposures to the same pathogen [15,4].

The analysis of epidemiological studies from 2024 to 2026 demonstrates a statistically robust connection between low human development indices (HDI) and high mortality rates from curable infections. Georeferencing surveys reveal that, in territories with a lack of sanitation, the mortality rate from diarrheal diseases and arboviruses is up to five times higher than in sanitated neighborhoods, regardless of the patient's age. This evidence confirms that the "biological risk" of death is, in fact, an indicator of accumulated "social risk", where the biosocial interface determines who survives exposure to the pathogen [34,8].

Chart 1: Mechanisms of Biological Incorporation of Social Determinants in Infectious Diseases

Social Factor (Exposure)	Biological Mechanism of Mediation	Clinical-Infectious Outcome
Food Insecurity	Micronutrient depletion and hypoproteinemia.	Fragility of mucous membranes and reduction of chemotaxis leukocyte.
Chronic Stress (Vulnerability)	Persistent activation of the HPA axis and hypercortisolism.	Secondary immunosuppression and reactivation of latent infections (e.g . TB).
Housing Precariousness	High population density and low air renewal.	Increased bacillary/viral load and facilitation of transmission by aerosols.
Low Environmental Sanitation	Continuous exposure to environmental reservoirs.	Repetitive cycles of reinfection by enteric pathogens and AMR.

Inequalities in Access to Health and Prevention: Barriers to Equity

The relationship between inequality in access to health care and the increased burden of infectious diseases is direct and quantifiable. In vulnerable populations, the absence of a capillary Primary Health Care (PHC) network results in a diagnostic "loss of opportunity", allowing infected individuals to remain active reservoirs of the pathogen in the community. The literature from 2024 to 2026 highlights that the burden of diseases such as Tuberculosis and STIs is maintained by "pockets of exclusion", where the health system fails to carry out the active search, transforming treatable diseases into persistent outbreaks [17,29].

Inequality in access to prevention and vaccination is one of the biggest health setbacks of the decade. The phenomenon of "vaccine hesitancy" in contexts of vulnerability is often fuelled by a lack of health literacy and logistical barriers, such as opening hours of basic units incompatible with informal working hours. Studies published in The Lancet Regional Health - Americas indicate that vaccination coverage in subnormal urban agglomerations is, on average, 15% lower than in central areas, creating "immunological windows" that favor the reemergence of vaccine-preventable diseases, such as measles and poliomyelitis [16,26].

Geographical, economic, and cultural barriers form the "triangle of exclusion" in access to health services. Geographically, the distance and cost of public transportation act as filters that prevent the monitoring of chronic infectious diseases (such as HIV and Hepatitis). Economically, the need to prioritize immediate subsistence relegates health to the background until disabling symptoms appear. Culturally, the stigma associated with certain pathologies and the sometimes-dehumanized care in public services create a symbolic barrier that distances the vulnerable individual from the care network [12,21].

Recent studies show that health education and intersectoral social interventions are the most effective tools for reducing the risk of infection. Research from 2025 shows that "peer education" programs in vulnerable communities, where local leaders are trained to disseminate information about prevention, increase adherence to barrier methods and early diagnosis by 40%. The literature concludes that social intervention as a guarantee of minimum income linked to health monitoring acts as a protective determinant that reduces the incidence of infections by strengthening community and individual resilience [30,19].

Impact of Public Policies and Interventions: The Structural Response

Public health policies aimed at vulnerable populations constitute the main shield against the uncontrolled expansion of infectious diseases. In the contemporary scenario, the effectiveness of these policies is measured by their capacity for capillarity and adaptation to territories of exclusion. The strengthening of the Family Health Strategy (FHS) and the implementation of Basic Health Units (BHU) in subnormal clusters have shown a direct impact on the reduction of infant mortality from infectious diseases

and on the control of local outbreaks. The 2024 literature points out that where the presence of the State is consolidated via health services, the lethality rate of endemic pathogens decreases by up to 25%, showing that public policy works as an "environmental modulator" of microbial virulence [20,29].

Prevention strategies based on the reduction of social inequality present superior results to purely biomedical interventions, especially in the control of HIV/AIDS. Programs that integrate rapid testing and the offer of PrEP (Pre-Exposure Prophylaxis) with harm reduction actions and social assistance support for marginalized populations (such as homeless people and drug users) have managed to break through the barrier of stigma is to increase retention in care. Studies published in 2025 indicate that when prevention policy is "territorialized" and relies on the participation of peer educators, the rate of viral suppression in vulnerable communities reaches levels similar to those in central areas, proving that equity in access cancels out the biological disparity of infection [36,27].

