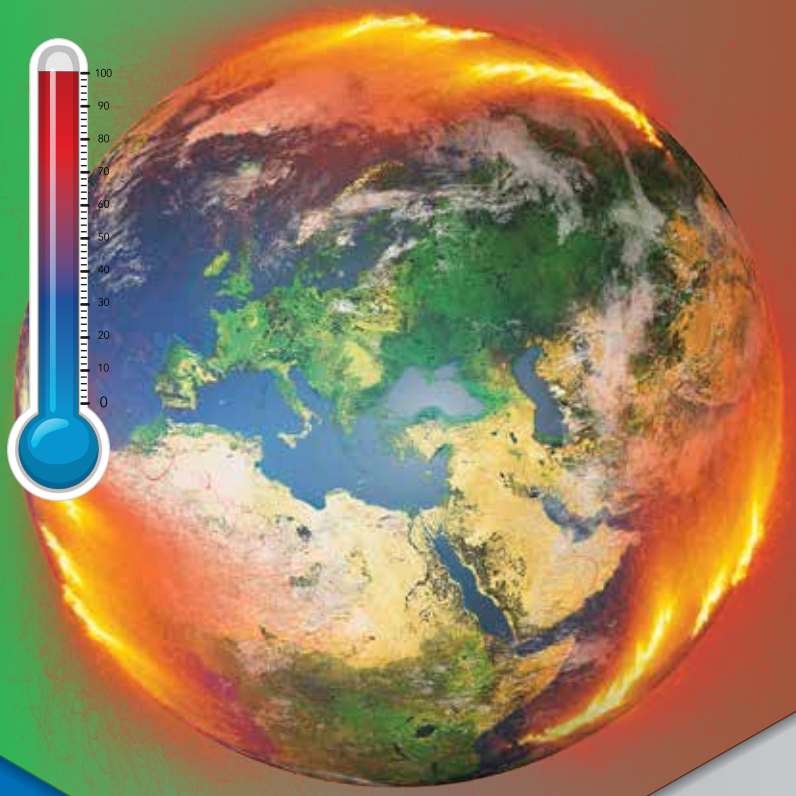
Development of a Framework to Identify Research Priorities for Mitigating the Impact of Climate Change on HIV Response in India



UNDP

INDIAN COUNCIL OF MEDICAL RESEARCH

NATIONAL INSTITUTE OF CHOLERA AND ENTERIC DISEASES

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Cover and report designed by
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सत्यमेव जयते

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Foreword

Climate change has been recognized as a public health concern at both national and international levels. Direct impact of climate change is evident on the physical environment. However, the indirect impact extends towards the societal life which includes population health. In this regard, the impact of climate change on the response to HIV epidemic in India requires timely attention. For this, firstly, systematic understanding of the multi-factorial pathways and processes that exacerbate adverse impact of climate change on HIV response need to be understood.

In the present report, ICMR-National Institute of Cholera and Enteric Diseases has mapped the availableevidences on the impact of climate change on HIV responses through identification of an evidence gap-map approach to determine key research priorities. A review of global evidence was undertaken, which suggested there were lack of primary studies in India. Despite the challenge of navigating through indirect and multi-factorial pathways, cross-cutting themes across climate change and HIV has been charted out.

Food insecurity, migration, service and infrastructure disruption and mental health were identified as the major cross-cutting themes. These themes fall on the key channels through which climate risks pose disproportionate impact on high-risk groups as well as People Living with HIV. The findings of this review-based report facilitateto identify the range of research priorities for the communities, interested in such topics.

I sincerely thank the United Nations Development Programme (UNDP) for funding the project and congratulate the entire research team oflCMR-National Institute of Cholera and Enteric Diseases and Technical Resource Group Members for coming up with this preliminary repoft, which would enable undertaking future research and policymaking in this area, gearing HIV response in India, sensitive to the impact of climate change.

(Rajiv Bahl)

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United Nations Development Programme

Message

The adverse effects of climate change are widespread, impacting everyone, but its harshest consequences often fall on vulnerable populations. For people living with HIV, it amplifies existing health, social, and economic challenges. Climate-induced food insecurity, for instance, can lead to nutritional deficiencies among People Living with HIV (PLHIV). Climate-induced disasters further magnify these challenges, forcing displacements and exposing PLHIV and their families to physical and mental shocks, disrupting their treatment and care cycles.

In a geographically diverse country like India, where droughts, cyclones, floods, and landslides are increasingly common each year, mitigating health risks arising from climate change becomes paramount. It is crucial to prioritize research to navigate the intricate intersection of climate change and HIV.

UNDP, driven by its mission to leave no one behind, is committed to taking action on climate change risks to overcome its adverse impact on health. We actively explore ways to integrate climate considerations into global health initiatives. In 2015, we initiated greenhouse gases (GHG) accounting and implemented emission reduction strategies feasible for global health initiatives, including HIV/AIDS. Our recent report, "Connecting the Dots Towards a More Equitable, Healthier, and Sustainable Future: UNDP HIV and Health Strategy 2022-2025," further strengthens our commitment to a future where health, equity, and sustainability thrive.

I express my deepest appreciation to the Indian Council of Medical Research and the National Institute for Cholera and Enteric Diseases for undertaking the critical research project to develop a framework addressing the impact of climate on India's HIV response. This research project will not only help mitigate and adapt healthcare for PLHIV but will also guide future research initiatives. I am hopeful that the framework will assist the National AIDS Control Organization (NACO) and the State AIDS Control Societies (SACS) in developing climate-resilient strategies for the HIV program.

As a co-sponsor of the Joint UN Programme on HIV and AIDS (UNAIDS), UNDP is committed to supporting the Government of India in its HIV response.

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WHO COLLABORATING CENTRE FOR RESEARCH AND TRAINING ON DIARRHOEAL DISEASES

Dr. Shanta Dutta, MD, PhD, MAMS, FWAST, FNASc
Director & Scientist-G

Preface

I am privileged to be the lead investigator of the UNDP funded project "Development of a framework to identify research priorities for mitigating the impact of climate change on HIV response in India". This is a relevant topic in the context of emerging challenges posed by the climate change in the current times. The negative impact of frequent climate change has created ripples in every aspect of physical existence of humans and social development. Recognizing its potential effect on the HIV responses in India and demonstrating the escalating challenges to it in case of Climate risk is a topic of high priority: Exploring this ares includes determination of the multidimensional factors which are not visible normally, In-depth research is required on this topic for finding out different intersectional areas that characterize the problem and creating evidences that support corrective actions. This report is of significance as it develops a framework that provides direction to further research in this area on mitigating actions and health system preparedness for climate risk to HIV response in India.

This topic being an emerging one, hence, having the challenge of scarcity of related primary data from India. Through a systematic and objective criterion, the study has been successfully Integrated with the global evidences noted in the data bases and research publications available in the public domain with the wisdom of the experts in the field of climate change and HIV/AIDS research to come up with an evidence-based and robust conceptual framework that outlines the major pathways through which climate risk creates adverse impact on the entire continuum of HIV prevention and care. The conceptual framework presented through this state of the art report would be revealing areas for further research with the advantage of addressing the proximal and distal causes that fail on the pathway of HIV response affected by potential threats due to climate risks. This report will be useful for making policy decisions and programmatic action and also encourage participation of various stakeholders in the action plans to follow

I sincerely thank the United Nations Development Programme (UNDP) for providing generous funding to this important research project and ensuring its effective implementation. I heartily congratulate the team of scientists and project staff at ICMR-NICED for conducting the study successfully overcoming the challenges met during Its implementation. I believe that this report would be immensely useful for guiding further research and planning actions on this emerging challenge which is an important step towards further strengthening health system preparedness in India.

I extend my sincere thanks and heartfelt gratitude to the experts whe were members of the Technical Resource Group and who enriched the document with their valuable insights and opinions.

S. Dutta

(Shanta Dutta)

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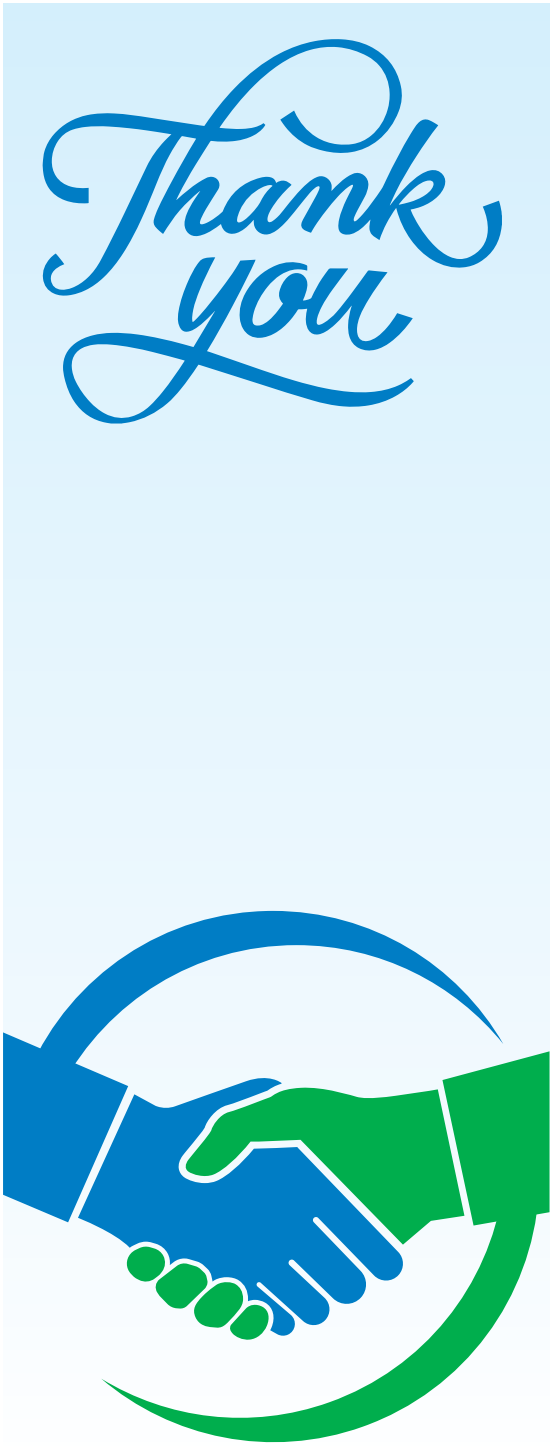
Acknowledgement



A pioneering report on the “Development of a framework to identify research priorities for mitigating the impact of climate change on HIV response in India” through evidence synthesis and consultation with Technical Resource Group members was prepared by ICMR-National Institute of Cholera and Enteric Diseases (NICED). The project was funded by United Nations Development Programme (UNDP). The entire process was truly an intellectually stimulating journey which was enriched by every person who contributed in its successful completion. We take great pleasure in thanking all those people who made this report possible.

