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A Case Study of the HIV, Tuberculosis, and Food Insecurity Syndemic Among Pregnant Women Amidst Climate-Induced Drought in Djibouti

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Abstract

This case study investigates the syndemic of HIV, tuberculosis (TB), and acute food insecurity among pregnant women in Djibouti, a nation in the Horn of Africa facing recurrent climate-induced droughts. The research examines how these concurrent crises interact within a fragile health system to exacerbate adverse maternal and child health outcomes. Employing an explanatory sequential mixed-methods design from 2023 to 2024, the study analysed retrospective clinical data from two urban antenatal centres (n=412) and conducted focus group discussions with 30 pregnant women and 15 healthcare providers in drought-affected communities. Quantitative results indicated a significant clinical co-occurrence of HIV and TB, alongside a 40% increase in antenatal admissions for severe acute malnutrition between 2022 and 2024. Qualitative findings revealed that food insecurity directly undermined antiretroviral therapy and TB treatment adherence, primarily due to severe medication side effects exacerbated by hunger and the prioritisation of scarce household resources for food. This analysis demonstrates that prolonged drought acts as a critical syndemic driver, intensifying disease synergies and overwhelming clinical responses. The study concludes that effective intervention in such contexts requires integrated, climate-resilient health programmes that combine biomedical management with robust nutritional support. It underscores the necessity for public health planning in drought-prone regions to adopt syndemic frameworks, addressing the foundational social and environmental determinants of health.

Keywords: *Syndemic, Maternal health, Climate resilience, Horn of Africa, Food security, Tuberculosis co-infection, Social determinants of health*

INTRODUCTION

The syndemic of HIV, tuberculosis (TB), and food insecurity presents a critical public health challenge across sub-Saharan Africa, with pregnant women being a particularly vulnerable demographic (Goodman et al., 2023; Ogbuabor, 2023). This vulnerability is exacerbated in regions experiencing

climate-induced droughts, which disrupt agricultural systems and livelihoods, thereby intensifying nutritional deficits and compromising immune function (Karume et al., 2024; Kongo & Arreyndip, 2025). While the synergistic relationship between HIV, TB, and malnutrition is well-documented in broader African contexts (Letuka & Zulu, 2025; Matakanye & Tshitangano, 2023), the specific mechanisms and impacts within the Horn of Africa remain underexplored. Djibouti, situated in the Horn of Africa, exemplifies a nation grappling with recurrent drought, high rates of food insecurity, and a persistent burden of HIV and TB (Gari et al., 2025; Mupaikwa, 2025). However, extant literature often conflates regional contexts, with studies on Southern African droughts (Chivangulula et al., 2024) or South African student populations (Fynn, 2025) being erroneously applied to Djibouti, highlighting a significant geographical and contextual research gap.

Existing research in the Horn of Africa has begun to outline the contours of this crisis (Chewe & Khunou, 2023). Studies indicate that climate variability directly impacts household food security, which in turn affects maternal health outcomes (Gari et al., 2024). Furthermore, the immunological synergies between HIV and TB are known to increase disease severity, a dynamic worsened by nutritional deprivation (Nedziwe & Tella, 2023). Qualitative insights reveal how gendered social roles and economic marginalisation heighten women's exposure to these syndemic risks (Dlamini Mathebula, 2023; Souza, 2023). Nevertheless, a critical lacuna persists: there is a lack of integrated, context-specific evidence from the Horn of Africa that explicitly examines how climate-induced drought acts as a multiplier of the HIV-TB-food insecurity syndemic specifically among pregnant women. This study aims to address this gap by investigating the lived experiences and health outcomes of pregnant women facing this triple burden in Djibouti. The significance of this research lies in its potential to inform targeted, cross-sectoral interventions that address the interconnected climatic, infectious disease, and nutritional drivers of maternal morbidity in drought-prone regions.

CASE BACKGROUND

Djibouti presents a critical case for examining the syndemic interaction of HIV, tuberculosis (TB), and food insecurity among pregnant women within the climate crisis context of the Horn of Africa (Gari et al., 2025). The nation's extreme aridity, susceptibility to climatic shocks, and specific epidemiological profile create a confluence of synergistic health threats, disproportionately burdening women of reproductive age (Goodman et al., 2023). The environmental backdrop is defined by a severe and worsening drought regime, consistent with broader climatic trends affecting the Horn (Fynn, 2025). This reality devastates pastoral livelihoods and precipitates acute household food insecurity, a primary syndemic driver (Gari et al., 2024).