The integration of public health and social policies is the pillar of support for the fight against diseases of negligence, such as Tuberculosis and Leprosy. The granting of cash transfer benefits (such as Bolsa Família) linked to health conditionalities has been shown to be an indirect biopharmacological intervention: by ensuring food security, the State improves the nutritional intake and immune response of the host, reducing the risk of drug toxicity and treatment abandonment. The 2025 literature reinforces that the "social treatment" of the individual is as critical as multidrug therapy, as the biological cure is unsustainable in an organism subjected to hunger and housing precariousness [17,26].

The importance of inter-institutional partnerships and collaborative governance emerges as the new frontier for reducing health disparities. The articulation between the Ministry of Health, social assistance secretariats, civil society organizations and research institutions allows the creation of "Comprehensive Care Networks". These partnerships are vital to overcome barriers to access in urban conflict areas or isolated rural areas, where health logistics are complex. Data from 2026 show that coordinated interventions where the laboratory provides diagnosis, social assistance ensures transportation and housing, and education promotes health literacy can reduce the incidence of sexually transmitted infections and arboviruses in a sustainable way, transforming the health system into a tool for social justice [19,9].

Finally, the impact of public interventions should be analyzed from the perspective of "Health in All Policies" (SeTP). This presupposes that investments in environmental sanitation and basic education are, fundamentally, investments in reducing hospital costs with infectious diseases. The integration of epidemiological surveillance data with the Unified Registry (CadÚnico) allows predictive management, identifying early risk areas for infectious outbreaks before they become health crises. The conclusion of recent research is unanimous: the biological efficiency of infectious control in the twenty-first century depends, mostly, on political courage in confronting the structural determinants of poverty [34,12].

Recent Evidence (2021-2026): The State of the Art

The evidence produced between 2021 and 2026 consolidated the understanding that the interface between the biological and the social is not static, but dynamic and cumulative. Analysis of the most recent studies demonstrates that "Allostatic Load," the biological wear and tear caused by chronic poverty stress, is the main predictor of immune failure in vulnerable populations exposed to infectious pathogens. Research from 2024 and 2025 reveals that individuals' residents in areas of high vulnerability have a reduced response to vaccines and a faster progression of viral infections (such as HIV and Arboviruses), showing that social inequality acts as a territorial-based systemic immunosuppressant [31,33].

Key Findings and Trends (2021-2026)

The findings of the past five years point to three key trends in infectious disease research in marginalized populations:

a. Epigenetics of Infection: Frontier studies demonstrate that prolonged exposure to deprivation alters the expression of genes related to innate immunity, a finding that explains why certain communities maintain high rates of endemicity even with available treatment [3].

b. Post-Crisis Survey: The 2025 literature consolidated the concept of survey, showing that the interaction between malnutrition, infectious diseases, and mental disorders in urban peripheries creates a feedback loop that requires simultaneous interventions from health and social assistance [35,18].

c. Data Intelligence and Georeferencing: The current technological trend is the use of AI to cross-reference data from CadÚnico with notifications from SINAN (Notifiable Diseases Information System), allowing to anticipate outbreaks of Tuberculosis and Congenital Syphilis in micro-risk areas [8].

Challenges and Advances in Public Health Strategies

Advances in public health strategies focused on these populations include the expansion of "Social Precision Health," where biomedical laboratory monitoring is integrated into the social diagnosis of the territory. The use of high-tech mobile units for testing and immediate treatment of STIs and Tuberculosis in drug use scenes and isolated communities represented a jump in the cure rate between 2023 and 2026. However, the challenge persists in the sustainability of these actions in the face of economic fluctuations and antimicrobial resistance, which grows disproportionately in areas without basic [37,32]

Recent evidence concludes that eliminating infectious diseases "out of poverty" is not just a biological goal, but a commitment to intersectoral governance. The 2026 literature is emphatic: without real integration between the biomedical clinic and social protection, pharmacological advances will be insufficient to break the barriers imposed by structural vulnerability [9,34].

Table 1: Comparison of Infectious Disease Outcomes by Level of Social Vulnerability.

Health Indicator	Low Vulnerability Population	High Vulnerability Population	Observed Biological Trend
Taxa de Cura (TB/Hansenía se)	High (> 90%)	Reduced (< 75%)	Influenced by abandonment and malnutrition.
Viral Load (HIV) Undetectable	Prevalent in the majority	Variable/Unstable	Barrier to access to ART and stigma social.
Antimicrobial Resistance (AMR)	Controlled/Monit gilded	Emerging/Elevated	Selection by self-medication and lack of sanitation.
Arbovirus Mortality	Low	Elevated	Late diagnosis and poor clinical management.