We express our sincere gratitude to Dr. Rajiv Bahl, Secretary, Dept of Health Research (DHR) and Director General, Indian Council of Medical Research (ICMR) for his continuous support and guidance in the course of coming up with this report. We would like to sincerely thank Isabelle Tschan, Resident Representative a.i. and Dr. Chiranjeev Bhattacharjya, National Program Manager, United Nations Development Programme (UNDP), India. We thank all the TRG members, Dr. Rituparna Acharya, Dr. Suman Ganguly, Dr. Protim Roy, Dr. Saikat Sinha Roy, Prof. Sugata Hazra, Prof. Subhas Chandra Santra, Dr. Vivek Verma, Prof. Matin Ahmed Khan, Dr. Sreerupa Sengupta, Mr. G. S. Srinivasan, Prof. D.N. Goswami and Dr. Rajat Subhra Adhikary for their sincere contributions towards this report.

Table of Contents

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Mr. G. S. Srinivasan	Technical Expert	Path International
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Abbreviation

AIDS	Acquired Immunodeficiency Syndrome
ANC	Antenatal Care
ARI	Acute Respiratory Infection
ART	Antiretroviral Therapy
ARV	Antiretroviral
BMI	Body Mass Index
BPL	Below Poverty Line
CBO	Community Based Organization
CC	Climate Change
COVID	Coronavirus Disease
CSW	Commercial Sex Worker
FI	Food Insecurity
FWID	Female Who Inject Drugs
GDP	Gross Domestic Product
GGG	Global Gender Gap
GHS	Government Health Systems
HACC	HIV and Climate Change Complex
HBV	Hepatitis-B Virus
HCV	Hepatitis-C Virus
HIV	Human Immunodeficiency Virus
HRG	High Risk Group
IEC	Information, Education and Communication
LFU	Loss to follow-up
LGBTQ	Lesbian, Gay, Bisexual, Transgender, and Queer
MDG	Millennium Development Goals
MTCT	Mother-to-Child Transmission
NACP	National AIDS Control Programme
NAPCC	National Action Plan for Climate Change
OST	Opioid Substitution Therapy
PECOS	Population, Exposure, Comparison, Outcome, Study design
PLHIV	People living with HIV and AIDS
PNT	Poverty Nutrition Trap
PPP	Public Private Partnership
PRISMA	Preferred Reporting Item for Systematic Reviews and Meta-Analysis
PTSD	Post-traumatic Stress Disorder
PWUD	People Who Use Drugs
PWID	People Who Inject Drugs
QoL	Quality of Life
SAARC	South Asian Association for Regional Cooperation
SCM	Supply Chain Management

SDG	Sustainable Development Goals
SMI	Serious Mental Illness
SOP	Standard Operating Procedure
SRH	Sexual and Reproductive Health
STI	Sexually Transmitted Infection
TB	Tuberculosis
UNAIDS	The Joint United Nations Programme on HIV/AIDS
UNDP	United Nations Development Programme
WHO	World Health Organization

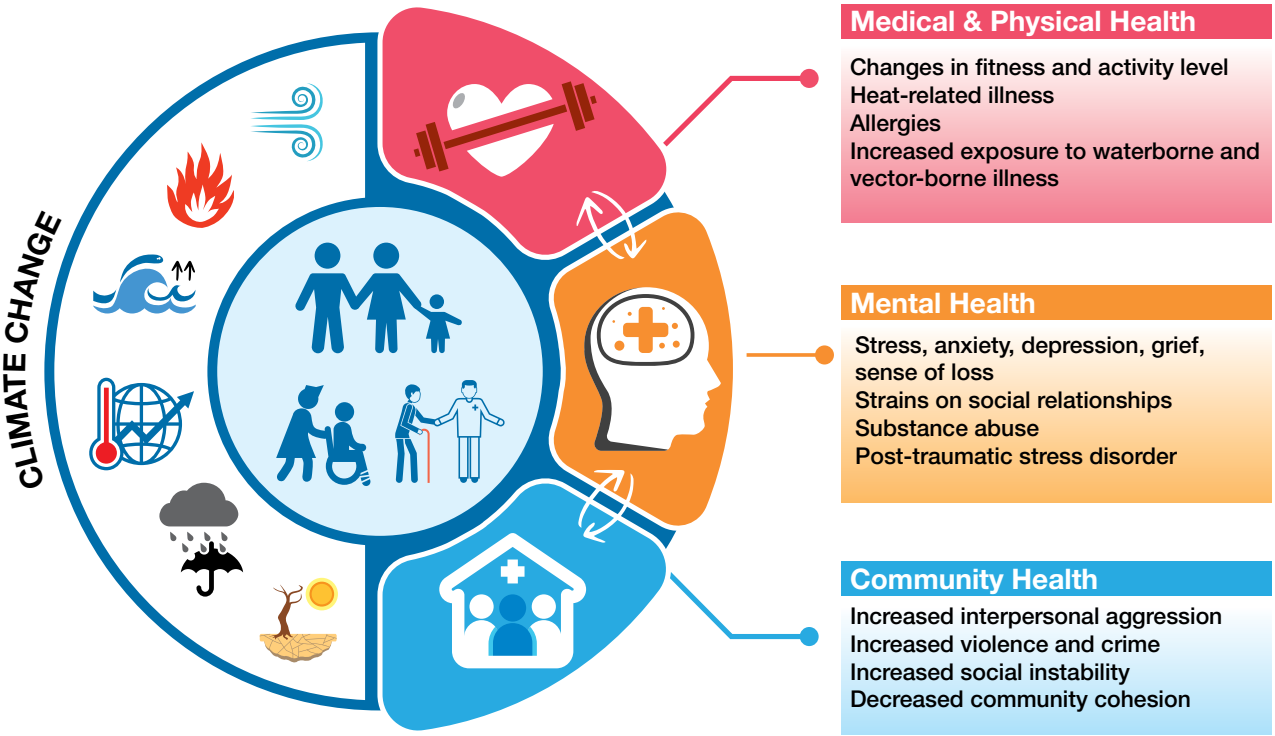
Scope and Limitation of the Study

This comprehensive report has been prepared with the objective to map the available evidences on impact on climate change on HIV responses and identify key research priorities through an evidence gap - map approach. Since the consequences of climate change on prevention and management of HIV is indirect and multifactorial, our efforts are limited by the scarcity of primary studies particularly in India. However, based on available global evidence certain important and cross cutting pathways have been identified such as Food Insecurity, Migration, Service and infrastructure disruption, mental health. All of these may be a consequence of climate change and driver of HIV transmission and responses.

Since any primary data collection was not included in the scope of the study, our study is limited by number of available literature in scientific databases/ public domain but it opens the scope to the various research communities for diving into evidence generation at much deeper level on the foundation of identified research priorities in various pathways between climate change and HIV response.

Introduction

Climate change (CC) manifestations, such as floods, draughts, cyclones, and wild fires, are being gradually felt by billions of marginalized communities, living in areas highly vulnerable to climate change. There is evidence of a dramatic increase in global average temperature, as that in 2022 was about 1.15°C above the 1850-1900 average, and prediction of rise up to 1.8°C, in the coming four years [1]. These climate changes lead to changes in the distribution and occurrence of climate sensitive diseases[2] impacting HIV response. As predicted[3], climate change and related extreme events will significantly increase ill health and premature death. The burden of several climate-sensitive diseases is projected to increase affecting immunocompromised and geriatric population, in particular. Emerging climate-sensitive health risks that is hypothesized is illustrated (Figure-)



Climate changes both due to acute disasters and displacement of population and chronic migration due to crop failure and food insecurity forces to increased sexual occupation as a means of livelihood particularly for women. Compromised mental health augments substance abuse including injecting drug through sharing of needles and syringes. Solo male migration for occupation increases their vulnerability to have multiple partners. All of these eventually lead to increased transmission of HIV.