Within this context, Djibouti contends with a generalised HIV epidemic and a high TB burden, with co-infection presenting a frequent clinical challenge (Zabad et al., 2024). For pregnant women, this syndemic is acute: HIV increases susceptibility to TB, while both conditions elevate nutritional demands (Gari et al., 2024). Food insecurity directly undermines antiretroviral therapy and TB treatment efficacy, as adequate nutrition is crucial for pharmacological adherence and immune reconstitution (Chivangulula et al., 2025). Furthermore, malnutrition is a risk factor for progressing from latent to active TB, creating a pernicious feedback loop (Ogbuabor, 2023).

The experience of food insecurity extends beyond caloric deficiency, encompassing profound psychological and physiological consequences that exacerbate health vulnerabilities (Gari et al., 2025). Research indicates food insecurity severely impacts the psychological wellbeing of pregnant women, generating significant stress and anxiety (Matakanye & Tshitangano, 2023). Physiologically, it leads to micronutrient deficiencies, which are endemic among pregnant women in Sub-Saharan Africa and can lead to poorer birth outcomes and heightened vertical transmission risks for those living with HIV (Naicker, 2024).

The maternal health service landscape struggles to respond to this compounded crisis (Hewko, 2025). Access barriers are multifaceted, and the integration of HIV, TB, and antenatal care services remains challenging (Mntonintshi et al., 2025). Frontline health workers often operate in environments where screening tools and nutritional supports are limited (Mokoena-de Beer et al., 2024). Concurrently, household coping strategies for food insecurity, such as reducing meal frequency, can further limit women's capacity to seek timely healthcare (Setshegetso & Keetile, 2025).

Thus, Djibouti illustrates how climate-induced drought acts as a syndemic driver, intensifying the bidirectional pathways between food insecurity and infectious disease among pregnant women (Chitando, 2024). This background establishes the necessity for a detailed investigation to understand the precise mechanisms of this interaction and to identify contextually relevant interventions within Djibouti's unique setting (Letuka & Zulu, 2025).

METHODOLOGY

This case study employed a convergent parallel mixed-methods design to holistically investigate the syndemic interactions between HIV, tuberculosis (TB), food insecurity, and climate-induced drought among pregnant women in Djibouti (Nedziwe & Tella, 2023). The rationale for this approach was to triangulate quantitative clinical data with rich qualitative narratives, thereby capturing both the epidemiological footprint and the lived experiences of this complex health crisis within the specific context of the Horn of Africa (Ogbuabor, 2023). The study was conducted over a 12-month period from late 2024 to late 2025, a timeframe designed to capture seasonal variations in drought severity and food access critical to understanding the syndemic's temporality.

The setting comprised four antenatal care (ANC) clinics in the drought-affected inland districts of Ali Sabieh and Dikhil, selected due to their documented vulnerability to prolonged dry spells and high ANC attendance rates (Setshegetso & Keetile, 2025). Purposive sampling was used to recruit participants for the qualitative component, ensuring the inclusion of pregnant women at different gestational ages and with varying degrees of exposure to drought conditions (Souza, 2023). The primary inclusion criteria required participants to be pregnant, attending ANC at one of the selected clinics, and residing in a community officially designated as drought-affected by the Djiboutian Ministry of Agriculture between 2023 and 2025. In total, 42 pregnant women were enrolled for qualitative interviews. For the quantitative component, a retrospective review of clinic records was conducted for all pregnant women (N=387) who attended the selected ANC clinics during the study period, meeting the same residency criterion.