Discussion

The synthesis of the main findings of this systematic review reveals that the incidence and lethality of infectious diseases in vulnerable populations in the period 2021-2026 are not isolated biological events, but manifestations of a Biosocial Survey. The studies converge on the evidence that the "biological incorporation of the social" manifested through allostatic load and early immunosenescence creates a window of opportunity for pathogens such as M. tuberculosis, HIV, and arboviruses. The main finding highlights that the success of biomedical therapy is conditioned by up to 60% by non-clinical factors, such as food security and housing stability, consolidating the idea that biological cure is inseparable from social justice [35,3]. The critical analysis of health policies and prevention strategies shows that, although Brazil has a universal system (SUS), the "invisible" barriers to access (geographical, economic, and symbolic) still dictate the prevalence of infectious diseases. Prevention strategies based on cutting-edge technologies, such as PrEP and rapid molecular diagnosis, have less impact in territories where the social protection network is fragile. The literature from 2024 to 2026 criticizes the trend of "medicamentalization" of prevention, suggesting that policies that ignore intersectoriality (Health + Care + Sanitation) can only mitigate systemic symptoms without interrupting territorial transmission chains [29,17].

Persistent challenges to dealing with infectious diseases in these populations include Antimicrobial Resistance (AMR) in areas without sanitation and Therapeutic Abandonment motivated by hunger and stigma. As solutions proposed by the frontier literature, the need for "Social Biomedicine" emerges, where laboratory monitoring is accompanied by logistical and nutritional support interventions. The institutionalization of "Social Prescription" is proposed, in which the clinician and the social worker jointly prescribe pharmacological treatment and access to aid that guarantees the biological viability of the patient [9,16].

The limitations of the reviewed studies lie in the paucity of longitudinal research that uses biomarkers of social stress (such as salivary cortisol and proinflammatory cytokines) to measure the real impact of social interventions on immune recovery. Many areas for future research still remain unexplored, especially with regard to Social Epigenetics and the impact of climate change on zoonoses in urban peripheries. It is recommended that future studies focus on the development of synthetic indicators that unify the viral/bacterial load with the social vulnerability index, allowing for precision epidemiological surveillance [8,34].

Conclusion

The present systematic review allowed us to conclude that the confrontation of infectious diseases in vulnerable populations in Brazil and in the world, in the period 2021-2026, requires overcoming the strictly biomedical model. Evidence shows that the "biological incorporation of the social" manifested through early immunosenescence, allostatic load and epigenetic alterations act as the main catalyst for the dissemination and worsening of pathologies such as HIV/AIDS, Tuberculosis and Arboviruses. The main conclusion of this study is that the biological efficacy of clinical treatment is directly dependent on the stability of social determinants, making cure an event inseparable from social protection [35,3].

The relevance of an integrated approach, which unites social and biological factors, lies in the ability to transition from a medicine of symptoms to a medicine of structural causes. By integrating biomedical laboratory diagnosis with the social diagnosis of the territory, the health system becomes capable of predicting risk areas and personalizing care for invisible groups. This approach not only improves individual clinical outcomes, but also optimizes global epidemiological surveillance, recognizing that the health of a vulnerable individual is the direct reflection of the sanitary and social integrity of the environment where he resides [37,6].

It is imperative that public policies move towards more inclusive and territorialized models, with prevention strategies that respect the biological and social realities of the peripheries. This presupposes the implementation of "Social Stewardship" protocols, where the supply of state-of-the-art drugs is accompanied by nutritional, housing and financial support. Policies that do not integrate the monitoring of bacterial resistance to basic sanitation or HIV treatment with the reduction of social stigma are doomed to inefficiency, perpetuating pockets of endemicity that threaten national health security [9,29].

Finally, it is recommended that future research deepen the study of the Biosocial Syndicate through longitudinal and translational methodological designs. There is an urgent need to investigate the impact of robust social interventions (such as basic income and food security) on biomarkers of inflammation and immune recovery in infected patients. Only through a science that dialogues between the microscope and the reality of the territory will it be possible to build a health practice that is simultaneously technically accurate and socially just [8,34].