Studies indicated that[4], climate change may not be directly influencing global HIV response, but the changes that it generates in environmental and social systems eventually impact the whole sequelae of the HIV/AIDS. The epidemic is thought to lead to overuse of natural resources, loss of traditional knowledge, loss of human capacity and labor[5]. The epidemic is also causing significant alterations in the proximal environment, social systems, and human behaviors[6], to produce socio-economic disparities. In this light, environmental justice has emerged as an important lens in assessing the impact of climate change on vulnerable population, including PLHIV[7]. The shift in the framing of HIV, beyond health and human rights, to environmental justice, in recent years, has provided the nudge for focused study on the pathways between climate change and HIV.

Growing evidences suggest that CC-led rise in temperature and disasters is causing increased food insecurity[8], that is intertwined in intense

circle that heightens vulnerability to, and worsen the severity of HIV/AIDS[9]. Climate change and HIV vulnerability is also linked to - (a) heavy rainfall prompted increase in sexually transmitted infection and probable risk of HIV transmission[10]; (b) enhanced drought events initiate the array of risk behaviors, including transactional and commercial sex[11&12], (c) increased ART non-adherence among PLHIV during droughts[13] (d) flood occurrence linked to increase in HIV prevalence among low-literate rural adolescent girls due to trafficking[14], (e) HIV care continuum disruption due to natural disasters[15] are highlighters. Additionally, climate-induced increase in infectious disease attack on PLHIV[16&17]; with noticeable climate migration and displacement[18] tend to impact global HIV response, adversely.

Gender is a cross cutting theme in Climate change and HIV[19], and climate change reflects and reinforces gender disparities[20]. HIV pandemic exposed that gender inequality disproportionately increases vulnerability of men, women, and third gender individuals[21] to HIV/AIDS. Women, in their differential access capacities, empowerment levels[22]; and biological differences are more vulnerable to contracting HIV, at the nexus of climate change, food security and health[23].

Successes in HIV prevention using the risk-reduction approach have been implemented over the past few years[24]. Simultaneously, initiation of rapid antiretroviral therapy (ART) for people identified with the HIV infection is attributable to notable reduction in HIV related mortality globally, as the HIV/AIDS by numbers will indicate.

However, the achievements of HIV/AIDS preventive intervention stand exposed to global climate change[25]. Regionally HIV related morbidity and mortality is poised to increase under HIV and Climate Change Complex (HACC), and the same may exert an immense opportunity cost, diverting resources from public health[26].

Most HIV/AIDS research and initiatives have prioritized behavior change as a means of prevention and treatment, with insignificant emphasis on socio-economic and cultural contexts. We found that malnutrition, non-communicable diseases and mental health CC issues linked to HACC were understudied[27]. Interestingly, many local communities are already adapting to the impacts of climate change on a daily basis. Case studies of their livid experiences can provide important lessons for climate change impact mitigation. The Life course of HIV epidemic to date has also demonstrated that engaging with social justice is core to any successful HIV response, and social science research is critical to understand the effects of race, class, culture, and gender in which epidemic was playing itself.

India is amongst the countries most vulnerable to impacts of climate change (CC). Climate change has already begun to alter growing seasons in India[28] and with almost 50 per cent of Indians working in agriculture and other climate sensitive sectors[29], the damage to productivity and health is substantial[30]. India's population is also vulnerable to sea level rise, with 310 million people inhabiting low elevation coastal zone. Many Indians live in 'climatic hotspots', where changes in climate affect living standards[31]. A recent rapid attribution study indicated notable heatwave related mortality in India[32]. Notably, in the past five years, India's overall global rank in meeting Sustainable Development Goals (SDGs) has slipped behind many of the neighboring SAARC countries[33].

India's overall response to HIV/AIDS was successful in controlling the epidemic and it has been suitably documented[34, 35, 36, 37 38 and 39]. The National AIDS Prevention and Control Policy embarks at adopting a holistic approach, but so far taking cognizance of climate change and its likely impact on HIV response in India is not on policy agenda.

India's vast coastline, measuring 7516.6 kilometers[40], encompasses nine states currently. Again, the drought-prone areas of the country have increased by 57% since 1997[41]; and around 15% of the country's landmass stand prone to hydro-geological hazards[42].Evidences from studies indicated increase of HIV vulnerability among populations in coastal areas during and/or just after natural disaster[43, 44, 45 and 46]; and floods pose major problems to PLHIVs in worsening their health condition, in many of the drought-prone areas[47]. In India, about 0.42 million sq. km or 12.6% of land area, is prone to landslide hazard[48], and 4% of forest cover stand vulnerable to wild forest fires[49]. The fallout of these episodes directly affects vulnerable population, including PLHIVs in their availability of continuum of healthcare services[50 and 51]. Against the backdrop of observable changes to climate this study embarks at identifying pathways through which CC tends to affect HIV response, and identify mitigating approaches through research, program and policies.

Aims and Objective

Aim of present work is to develop a broad framework to identify Research Priorities for mitigating the impact of climate change on HIV response in India through –

- Synthesize the literature on issues associated with HIV/AIDS and Climate Change;
- Identify data and knowledge gap;
- Develop conceptual framework to address the links between Climate Change and its impact on HIV response in India; and
- Suggest next step for basic and operational research for suitable mitigation and adaption to climate change on HIV response.

Materials and Method

The study methods were developed following PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guideline.

This scoping review of published literatures, articles and reports has been performed, using search engine through e-database PubMed and Google Scholar with appropriate search terms. Inclusion of published articles was based on PECOS (population, exposure, comparison, outcome, study design) method criteria. Articles from countries other than India, other than English language, articles describing non-environmentally affected households, and articles with non-socioecological impacts to come under exclusion criteria.

Inclusion Criteria: PECOS (population, exposure, comparison, outcome, study design) framework is used for defining review questions according to the universal method. Any article published in peer-reviewed journals, any reports by the government or authorized and competent non-governmental agencies during the accepted timeline (i.e. January 2003 to July 2023)

Population: The population belongs to the high-risk group and vulnerable population with additional risk behavior as per NACO Case definition, and People Living with HIV AIDS (PLHIV)

Exposure: Climate related events (food insecurity (agriculture, fisheries), drought; landslides, flood/ river bank erosion, air pollution)

Comparison Group: Not relevant to this study

Outcome (expected): Relationship of climate factors to HIV transmission and services via different intermediate determinants.

Study Design: cross-sectional or cohort studies or reviews

Exclusion criteria: Articles from countries other than India, other than English language, articles describing non-environmentally affected households, and articles with non-socioecological impacts to come under exclusion criteria.

Reports are taken from different National and International bodies, are as follows:

1. NACO- National AIDS Control Organization
2. CDC document - Centers for Disease Control and Prevention
3. WMO Press Release- World Meteorological Organization
4. UNEP- United Nations Environment Programme
5. UNAIDS- Joint United Nations Programme on HIV/AIDS
6. UNWOMEN- United Nations Entity for Gender Equality and the Empowerment of Women
7. FAO- Food and Agriculture Organization
8. IPCC- Intergovernmental Panel on Climate Change
9. OECD- The Organization for Economic Cooperation and Development
10. NITI Aayog- National Institution for Transforming India

11. NDMA - National Disaster Management Authority
12. NCERT - National Council of Educational Research and Training
13. Down-to-earth
14. NIDM - National Institute of Disaster Management
15. Population association
16. GSI - Geological Survey of India.
17. FSI- Forest Survey of India
18. BPRD-Bureau of Police Research and Development
19. Cseindia- State of India's Environment
20. CPS-Centre for Policy Studies
21. OXFAM
22. World Bank
23. Global nutrition
24. India-Global Hunger Index
25. Millennium Assessment
26. IMD- India Meteorological Department
27. UNHCR- United Nations High Commissioner for Refugees
28. DPD- District Human Development Report
29. CAG-Comptroller and Auditor General of India
30. DALBERG- Dalberg Global Development Advisors
31. UNFPA: United Nations Population Fund
32. IOM- The International Organization for Migration
33. GHI- Global Hunger Index

Searched was done as per searched terms, as follows:

Pubmed: Search Terms

Filters: from 2003 – 2023
Search: India OR Indian
(Food insecurity) OR (migration) OR (natural calamities) OR (disease outbreak) OR (supply chain) OR (socioeconomic status) OR gender OR sexuality age OR (demographic factors) OR education OR literacy OR occupation OR (medical facility) OR treatment OR therapy OR ARV OR (anti-retroviral) OR (drug availability) OR ART OR (anti-retroviral therapy) OR counselling OR assistance OR guidance OR consultation
Search: (climate change) OR (climate adaption)
Search: HIV OR AIDS
Search: Impact OR result OR relation OR relationship OR related

Our literate search enabled coming across very few studies that attempted to discuss pathway-based impact of environmental changes on HIV/AID but they were contextualized on countries in different geographic location. Nonetheless, essence of those studies, brainstormed by our study team, enabled the identification of pathways that link climate change and HIV/AIDS in India–located in tropical zone but with varied climatic conditions due to holding six major climatic subtypes (Climate regions of India: INFLIBNET Centre: https://ugcmoocs.inflibnet.ac.in). The prime outcome of the process led to the development of study framework as illustrated (Fig.) and subsequently embark at investigating the pathway-based status of CC related impact on HIV/AIDS. Also, premised on the findings of current knowledge gaps, each of the pathway-based implementable research priorities have been proposed.