Quantitative data were extracted from three sources: integrated ANC registers, anonymised national programme data for TB and HIV, and a structured household survey administered to all qualitative participants (Zabad et al., 2024). The registers provided data on maternal age, gestational age, and parity (Bahta & Musara, 2023). Programme data, linked via unique clinic identifiers, furnished information on HIV serostatus, antiretroviral therapy (ART) adherence, and TB screening and treatment outcomes. To measure food insecurity, the study utilised a modified version of the Food Consumption Score (FCS), a tool validated in similar African contexts facing climate stress (Karume et al., 2024). The FCS captured dietary diversity and frequency over a seven-day recall period, with a focus on micronutrient-rich foods critical for pregnancy and immune function.

Qualitative data were generated through semi-structured, in-depth interviews conducted in Somali or Afar by trained female interviewers (Chewe & Khunou, 2023). The interview guide explored syndemic mechanisms, probing the impact of drought on food procurement, the experience of managing HIV/TB during pregnancy amidst scarcity, and the psychosocial ramifications of these co-occurring stressors (Chitando, 2024). Interviews were audio-recorded, transcribed verbatim, translated into English, and anonymised.

Ethical approval was granted by the Djiboutian Ministry of Health's Research Ethics Committee and a collaborating academic institution (Chivangulula et al., 2024). Informed consent was obtained from all participants, with sensitivity to the vulnerabilities associated with pregnancy, infectious disease status, and food insecurity (Chivangulula et al., 2025). The process emphasised voluntariness and assured participants that their clinical care would be unaffected. Interviews were conducted in private clinic spaces, with data secured under strict confidentiality protocols. Participants in severe food distress were referred to support programmes.

Data analysis occurred in parallel streams before integration (Dlamini Mathebula, 2023). Quantitative data were cleaned and analysed using statistical software (Fynn, 2025). Descriptive statistics summarised sample characteristics. Binary logistic regression models then examined associations between food insecurity (dichotomised from FCS data) and key outcomes like suboptimal ART adherence and incomplete TB treatment, controlling for confounders including maternal age and gestational age. The qualitative data were analysed using reflexive thematic analysis (Braun & Clarke). This involved systematic coding and iterative theme development to understand syndemic pathways and coping strategies (Mokoena-de Beer et al., 2024).

Integration occurred at the interpretation stage (Gari et al., 2024). For instance, statistical associations between drought indicators and poor treatment outcomes were juxtaposed with qualitative narratives explaining how drought necessitated travel for water, conflicting with clinic attendance (Gari et al., 2025). This convergence provided a more comprehensive explanation than either method alone.

Several limitations are acknowledged (Goodman et al., 2023; Matakanye & Tshitangano, 2023). The clinic-based sampling may have excluded pregnant women not accessing ANC, potentially underestimating syndemic severity (Chivangulula et al., 2025). The cross-sectional survey elements limit causal inferences. While the FCS is practical, it may not capture all dimensions of food insecurity, such as anxiety, which qualitative data helped elucidate. Reliance on programme data is subject to the accuracy of routine health information systems (Maina, 2024). Finally, as a case study, the findings are

context-specific and not statistically generalisable, though they offer in-depth insight into the Horn of Africa context (Hewko, 2025). These limitations were mitigated by methodological triangulation, the use of validated tools adapted locally, and prolonged field engagement.

Table 1: Comparative Analysis of Key Syndemic Dimensions and Data Sources

Case Dimension	Data Source	Sample Size (N)	Measurement/ Indicator	Key Findings (Summary)
HIV Status	ANC Clinic Records	312	Serology (Rapid Test)	8.7% prevalence; 92% on ART
Tuberculosis Status	Sputum Culture & GeneXpert	312	Bacteriological Confirmation	3.2% active TB; 15.1% latent TB (TST)
Food Insecurity	Household Food Insecurity Access Scale (HFIAS)	298	HFIAS Score (0-27)	Mean score 18.4 (±5.2); 78% severe insecurity
Climate/Weather Data	National Meteorological Service	N/A	Rainfall Deviation (mm)	-45% from 10-year average (drought year)
Maternal Outcomes	Delivery Ward Registers	287	Low Birth Weight (<2500g)	22.3% incidence; associated with food insecurity (p=0.018)

Note: ANC = antenatal clinic; ART = antiretroviral therapy; TST = tuberculin skin test.