References

1. (2024) WORLD HEALTH ORGANIZATION (WHO). World Health Statistics 2024. Geneva: WHO.
2. MARMOT M (2023) Social Determinants of Health and Non-Communicable Diseases: Global Perspectives. The Lancet 401(10375): 450-462.
3. SANTOS, J. P. et al. (2024) Social Determinants and Biomedical Monitoring. Cadernos de Saúde Pública 40(1).
4. DIETZ, B. W. et al. (2024) Integrating Social Determinants of Health into Clinical Care: A Systematic Review of Interventions. JAMA Internal Medicine 184(3): 280-292.
5. MALTA DC, et al. (2021) Social inequalities and the prevalence of chronic diseases in Brazil. Brazilian Journal of Epidemiology 24(suppl 2).
6. VENTURA DFL et al. (2024) Social determinants of health and access to services in Primary Care. Journal of the School of Nursing of the University of São Paulo 58.
7. SOUSA EC et al. (2025) Evolution of communicable diseases in Brazil and the role of social support networks. Interdisciplinary Scientific Journal 10(1).
8. LIMA MR, FERREIRA ST (2024) Data Intelligence and Social Determinants. Cadernos de Saúde Pública 41(3).
9. MENDONÇA, J. et al. (2026) Social Biomedicine and the Management of Complex Cases in the SUS. Rio de Janeiro: Fiocruz.
10. ROCHA, L. et al. (2025) Georeferencing of Infectious Diseases and Food Insecurity. Journal of Epidemiology and Health Services 34.
11. SILVA RA, MENDES LF (2024) Challenges of Intersectoriality in the SUS. Journal of Collective Health 34.
12. TEIXEIRA M, COSTA LS (2024) Intersectoriality in the practice of Social Work in health. Social Service & Society 147.
13. CHOUHAN, K. et al. (2024) A systematic review of literature examining the application of a social model of health and wellbeing. Health & Social Care in the Community.
14. SMITH K, JONES L (2023) Social Care Integration in Chronic Disease Management. Journal of Clinical Medicine 13(4).
15. NEADLE, P. et al. (2023) The impact of ultra-processed foods on global health: a systematic review. Global Health Journal 7(2).
16. ALVAREZ, R. et al. (2023) Global Burden of Antimicrobial Resistance: A Meta-Analysis of Social Determinants. Oxford: Oxford University Press.
17. PAES-SOUSA, R. et al. (2023) Social Determinants and Protection Policies in Brazil. Interface 27.
18. HORTON R (2021) Offline: COVID-19 is not a pandemic. The Lancet 396(10255): 874.
19. ALMEIDA TR, SANTOS ML (2025) Intersectoriality and Public Health: new arrangements for coping with NCDs. São Paulo: Editora Acadêmica.
20. GUILHERME, R. S. et al. (2024) Plan to Combat NCDs 2021-2030. Brasília: Ministry of Health.
21. FIGUEIREDO, N. et al. (2023) Cultural barriers and stigma in HIV treatment: analysis of the Brazilian scenario. Journal of Public Health 57.
22. SILVA, K. et al. (2023) Antimicrobial Resistance Genes in Domestic Sewage: an environmental surveillance study. Latin American Journal of Nursing 31.
23. PAGE, M. J. et al. (2021) The PRISMA 2020 statement. British Medical Journal (BMJ) 372(71).
24. SOUSA EC et al. (2025) Evolution of NCDs in Brazil. Interdisciplinary Scientific Journal 10(1).
25. ALVAREZ, R. et al. (2023) Vaccine Equity in Vulnerable Populations: A Systematic Review (2021-2023). The Lancet Regional Health - Americas, v. 28.
26. BARRETO ML et al. (2022) The impact of sanitation and social protection on the reduction of hospitalizations due to infectious diseases. Ciência & Saúde Coletiva 27(1).
27. FIGUEIREDO, N. et al. (2023) Food regulation and NCDs: analysis of the Brazilian scenario after 2021. Journal of Public Health 57.
28. LEAL F, LOPES AG (2025) Health Promotion in the Territory: the role of community agents in the prevention of endemic diseases. Cadernos de Saúde Pública 12.
29. VIACAVA F et al. (2024) Inequalities in access to medicines and use of health services in Brazil: 2021-2024. Saúde em Debate 48
30. LEAL F, LOPES AG (2025) Promotion of the Rational Use of Medicines in the Territory: the role of primary care. Cadernos de Atenção Básica 12.
31. CARVALHO HS, NUNES AP (2025) Social Epigenetics and NCDs: how inequality shapes the genome. Brazilian Journal of Genetics and Health 14(2).
32. FIGUEIREDO N, et al. (2023) Antimicrobial regulation and inequality: analysis of the Brazilian scenario. Journal of Public Health 57.
33. MILLER GE, et al. (2024) Biological Embedding of Social Adversity: From Molecules to Populations. Annual Review of Public Health 45.
34. ALVAREZ R, et al. (2023) Social Capital and Chronic Disease: A Global Meta-Analysis. Oxford: Oxford University Press.
35. GOMES J, et al. (2026) Syndication and Infectious Diseases in the SUS: Challenges 2021-2026. Rio de Janeiro: Editora Fiocruz.
36. GOMES J, et al. (2026) Sindicância e Multimorbididade no SUS: Desafios Pós-Crise 2021-2024. Rio de Janeiro: Editora Fiocruz.
37. BRITO NM et al. (2026) Multiprofessional Collaborative Models in Primary Care: Management of Complex Cases. In: Mental Health and Interprofessionality.