Pubmed: Search Terms

Filters: from 2003 – 2023
(Food insecurity) OR (migration) OR (natural calamities) OR (disease outbreak) OR (supply chain) OR (socioeconomic status) OR gender OR sexuality age OR (demographic factors) OR education OR literacy OR occupation OR (medical facility) OR treatment OR therapy OR ARV OR (anti-retroviral) OR (drug availability) OR ART OR (anti-retroviral therapy) OR counselling OR assistance OR guidance OR consultation
Search: (climate change) OR (climate adaption)
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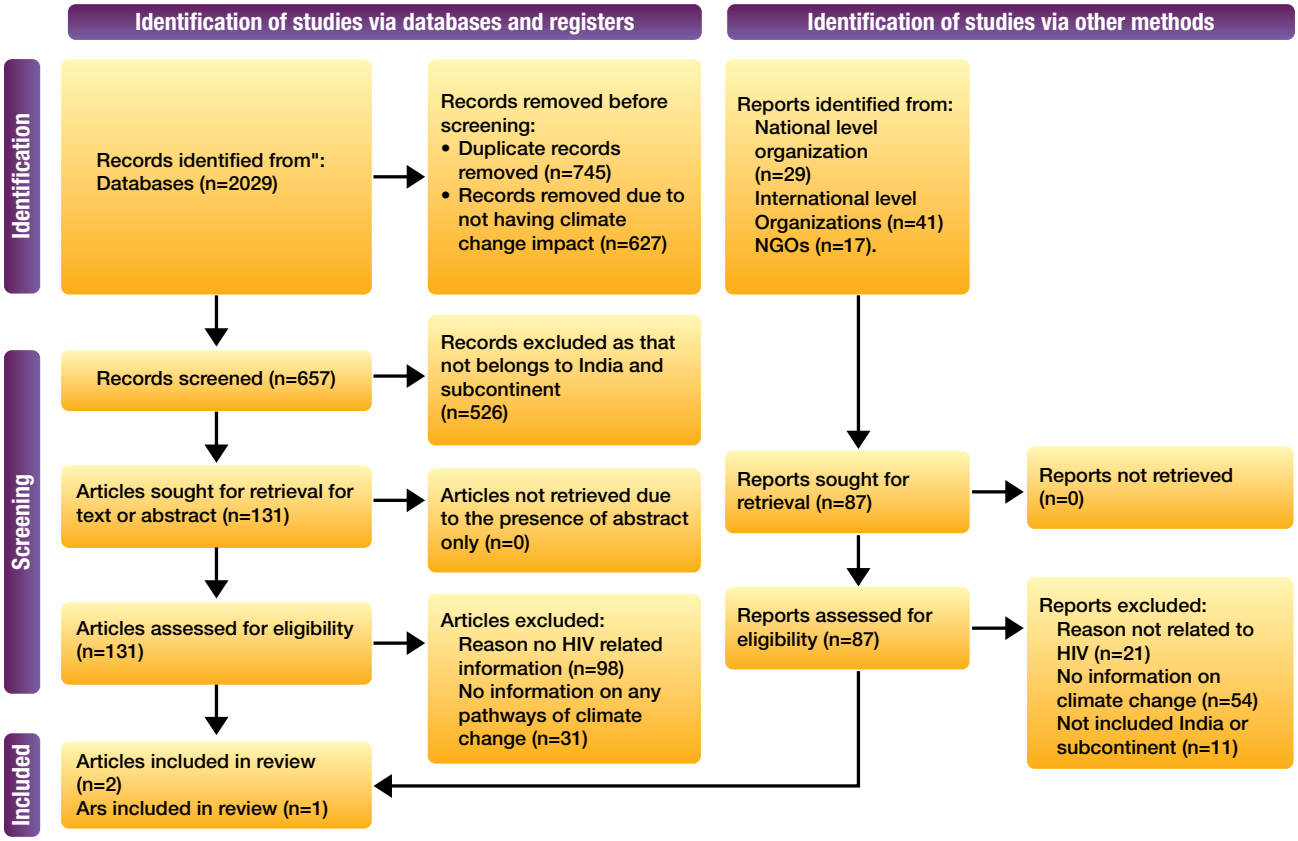
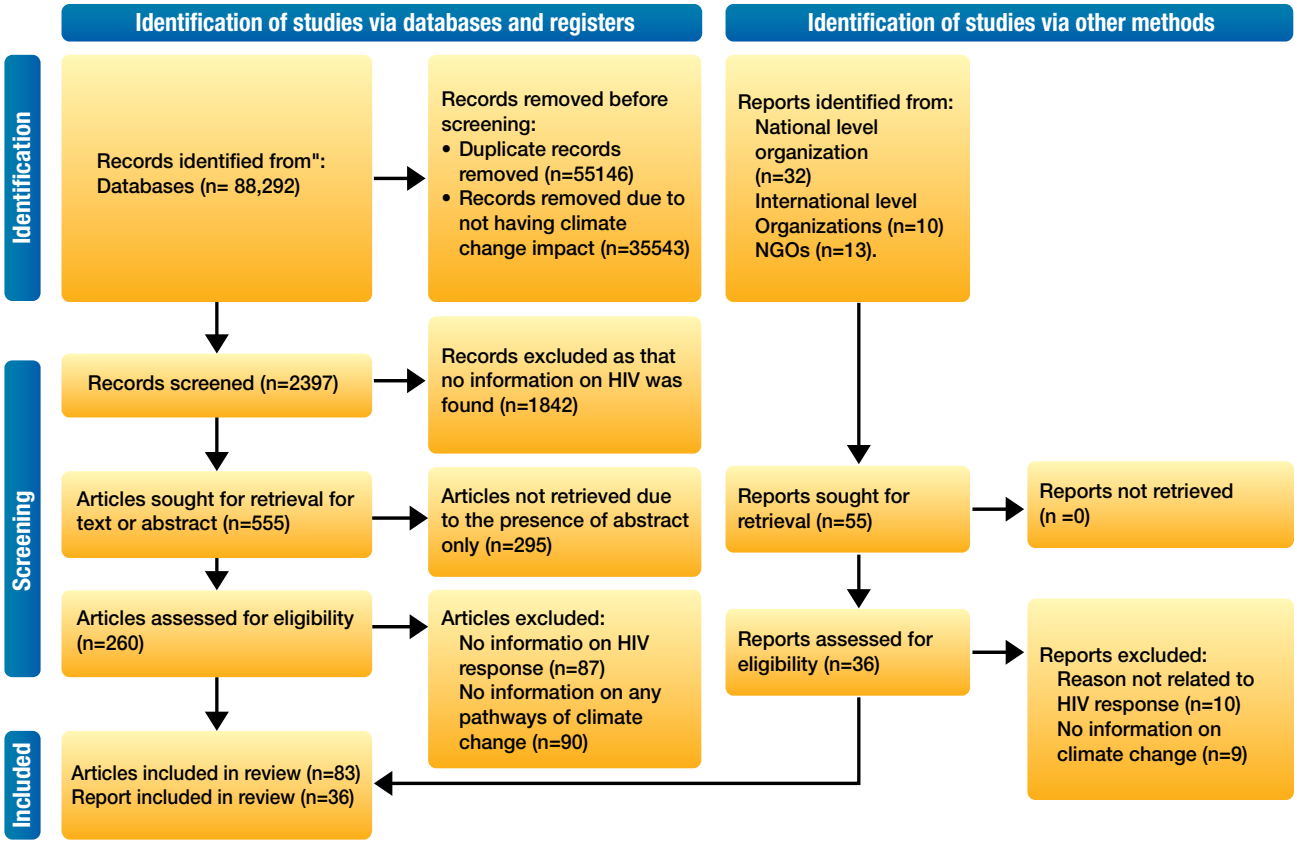
PRISMA Flow Diagram



*Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/registers).
**If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation tools.
From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021,372n71.
doi: 10.1136/bmj.n71. For more information, visit: http://www.prisma-statement.org/

PRISMA Flow Diagram



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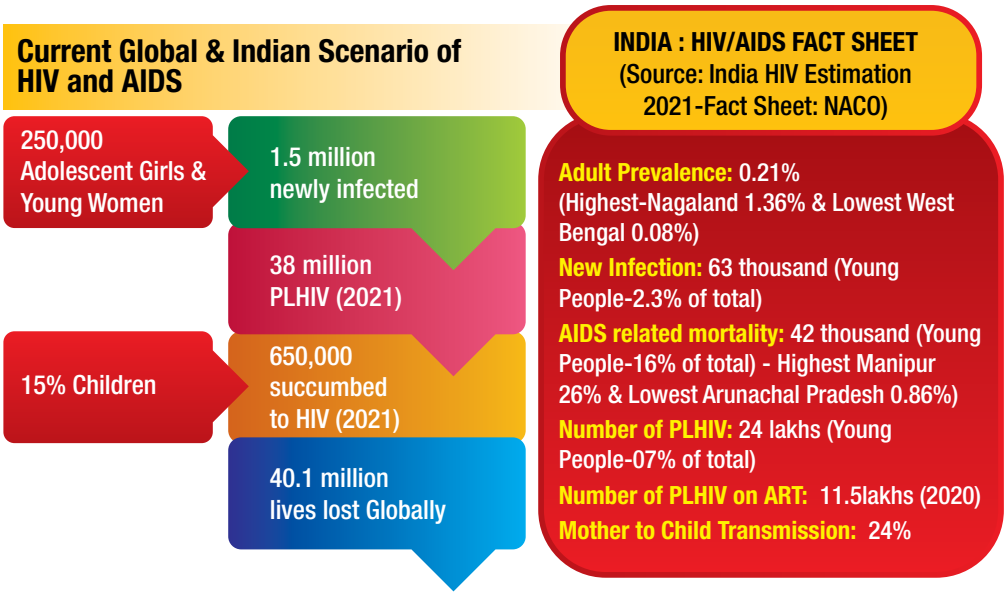
doi: 10.1136/bmj.n71. For more information, visit: http://www.prisma-statement.org/