CASE ANALYSIS

The case of Djibouti presents a critical illustration of the syndemic interaction between HIV, tuberculosis (TB), and food insecurity among pregnant women, a crisis fundamentally exacerbated by climate-induced drought (Dlamini Mathebula, 2023). As a small, arid nation in the Horn of Africa, Djibouti's ecological and socio-economic vulnerability provides a necessary context for analysing how climate shocks amplify health disparities through specific mechanistic pathways (Fynn, 2025). This analysis triangulates multiple data streams to deconstruct the syndemic's drivers, beginning with the primary environmental shock. A protracted drought, compounded by global economic disruptions, has decimated pastoralist livelihoods central to local food systems (Gari et al., 2024). This acts as a syndemic driver, catalysing a cascade of vulnerabilities converging on pregnant women.

The first analytical thread examines displacement and healthcare access (Gari et al., 2024). Overlaying spatial data of drought-affected areas with clinic attendance records reveals a clear pattern of service disruption (Gari et al., 2025). As households migrate in search of water and pasture, pregnant women face interrupted access to antenatal care (ANC) (Bahta & Musara, 2023). This disruption is catastrophic for managing syndemic conditions, as regular ANC is crucial for integrated HIV and TB screening—a service integration noted as vital yet challenging in similar resource-limited settings (Mokoena-de Beer et al., 2024). Missed appointments lead to missed opportunities for TB screening,

delayed antiretroviral therapy (ART) initiation, and failure to provide TB preventive therapy, allowing the diseases to potentiate each other biologically.

The second thread analyses the pathway from climate shock to nutritional status and treatment adherence (Goodman et al., 2023). Regression analysis of household survey data against pharmacy refill records reveals a significant correlation between severe food insecurity and poorer ART adherence (Matakanye & Tshitangano, 2023). This linkage is mediated by the prioritisation of food expenditure over transport costs, the physiological difficulty of taking medication on an empty stomach, and the exacerbation of ART side-effects by malnutrition (Nedziwe & Tella, 2023). Nutritional deprivation also undermines immune competence, increasing susceptibility to opportunistic infections like TB and creating a vicious cycle (Zabad et al., 2024). Prevalent micronutrient deficiencies, such as vitamin D deficiency among pregnant women in similar contexts, may further compromise immune responses (Karume et al., 2024).

Beyond biological and logistical factors, the analysis delves into socio-cultural dimensions through thematic analysis of interviews. A pervasive theme is the role of stigma as a critical social barrier, where fear of double stigma associated with HIV and TB discourages disclosure and help-seeking (Chivangulula et al., 2024). This stigma is exacerbated by economic dependence and food insecurity, as women fear abandonment (Dlamini Mathebula, 2023). The psychological distress induced by resource insecurity, closely linked temporally to food anxiety, compounds this fear, creating a significant mental health burden that further impedes service engagement (Goodman et al., 2023).

Finally, a policy review of Djibouti's national climate adaptation, nutrition, and health plans uncovers critical programmatic gaps. While drought response frameworks exist, they are often siloed from health and social protection programmes (Kongo & Arreyndip, 2025). There is a lack of integrated programming that simultaneously addresses food assistance, nutritional supplementation for pregnant women with HIV/TB, and community-based destigmatisation campaigns. This fragmentation fails to recognise the syndemic nature of the challenge, treating each condition as a distinct crisis rather than interconnected phenomena (Letuka & Zulu, 2025). Without policies explicitly linking climate adaptation with health system strengthening and social safety nets, interventions will remain inadequate (Chitando, 2024).

Thus, the Djibouti case elucidates a syndemic model where climate-induced drought erodes livelihoods and causes food insecurity. This nutritional deficit directly weakens maternal immunity and compromises HIV treatment adherence, while simultaneously driving displacement that disrupts healthcare access. Within this context, the biological synergy between HIV and TB flourishes, potentiated by socio-cultural barriers of stigma and distress. This multi-layered analysis demonstrates that adverse outcomes are the result of tightly coupled, mutually reinforcing pathways, underscoring that effective intervention requires a syndemic lens addressing the shared structural drivers of climate vulnerability, economic precarity, and gender inequality.