Subject	Article	Report	Total
Food insecurity	24	9	33
Migration	20	11	31
Syndemic of infectious diseases	10	4	14
Total	**54**	**24**	**78**
HIV and Climate change	12	4	16
HIV and Food insecurity	9	0	9
HIV and Migration	8	8	16
Total	**29**	**12**	**41**

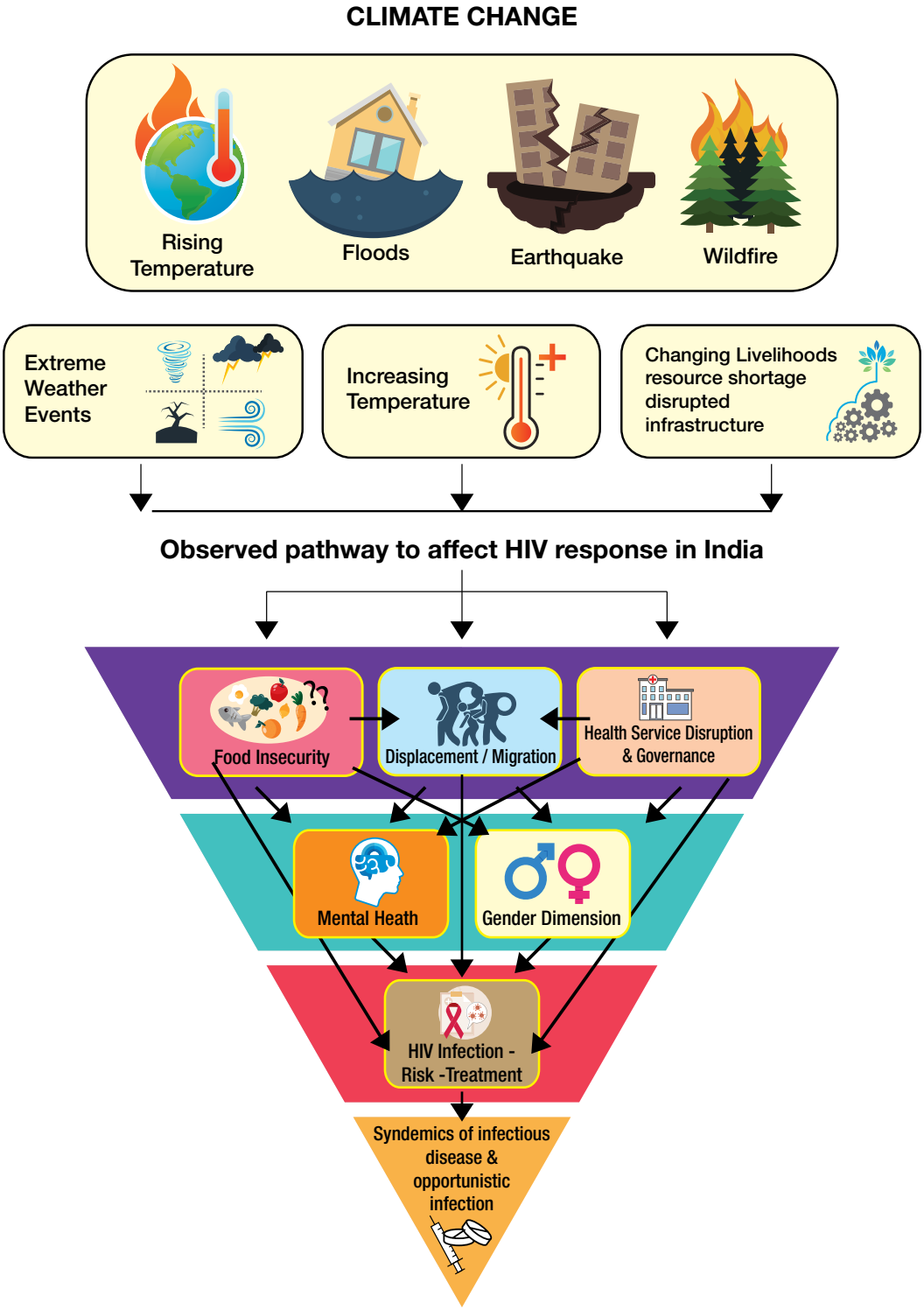
Result of performed searched from e database of published peer review articles and different publish repots by international, national level organization and NGOs are depicted above.

The above table showing different number of articles and reports on the impact of climate change (and its pathways) on HIV are based on global scenario. In India there are few numbers of articles and reports were found, which compelled us to perform search once again same topic on global scenario. These findings will also require to prepare evidence gap map on same topic.

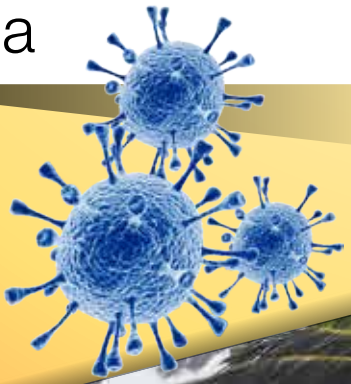
Conceptual study framework hypothesized from the understanding that Climate Change impact on HIV response in India is vertically influenced by Food insecurity resulting from deficits in crop and livestock, fisheries and forestry products, also mediating through mental health and gender issues; with linear linkage with displacement and climate migration pathway. Climate migration, owing to climatic extremities, posited second important pathway, where mental health and gender intermediated to impact HIV outcome. Governance of health system disruption as a result of climate disaster postulated a distinct pathway for overall effectiveness of state-specific HIV preventive intervention and continuum of care services in emergencies, with interceding mental health and gender issues, and linear influencing displacement and migration. The synergism of other Infectious Diseases with HIV conjectured due to immunosuppression associate with disease progression, with social and structural determinants, is illustrated sub-pathway influencing HIV response in India.



Conceptual Framework of the Study



Climate change (CC) food insecurity (FI) and HIV response in India



Climate Change, Food Insecurity, and HIV Response in India

In India, climate change is projected to affect both food security and the livelihoods of a majority of population who depend on climate sensitive sectors as, agriculture, forestry and fishing for livelihood. Production is projected to decline in tropical regions[1]; and India being situated in tropical zone, the aspects of food availability, food accessibility, food utilization and food system stability will be adversely impacted. The same will also have an impact on human health, livelihood assets and food production and distribution channels[2], including production of commercial crops, lack of food grain market, income of the people, availability of drinking water. Other aspects as, education level, level of employment, higher population growth, rapid urbanization shall contribute to aggravate. The climate change, agriculture productivity, food security, and poverty possess causal effect[3] of injury and infection; as people during displacement-led migration are stressed to indulge in risky behavioral practices and consequently to contracting infection. Also, lack of food can lead to power imbalances for girls and women in sexual relationship and result transactional sex, both of which increase an individuals' chance of contracting an infection[4].

In India average food consumption is low as compared to other countries[5], and the same get reflected on the country's standing in global hunger[6] and nutrition indexes[7]. Agriculture and nutrition share a common entry point: "food" containing macro and micronutrients. The common factors contributing to malnutrition in India are poverty, lack of clean drinking water, poor feeding practices, and poor sanitation- all of which can cause both undernutrition and overweight and obesity, as well as diet related noncommunicable diseases. Income loss lead to poor purchasing capacity of inhabitants of flood, cyclone, and drought-prone areas, may led to their dependence on insufficient, unhealthy and unvaried food supplies. These despite India's notable GDP growth in recent years, yet substantial number of people continue to live below poverty line (BPL). Poverty nutrition trap (PNT) is a serious concern which means climate shocks may reduce agricultural productivity and income, causing adverse nutrition and health consequences[8].

Climate change stress on migration is complex, as several economic and sociopolitical factors interplay in between. Emerging scientific evidence implies that climate change-induced food insecurity is influencing the pattern of migration and displacement, even if it is challenging to establish and quantify the monocausal relationship of climate change on human mobility. While displacement and migration brought on by disasters that strike suddenly are obvious, it is often harder to analyze movement patterns caused by slow-onset disasters. Population displacement due to rising seas is taking place in India where fishing communities are gradually incapacitated. It is highly likely that climate change may intensify the current pattern of displacement along the coastal areas of India. Again, rural-urban migration due to chronic climate change also impact the small farmers who are forced to migrate to urban areas in search of non-agricultural jobs and an income. In acute climatic events-led dispersion, migration becomes a compulsion, but in case of slow-onset climate change, migration turn into a sensible adaption strategy for small farmers in India, as per a research study[9] that used a model that projected future changes in spatial distribution of internal population in India with constant ecosystem loss and drought adding new drivers of climate migration. Migrated males and females are often compelled to undertake low-paid, menial and hazardous jobs that can possibly inflict on them physical and mental torture by employers, agents and others. Thus, the migration outcome can cause on individuals mental and physical stress, for triggers of alcoholism, drug use, and other risky behavioral practices[10], and exposed to acquiring STI, HCV, HBV and HIV infection[11]. To reduce 'distress migration' from rural communities, the Government of India has a long history of running safety net and adaptive social protection programmes. However, actual results show that social protection programmes have not yielded desired positive outcome concerning migration in India due operational and administrative issues blocking the pathways.