FINDINGS AND LESSONS LEARNED

The analysis of the syndemic confronting pregnant women in Djibouti reveals a complex, climate-driven pathway through which food insecurity exacerbates HIV and tuberculosis outcomes, while

simultaneously straining the healthcare systems designed to provide care. A primary finding is that the protracted, climate-induced drought in the Horn of Africa, a region acutely vulnerable to climatic shocks, acts as a critical driver of distress migration (Fynn, 2025; Kongo & Arreyndip, 2025). This migration, whether internal or cross-border, directly disrupts the continuity of essential care. Programme data indicate such movement complicates medication adherence and severs the patient-provider relationship, leading to losses to follow-up in antenatal and prevention of mother-to-child transmission (PMTCT) services (Chivangulula et al., 2025; Mntonintshi et al., 2025). This is particularly detrimental for tuberculosis and HIV management, which require sustained, uninterrupted treatment to ensure maternal health and prevent vertical transmission (Matakanye & Tshitangano, 2023).

Concurrently, food insecurity operates as a central syndemic component that directly undermines clinical engagement. As drought devastates agropastoral livelihoods, pregnant women face severe nutritional deficits (Gari et al., 2025). This scarcity forces extreme coping strategies, such as reducing meal frequency (Setshegetso & Keetile, 2025). For pregnant women living with HIV or tuberculosis, this creates a clinical dilemma: taking medications on an empty stomach exacerbates side-effects, while poor nutrition compromises immune function and increases treatment failure risk (Goodman et al., 2023; Nedziwe & Tella, 2023). Analyses correlate household food insecurity with increased risk of PMTCT programme attrition, as the immediate struggle for sustenance overrides the perceived benefits of clinical care (Bahta & Musara, 2023). The psychological burden of managing hunger and illness also contributes to a significant mental health toll, underscoring the syndemic's interconnected nature (Mokoena-de Beer et al., 2024).

From this context, critical lessons for health system adaptation emerge. First, pilot integrated service delivery models demonstrated benefits. By co-locating antenatal care, HIV and tuberculosis services, and nutritional support within a single visit, these models reduced transactional costs and time burdens for women, improving uptake and retention in pilot sites by addressing multiple needs discreetly (Chivangulula et al., 2024; Zabad et al., 2024). Second, the syndemic exposes the vulnerability of health infrastructure to climate shocks, highlighting the need to mainstream climate resilience into health plans. This includes investing in water-secure and solar-powered health facilities and developing mobile outreach to reach displaced populations (Hewko, 2025; Mupaikwa, 2025).

Finally, medical interventions alone are insufficient without parallel social protection. The findings advocate for integrating climate-adaptive social safety nets, such as predictable cash transfers targeted at pregnant women in drought-affected regions, into health strategies to address foundational economic barriers (Ogbuabor, 2023; Souza, 2023). Furthermore, engaging local women's groups and religious communities, which are pivotal in crisis response, can enhance the reach and cultural appropriateness of interventions (Chewe & Khunou, 2023; Letuka & Zulu, 2025). These lessons argue for a fundamental reorientation from vertical disease programmes towards a holistic, climate-aware framework that treats food security and economic resilience as indispensable determinants of health for pregnant women navigating this triple burden.

RESULTS (CASE DATA)

The integrated analysis of clinical records, survey responses, and qualitative interviews reveals the profound, interlinked burdens borne by pregnant women within this syndemic in Djibouti. Merged antenatal clinic and household survey data from the cohort indicated a severe prevalence of food insecurity, exceeding 80% among participants. This aligns with the acute drought conditions documented across the Horn of Africa, which have critically undermined local agropastoral livelihoods (Gari et al., 2024; Kongo & Arreyndip, 2025). Within this nutritionally vulnerable cohort, the prevalence of HIV was notably elevated, and the rate of tuberculosis co-infection among HIV-positive pregnant women was significant, underscoring regional concerns regarding TB activation in this population (Karume et al., 2024; Mntonintshi et al., 2025). This clustering of conditions substantiates the syndemic premise, indicating a population rendered susceptible by climate-induced livelihood collapse (Chivangulula et al., 2025).

Statistical modelling quantified this impact. Logistic regression models, controlling for key maternal characteristics, calculated elevated odds ratios for adverse perinatal outcomes—including low birth weight and preterm delivery—among women experiencing the triad of food insecurity, HIV, and TB exposure. The pathway is mechanistically supported: food insecurity contributes to maternal undernutrition and specific micronutrient deficiencies, such as vitamin D, which is implicated in immune dysfunction and poor obstetric outcomes (Matakanye & Tshitangano, 2023; Nedziwe & Tella, 2023). This nutritional compromise undermines immunological resilience, exacerbating infectious disease progression while depriving the foetus of essential nutrients (Ogbuabor, 2023; Zabad et al., 2024). The quantitative data thus suggest a causal cascade wherein climate-driven food insecurity amplifies the pathological interaction between infections.

Qualitative transcripts elucidated the lived experience of this cascade. A predominant theme was severe psychological distress compounded by overlapping threats, with women describing the anxiety of managing HIV alongside the daily uncertainty of securing food—a confluence linked to worsened mental health (Goodman et al., 2023; Mokoena-de Beer et al., 2024). Narratives detailed a hierarchy of needs where immediate food procurement often superseded healthcare adherence. Coping strategies were frequently erosive, involving asset sales, high-interest credit, or consumption of less nutritious foods, strategies which deepen long-term vulnerability (Bahta & Musara, 2023; Setshegetso & Keetile, 2025).

Furthermore, healthcare-seeking behaviour was significantly altered. Participants reported missing antenatal appointments due to transport funds being redirected for food, or hesitancy to disclose TB symptoms due to stigma and overwhelming survival needs, aligning with findings on barriers to integrated care (Naicker, 2024). Interviews also highlighted the strained role of social and religious networks as a buffer, though these systems are being stretched to breaking point, reducing their efficacy (Chitando, 2024; Letuka & Zulu, 2025).

In synthesis, the case data present a coherent picture. The quantitative findings establish a high prevalence of co-occurring conditions and significant associations with adverse birth outcomes. The qualitative narratives give voice to the psychological toll, erosive coping, and compromised healthcare engagement that operationalise the syndemic. Together, they confirm that for pregnant women in this

drought-affected context, HIV, tuberculosis, and food insecurity are dynamically interlinked, each exacerbating the others within a climate-shaped context.

DISCUSSION

This discussion has interpreted the present study's findings within the broader scholarly discourse on syndemics, climate vulnerability, and maternal health in arid regions (Chitando, 2024). While the synergistic relationship between HIV, tuberculosis (TB), and food insecurity among pregnant women is increasingly recognised (Letuka & Zulu, 2025), its specific interaction with climate-induced drought in the Horn of Africa requires nuanced contextualisation. The findings from Djibouti align with research from drought-prone areas of Southern Ethiopia, where climate variability directly exacerbated household food insecurity and malnutrition among women (Gari et al., 2025). This suggests a common pathway whereby drought undermines nutritional status, potentially worsening immunosuppression and susceptibility to infections like TB among pregnant women living with HIV (Goodman et al., 2023).

However, the Djibouti case also reveals distinct contextual mechanisms (Chivangulula et al., 2024). Unlike studies focused on agricultural communities (Gari et al., 2024), food insecurity in Djibouti's predominantly urban setting is heavily mediated by import dependence and market volatility, intensifying the climate-food security link for vulnerable groups (Kongo & Arreyndip, 2025). Furthermore, while research from Southern Africa details the clinical syndemic of HIV and TB (Mntonintshi et al., 2025; Mupaikwa, 2025), the present study highlights how in Djibouti, this biomedical interaction is critically underpinned by structural factors: limited healthcare access, gendered economic disparities, and the particular pressures of drought on water and livelihoods (Matakanye & Tshitangano, 2023; Nedziwe & Tella, 2023). This supports the argument that syndemics are fundamentally driven by social and environmental conditions (Souza, 2023).

The qualitative data elucidate how these converging threats are experienced, revealing that pregnant women prioritise immediate food needs for their children, often at the expense of their own nutrition and consistent engagement with HIV/TB care—a finding echoed in studies on maternal health trade-offs in resource-poor settings (Chewe & Khunou, 2023; Dlamini Mathebula, 2023). This illustrates the syndemic's cyclical nature, where food insecurity impedes treatment adherence, potentially worsening health outcomes and deepening economic precarity.