The potential three-way relationship among CC, FI, and mental health is difficult to establish[12], and one study that attempted to explore in context of droughts[13] found the relationships

were challenging to quantify. But some recently published articles have stated that food insecurity was significantly and positively associated with multiple indicators of psychological distress. A study[14], that reviewed 2104 Gallup World Poll, along with scoping and systematic review of the recent past, stated that food security and psychological distress exists in adults, adolescent and young adults, parents, and individuals with chronic disease, as People living with HIV and Diabetes. These apart, extreme heat exposures have potentiality to cause to aggressive behavior[15], physical as well as psychological exhaustion[16], and distress in work place for workers[17]. Similarly, droughts, floods, rising and sea level can cause mental stress in psychological distress through many mediators, apart from affecting agriculture and food security. India's national project initiated meaningfully for disaster risk reduction and preparing cities to respond to climate risks and address mental health and psychosocial needs, is required to be scaled up in building disaster resilience mindset for vulnerable inhabitants of rural and coastal areas.

Climate change is a potential threat to gender equality in agriculture and food systems, and gender issue is highly connected to FI in India. Women, who play a pivotal role in the food system[18], face barriers in accessing land, financial services, and know-how[19]. Women have a crucial role in converting agriculture products into food and nutritional security for their families. Women are generally responsible for food selection and feeding of children[20]. Gender differences, arising from the socially constructed relationship between men and women, affect the distribution of resources between them and cause many disparities in development outcomes. Besides, women exclusively hold the reproductive roles that includes the care of actual and future workforce of the family. In spite of these attributes, food insecurity among women in India is significant, and a study among 250 women in north India measured food insecurity via household food insecurity access scale found 77.2%% women and 8.7% children food insecure[21]. Low status of women in India, coupled with poverty, early marriage, trafficking, sex-work, migration, lack of education and gender discrimination are some of the reasons why women and girls are more susceptible to contracting STI and HIV infection. There are serious economic and social repercussions associated as the epidemic seems to disproportionately affect women and girls in terms of psychology, society, and the economy[22].

In the gender dimension, poverty, joblessness, and homelessness is also rendering third gender categorized individuals to food insecurity and consequent vulnerability to contracting infection[23]. Transgender people are 13 times more likely to acquire HIV than other population, and that prevalence of HIV is disproportionately higher among adult transgender women than among adult women[24]. Empowering women and rights-based approaches to decision-making can create synergies among household food security, adaptation, and mitigation[25].

The "synergestic" relationship between food insecurity and HIV exist due to positive biological and social interaction in which harmful health effects are intensified[26] and CC adds additional dimensions. Hunger and malnutrition are exacerbated by food and nutrition insecurity, which increases susceptibility to HIV exposure and infection. In settings where subsistence agriculture is the norm, HIV/AIDS directly impact agriculture production and threatens food security by reducing labor available for agriculture production[27]. Observational studies have reported an association between communities suffering poor food security and HIV transmission. Poverty, and the concern for dependents, can drive individual behaviour in ways that place health and safety at risk[28]. These links underscore the need to build bridges between the agriculture and health sector to support rural households where AIDS and hunger are not only a concern, but also a source of concern.

Good nutrition is necessary for the ARV drugs to be effective and, without food, their side-effects can be severe. Among PLHIV, FI has been associated with incomplete viral load suppression[29], lower body mass index (BMI)[30], ART non- adherence[31], poor quality of life, increase opportunistic infection, hospitalization[32], and HIV related mortality[33]. Household water and food insecurity can co-occur to cause poor mental and physical health among PLHIV[34].

Food insecurity among female HIV infected receiving ART was 53% higher than male HIV infected adult[35] and women found facing worst HIV outcome[36]. Studies have found low caloric intake and poor micronutrient increase the rate of transmission of HIV from mother to her baby in India[37]. However, the articles reviewed, had no consistent correlation between food insecurity and the prevalence rate of HIV or AIDS. HIV/AIDS have been found to affect food utilization and

access to food, but there is insufficient evidence to claim it also affects food availability at the macroeconomic level[38].

In the context of knowledge-gap, the literatures reviewed, indicated information gap subsist about the specific mechanisms by which food insecurity influences risk-taking behaviour and consequent vulnerability to HIV transmission in Indian context; and suggested that future research in the context of evaluating the association FI with sexual risk-taking, needle-syringe exchange, mother to child transmission, ART adherence, on authenticated scales, be preferably conducted longitudinally.

Major Supporting Evidence

Sl No.	Authors	Publication Year	Title of the Paper / Article	Highlights
1.	Bajaj et al	2023	CPS: FOOD CONSUMPTION IN INDIA AND THE WORLD	In India average food consumption is low as compared to other countries
2.	India-Global Hunger Index (GHI)	2022		India ranks 107th in the 2022 Global Hunger Index, with a serious hunger level of 29.1, out of 121 countries with sufficient data.
3.	Global Nutrition Report	2022	Country Nutrition Profiles	India is achieving maternal, infant and young child nutrition (MIYCN) targets, but has made limited progress in reducing anemia, low birth weight, exclusive breastfeeding, stunting, wasting, obesity, and achieving diet-related non-communicable disease targets.
4.	UNAIDS, WHO, UNDP	2022	TECHNICAL BRIEF: TRANSGENDER PEOPLE AND HIV IN PRISONS AND OTHER CLOSED SETTINGS	Transgender people are 13 times more likely to acquire HIV than other population.
5.	UNWOMEN	2021	Sustainable food systems and gender equality in the context of climate change and biodiversity conservation	Food systems, crucial for human life and livelihoods, are vulnerable to biodiversity loss and climate change, necessitating a major transformation to ensure food security and a decent life for all.
6.	Lieber et al	2021	The Synergistic Relationship Between Climate Change and the HIV/ AIDS Epidemic: A Conceptual Framework	Climate change and HIV/AIDS are interconnected through food insecurity, infectious diseases, migration, and erosion of public health infrastructure, necessitating future interventions to reduce emissions and invest in adaptation strategies.
7.	Miller	2021	Household Water and Food Insecurity Are Positively Associated with Poor Mental and Physical Health among Adults Living with HIV in Western Kenya	A Kenyan study suggests that addressing both food and water insecurity simultaneously may be more effective in improving health outcomes, particularly among HIV-positive adults.
8.	IFP	2021	AIDS and Maternity in India	This publication explores mother-to-child transmission in India, focusing on HIV/ AIDS women, discussing risks, social complexity, and three transmission routes, suggesting further research in social sciences and public health.
9.	Khan et al	2020	Are migration routes disease transmission routes? Understanding Hepatitis and HIV transmission amongst undocumented Pakistani migrants and asylum seekers in a Parisian suburb	The study examines the risk, exposure, and mobility dynamics of HIV and Hepatitis C and B among Pakistani male migrants and asylum seekers.

Sl No.	Authors	Publication Year	Title of the Paper / Article	Highlights
10.	Myers	2020	Food Insecurity and Psychological Distress: a Review of the Recent Literature	Food insecurity and psychological distress are interconnected health issues
11.	Russomanno et al	2020	Food insecurity and food pantry use among transgender and gender non-conforming people in the Southeast United States	The study reveals that 79% of Transgender and gender non-conforming individuals in the Southeast US experience food insecurity, highlighting the need for multi-level public health solutions.
12.	Boneya et al	2019	The effect of gender on food insecurity among HIV-infected people receiving anti-retroviral therapy: A systematic review and meta-analysis	The high-income countries showed weakest associations between gender and food insecurity than those conducted in low- and middle-income countries.
13.		2018	Groundswell: Preparing for Internal Climate Migration	Climate change is expected to drive millions of people to migrate within their countries by 2050, particularly in Sub-Saharan Africa, South Asia, and Latin America, necessitating significant climate and development measures.
14.	Derose et al	2018	Severe Food Insecurity is Associated with Overweight and Increased Body Fat among People Living with HIV in the Dominican Republic	The food insecurity significantly increases BMI and body fat among HIV-infected adults, highlighting the need for integrated nutrition education and sustainable approaches.
15.	Elisabeth et al	2017	Food insecurity, sexual risk behavior, and adherence to antiretroviral therapy among women living with HIV: A systematic review	Food insecurity was associated with increased sexual risk through transactional sex and inability to negotiate safer sex. Hunger and food insecurity were barriers to ART initiation/adherence
16.	United Nation Human Right	2015	The Right to Adequate Food	Over one billion people are undernourished, with two billion lacking essential vitamins and minerals. States commit to halving undernourished people by 2015.
17.	Powers et al	2015	Lack of association between drought and mental health in a cohort of 45–61 year old rural Australian women	The mental health did not vary with drought conditions for rural women or vulnerable sub-populations.
18.	Singer et al	2015	Does Food Insecurity Undermine Adherence to Antiretroviral Therapy? A Systematic Review.	Food insecurity negatively impacts antiretroviral therapy (ART) adherence,
19.	Wang et al	2014	The Role of Women in Food Provision and Food Choice Decision-Making in Singapore: A Case Study	The impact of women's shift in childcare on children's nutrition in Singapore, highlighting the need for work-family policies and child health considerations.

Sl No.	Authors	Publication Year	Title of the Paper / Article	Highlights
20.	Friel et al	2014	The impact of drought on the association between food security and mental health in a nationally representative Australian sample	In all drought exposure categories, people missing meals due to cost reported higher psychological distress than those not missing meals.
21.	Weisera et al	2012	Food insecurity is associated with morbidity and patterns of healthcare utilization among HIV-infected individuals in a resource-poor setting	Severe food insecurity was associated with worse Physical Health Summary (PHS), PHS, opportunistic infections, and increased hospitalizations
22.	FAO	2011	FAO, The State of Food and Agriculture (2011)	Women comprise, on average, 43 percent of the agricultural labour force in developing countries, ranging from 20 percent in Latin America to 50 percent in Eastern Asia and sub-Saharan Africa.
23.	Kjellstorm et al	2011	Climate Change, Workplace Heat Exposure, and Occupational Health and Productivity in Central America	Climate change is increasing heat exposure in Central America, particularly for working people. Heat stress at work is a real threat, and climate change is likely to worsen conditions, highlighting the need for solutions.
24.	FAO	2011	FAO, The State of Food and Agriculture (2011)	Women comprise, on average, 43 percent of the agricultural labour force in developing countries, ranging from 20 percent in Latin America to 50 percent in Eastern Asia and sub-Saharan Africa.
25.	Hertel et al	2010	The Poverty Implications of Climate-Induced Crop Yield Changes by 2030	Climate change could significantly impact agricultural production, economic livelihoods, and poverty incidence in poor countries, necessitating a comprehensive understanding of climate impacts by 2030.
26.	Byron et al	2010	Local Perceptions of HIV Risk and Prevention in Southern Zambia	The report examines HIV prevention strategies in sub-Saharan Africa, highlighting challenges in implementation and the need for increased focus on local risk behavior, customs, gender norms, and resource access.
27.	Frega et al	2010	Food insecurity in the context of HIV/AIDS: A framework for a new era of programming	This paper explores the link between food insecurity and HIV/AIDS, proposing interventions to promote food security, provide antiretroviral treatment, and limit risk exposure.
28.	World Bank	2009	World Bank, 'Gender in Agriculture Sourcebook', Washington, D.C., 2009	Gender equality is highly connected to Food linsecurity in India
29.	Weiser et al	2009	Food Insecurity is Associated with Incomplete HIV RNA Suppression Among Homeless and Marginally Housed HIV-infected Individuals in San Francisco	Food insecurity affects half of HIV-positive urban poor, affecting viral suppression. Ensuring food access is crucial for public health HIV programs serving impoverished populations.

Sl No.	Authors	Publication Year	Title of the Paper / Article	Highlights
30.	Weisera et al	2009	The association between food insecurity and mortality among HIV-infected individuals on HAART	Food insecurity, a risk factor for mortality in ART-treated individuals, particularly those underweight, necessitates the integration of innovative strategies into HIV treatment programs.
31.	Brown	2008	Climate. Food security under climate change	Climate change is predicted to significantly impact agricultural and food systems, potentially reducing crop yields and affecting global food security in the coming decades.
32.	Bailey	2008	Culture, Risk and HIV/AIDS among Migrant and Mobile Men in Goa, India	HIV/AIDS and migration do not have a linear, cause-effect link but they are known to be linked laterally.
33.	PRB	2007	Understanding How HIV/AIDS, Agricultural Systems, and Food Security Are Linked	The UN MDGs aim to address hunger and HIV/AIDS, but progress is needed to meet the 2015 hunger goal, with undernourishment and HIV/AIDS patient numbers increasing.
34.	Epstein et al	2006	Thermal comfort and the heat stress indices	Thermal stress affects productivity, health, and environmental tolerance, with complex indices like Wet-Bubble Globe Temperature and Discomfort Index being suggested as universal heat stress indices.
35.	McKay et al	2006	Measuring Food Insecurity in India: A Systematic Review of the Current Evidence	The potential for an Indian-specific food security measure to better understand and address India's high prevalence of malnutrition and food insecurity.
36.	Pradhan et al	2006	GENDER impact of HIV and AIDS in India	The study assesses the burden of care, health-seeking behavior, and attitudes towards PLWHA in India, highlighting the severe economic and social impacts of HIV and AIDS.
37.	ILO	2005	HIV/AIDS and poverty: the critical connection	HIV/AIDS is a significant cause and outcome of poverty in resource-poor settings, affecting livelihoods and social and economic conditions, highlighting the complex interplay between the two.
38.	Anderson	2001	Heat and Violence	The heat hypothesis suggests that high temperatures increase aggression, potentially leading to increased violent-crime rates, and improved climate controls in institutional settings may mitigate these issues.

Climate Migration and HIV response in India

Climate change, a driving force of migration that is becoming more powerful, continues to cause millions of people globally to leave their homes every year. The 2021 global report indicated that 59.1 million people were displaced due to cyclones and floods worldwide[1]. India is the fourth worst-affected nation globally when it comes to forced migration brought on by climate change, recently connotated as Climate Migration[2]. Climate migrants in India can be divided into two types, first, those who are compelled to relocate from rural to urban regions as a result of climate disasters in their original locations. Second, people leaving coastal areas due to slow sea level rise or an increase in the frequency of climate risks in coastal districts. Migration in India can happen due to several socio-economic and structural factors, as well. The emerged situations hold grave consequences for the poor and marginalized, with the forecasted increase in the frequency of climate hazards set to impact them sooner. There are ripple effects of such hazards that can have a long-term impact on their lives, making recovery difficult. However, very few studies have tried to distinguish between migration caused due to climate stresses and other factors.

Climate vagaries and unwarranted disasters cause infrastructural damages[3], unpredictable rainfall patterns cause floods and droughts[4], accelerated sea level rise[5], and soil salinity[6], force people to flee to safer areas, causing on them considerable mental agony and stress[7]. Climate induced rapid-onset disasters cause food/water shortage and loss of home and commotion[8], and slow-onset such as droughts are like a “silent poison” in India as a rising number of people end up migrating to survive. The situation leads to internal displacement that force people to leave their homes but relocate in another place within the country. According to latest report indication[9], India recorded the fourth largest disaster displacement, and had 631000 internally displaced people till 2022, with 237 disaster events recorded. However, estimating the number of internally displaced people in India is problematic. India has a national framework to protect people displaced due to development and conflict, but no records on disaster-induced displacement exist[10]. Migration process leaves hundreds of thousands of people vulnerable to forced labour or exploitative working conditions and risk of being trafficked. As per the report[11], of missing women and girls, apprehended to be trafficked, indicated three states as Maharashtra, West Bengal and Madhya Pradesh topped with missing women data.

When disaster strikes suddenly, migration decisions are made in different ways than in other less urgent situations, such as searching for economic opportunities. During sudden-onset disasters, people often make decisions quickly and under compulsion[12]. The circumstances and contexts of communities and households become important factors in understanding the resulting displacement[13], including the speed of onset of the disaster (both in terms of its rate of onset and the ability of those affected to perceive the risk and adapt in anticipatory fashion)[14]. Also, the household’s assets; access to land and natural resources; community assistance; social networks[15]; aid response; and likelihood of recurrence[16] are additional contributing factors. The scale of the resulting movement may be large or small depending on the type of disaster[17]. For example, sudden-onset of hazards tend to generate different sorts of mobility, often resulting in migration “swirls”—a mix of short-term and longer-term out-migration and, at times, sudden influxes of migrants into affected areas to help rebuild[18], as emerging literature suggest that within existing migration system, recovery migration occours, when displaced residents of the disaster-affected area return and new in-migrant arrive. Slow-onset events, on the other hand, normally do not generate immediate changes in existing migration patterns[19].

The forced migrations, both in transit and at destination, are faced with a variety of health issues[20], and existing health problems, before displacement[21], add to the intensity. Studies have shown an association between forced migration and depression, post-traumatic stress disorder (PTSD)[22], and substance use disorders[23], with greater risk of sexual exploitation, human trafficking and sexual and gender-based violence[24]. Disaster and human trafficking emerge concurrently[25], as in the case of Sundarban in West Bengal to cite[26].

Gender is at the heart of all debates about the causes and effects of migration, both forced and voluntary. It is acknowledged that a person's sexual orientation, gender identity, and gender conformity all contributed to the state of migration[27]. The migration rate of women in India has been considerably greater than that of males for decades. A latest survey in India[28] found that female migration rate was 47.9%, which is 37.2% points greater than males. Earlier studies on migration show that female migration entails a short move and that for the purpose of marriage. However, some subsequent studies indicated that women migration is more for economic reasons. Female migration is largely determined by a number of socio-economic factors[29] and is primarily a response to real and perceived spatial inequalities in socio-economic opportunities that are themselves the result of uneven sectoral and regional development. It is evident from various case studies that women's migration is now taking place increasingly for employment purposes[30], because technological developments in agriculture have displaced many women from agricultural work. Women may be compelled to migrate owing to their poor economic conditions[31], and due to the emerged pull factor of gender segregated labour markets in export processing zones and garment industries, both in informal labour market[32]. Migration process, evidently gendered, has a distinct impact on women and the third gender individuals[33]. Migrant women face health hazards on variables, including maternal health, antenatal care (ANC), anemia prevalence, reproductive health[34], and occupational health issues[35]. Additional threat of gender-based violence, both on women[36] and third gender[37] individuals, inflict on them physical and mental harms and expose them to acquiring infection. A cross-sectional epidemiological study conducted in a district in Maharashtra[38] among migrants, found incidences of HIV infection was higher among female migrants (infection rate stood 2.96% as compared to 0.77% among male migrants), and remarked that female migrants faced higher vulnerabilities and risk of HIV infection. Thus far, epidemiological studies are found not focused on migrant women and gender-specific issues that confer additional risk upon migrant women, and their partner.