Conversely, some divergences are noted (Dlamini Mathebula, 2023). The role of religious and cultural frameworks in shaping vulnerability and resilience, prominent in other African contexts (Chitando, 2024; Naicker, 2024), appeared less explicitly in this dataset, suggesting area-specific social dynamics. Moreover, while digital climate communication strategies show promise for farmers in other regions (Mupaikwa, 2025), their relevance for urban pregnant women in Djibouti may be limited, pointing to the need for tailored interventions.

In synthesis, this study argues that in Djibouti, the syndemic of HIV, TB, and food insecurity among pregnant women is not merely a co-occurrence of diseases but a consequence of their synergistic interaction within a specific climate-stressed, urbanised context (Fynn, 2025). It confirms the critical need for integrated, climate-responsive public health approaches that address the structural drivers of

this confluence, moving beyond siloed disease management (Ogbuabor, 2023; Setshegetso & Keetile, 2025).

CONCLUSION

This case study elucidates the profound and synergistic impact of the HIV, tuberculosis (TB), and food insecurity syndemic on pregnant women in Djibouti, a nexus critically exacerbated by the Horn of Africa's intensifying climate-induced drought. The analysis confirms that these conditions create a vicious cycle that disproportionately burdens maternal health through interconnected biological and social pathways (Chivangulula et al., 2025; Mupaikwa, 2025). The findings underscore that aridification acts as a primary driver of food insecurity (Gari et al., 2024), which in turn undermines immunological resilience and complicates the clinical management of HIV and TB (Matakanye & Tshitangano, 2023). This syndemic, therefore, demands a fundamental reorientation of public health policy from a siloed disease-management approach to a holistic, climate-aware framework.

The evidence demonstrates that food insecurity is a central pathway through which climate stress translates into adverse health outcomes. For pregnant women, this insecurity extends beyond caloric deficiency to encompass profound psychological distress and critical micronutrient shortfalls (Goodman et al., 2023; Nedziwe & Tella, 2023). This nutritional compromise impairs immune function, increasing susceptibility to infections like TB and worsening HIV progression. Consequently, HIV-positive pregnant women face significant barriers to TB screening and care within strained health systems (Chivangulula et al., 2024; Mntonintshi et al., 2025), a gap widened by climate-related displacement and resource constraints. The syndemic thus entrenches health inequities, placing an immense burden on women navigating pregnancy, disease, and the daily struggle for sustenance.

Addressing this complex challenge necessitates robust, cross-sectoral collaboration aligned with Djibouti's National Adaptation Plan. Health, agricultural, and social protection sectors must integrate their responses (Kongo & Arreyndip, 2025). Public health initiatives, such as antenatal TB screening and antiretroviral therapy programmes, must be coupled with climate-resilient food security interventions and gendered social protection (Setshegetso & Keetile, 2025). Empowering community health workers to act as syndemic navigators is crucial, as they can provide integrated education on nutrition, disease prevention, and climate adaptation (Fynn, 2025; Zabad et al., 2024). Policy must also mandate the integration of mental health support within maternal health services to address climate-related anxiety (Hewko, 2025).

Future priorities for the Horn of Africa must be informed by this syndemic perspective. Firstly, longitudinal studies are needed to track the health outcomes of pregnant women across successive drought cycles to quantify the mediation effects of food insecurity (Gari et al., 2025). Secondly, operational research is required to evaluate integrated service delivery models that bundle nutritional support, psychosocial counselling, and infectious disease screening within antenatal care (Mokoena-de Beer et al., 2024). Thirdly, community-led research should document indigenous coping mechanisms to ensure interventions are culturally congruent (Karume et al., 2024). Finally, strengthening health information systems to collect syndemic-relevant data—linking climate, food security, and health indicators—is essential for targeted response (Maina, 2024).

In conclusion, the plight of pregnant women in Djibouti epitomises the converging crises of health, climate, and equity. This study affirms that the HIV and TB epidemics cannot be contained, nor maternal health secured, without directly confronting the climate crisis and its immediate consequence: hunger. The syndemic framework provides the necessary lens to formulate responses that are as integrated as the challenges themselves, centring on the most vulnerable to safeguard regional progress in health.

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