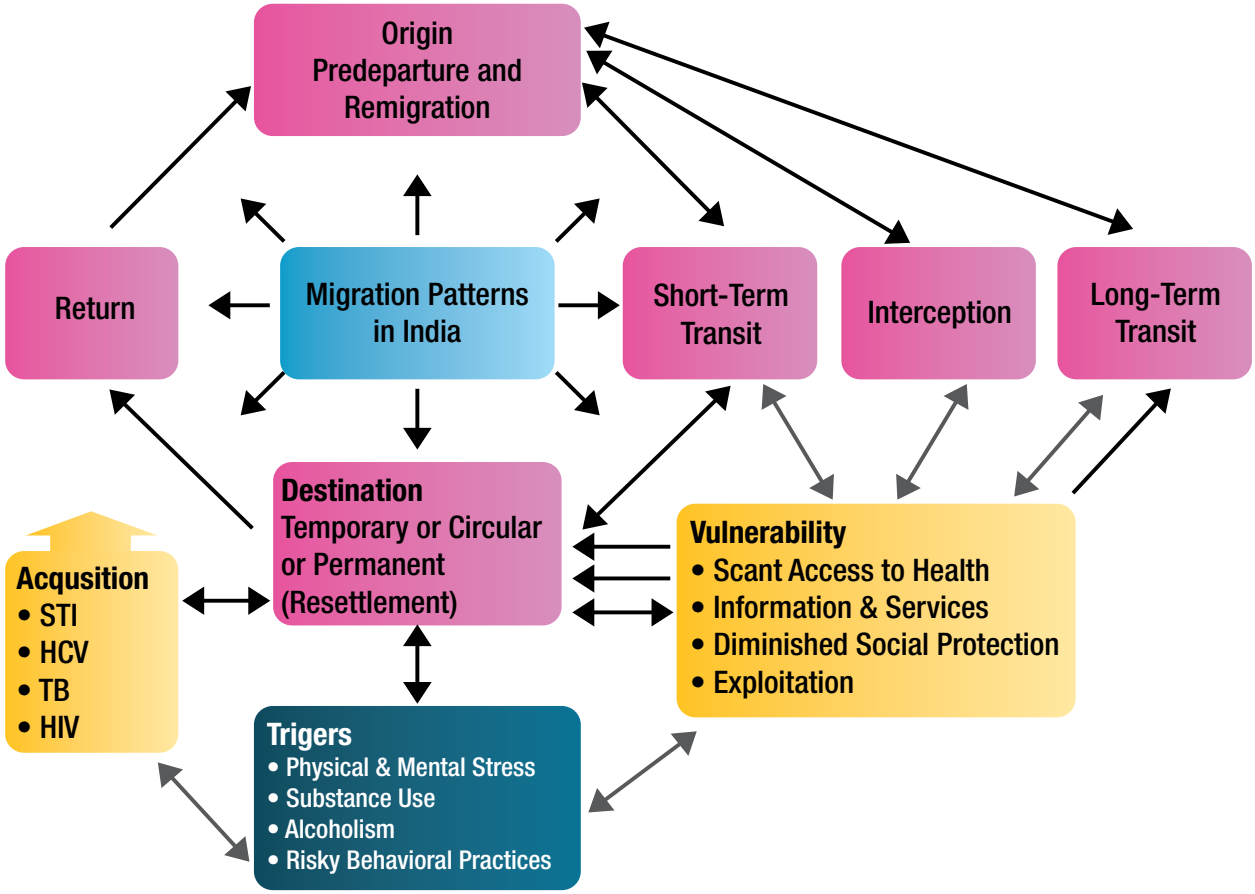
The structure of social protection in India makes it very difficult to design social protection schemes that are suitable for migrants. There are a large number of social protection schemes which are designed, funded and implemented by different levels of government. The Central Government has limited control over social protection (39). The portability of Health Insurance and Public Distribution System is not feasible as those are issued to families; and individuals, in course of migration, leave those for families to avail services at origin. Again, migrant workers are not able to access subsidies for food and cooking fuel as the National Food Security Act does not hold additional focus on migrant communities. Migrant workers and their families evidently have limited coverage and access to social protection[40]. Circulatory or seasonal migrants, and lower-income rural-urban migrants are particularly disadvantaged in terms of access to social protection that is both universal and portable. The public provision in urban destinations, and access to justice tend to elude these migrants, while urban public health systems continue to be disconnected from mobile community needs. Migrants have to depend on private medical practitioners and payout considerably for the treatment. The treatment seeking process bring upon them significant out-of-pocket expenditure[41]. However, many social protection programmes in India are evolving in a rights-based direction, which provide a positive vibe in the direction. Again, migrant workers as defined under NACP and registered with targeted intervention programme based on their risk for HIV, are provided free systematic treatment, and at-cost medicine supplies, together with STI and HIV preventive services[42]. The NACP for migrants aims to cover, its mapped, 8.64 million temporary, short duration migrants -considering them crucial group because of their 'mobility with HIV'[43].

HIV vulnerability does not corelate directly with migration[44], but significant correlation between migration and increased sexual risk behaviors[45] and inter alia contracting HIV[46] have been established. There is a complex interconnection between migration, the commercial sex locations and infectious diseases[47]; for reasons of which commercial sex zones tend to come up in locations where there are large number of circular migrants, such as cities, border crossing points, construction and mining sites, plantations, tourist destinations and transport corridors. Studies have indicated that unprotected non-spousal sex, common among migrant workers[48], and among male out-migrants[49] expose them to increased risk of contracting HIV infection. Circular migration is considered as the bridge for spread of HIV from high prevalence urban locations to rural India. There is a significant body of evidence for the association between circular or seasonal labor

workforce migration and HIV risk[50], consequent upon which circular or seasonal migrants have been viewed epidemiologically as a potential bridge population transmitting infection from a high-prevalence group to individuals who would otherwise be at low risk of infection[51]. On the whole, internal migration in India is thought to contribute to the spread of HIV epidemic in high out migration states in India where the prevalence of HIV found notably higher than the national prevalence rate 0.22%[52].

Drawing from the discussions above, it can be observed that there is extant literature linking climate change and migration and there are studies which link migration and HIV. However, empirical studies establishing direct linkage between climate change, migration and HIV are absent in the Indian context. Hence, there is necessity for interdisciplinary research on the links between climate change, migration and HIV for developing suitable responses to halt the epidemic spread in India.

Migration & Vulnerability to HIV Acquisition



Major Supporting Evidence

Sl No.	Authors	Publication Year	Title of the Paper / Article	Highlights
1.	UN	2023	Sustainable development goal summit	In 2018 alone, 17.2 million new displacements associated with disasters in 148 countries and territories were recorded (IDMC) and drought displaced 764,000 people in Somalia, Afghanistan and several other countries.
2.	Ghosh	2023	District Human Development Report	Post-lockdown, many impoverished families are enticed into child marriage, often leading to their daughters' trafficking to other states.
3.	Prasad et al	2023	Awareness of the Ayushman Bharat-Pradhan Mantri Jan Arogya Yojana in the Rural Community: A Cross-Sectional Study in Eastern India	Every two out of three rural individuals and three out of every four eligible participants were aware of the AB-PMJAY scheme, while the level of utilization was found to be very low at 1.3%
4.	IPCC	2022	Chapter 4: Water: Climate Change 2022 Impacts	Currently, roughly Half of the world's 8 billion people face severe water scarcity, with 44% of disasters being flood-related since the 1970s, leading to 60% of adaptation interventions.
5.	IDMS	2022	Internal Displacement Monitoring Centre	India records some of the highest numbers (6, 31,000 As of end of 2022) of internal displacements in the world every year, the vast majority of them triggered by disasters.
6.	NACO	2022	Migrant Intervention Strategy for National AIDS Control Organisation	To reduce HIV prevalence from 2.6% to less than 0.5% among migrant population
7.	Yarwood et al	2022	LGBTQI + Migrants: A Systematic Review and Conceptual Framework of Health, Safety and Wellbeing during Migration.	This review examines transit health risks for LGBTQI+ migrants, identifying discrimination, violence, coping, mental health, and physical/sexual health issues, as well as healthcare barriers.
8.	CANSA	2021	CLIMATE-INDUCED DISPLACEMENT AND MIGRATION IN INDIA	ActionAid and Climate Action Network South Asia predict 37.5 million will still be displaced people by 2030 and 62.9 million by 2050, with India alone facing 45 million migrations due to climate disasters.
9.	WHO	2021	Mental health and forced displacement	There were an estimated 272 million international migrants in 2019. Refugees, asylum seekers and irregular migrants are of special concern and need protection and support.

Sl No.	Authors	Publication Year	Title of the Paper / Article	Highlights
10.	Sankalak	2021	Status of National AIDS Response	Nationally, 23.19 lakh people are estimated to be living with HIV/AIDS, with adult prevalence at 0.22% in 2020, including 81 thousand children. NACO has done considerable research to identify migration corridors across the country where the greatest movement of migrants takes place between villages/districts and cities.
11.	CDC	2020	Human Trafficking in the Wake of Disaster	Disasters increase vulnerability to human trafficking, a public health concern, particularly among migrants, refugees, homeless youth, and those transitioning out of child welfare systems.
12.	INSTITUTE FOR HUMAN DEVELOPMENT	2020	Vulnerable Internal Migrants in India and Portability of Social Security and Entitlements	This paper examines India's social protection measures for internal migrants, focusing on seasonal and circular migrants, and the impact of the government's unique identity number-based registration.
13.	ILO	2020	Road map for Development of Policy Framework for the Inclusion of Internal Migrant Workers in India	India's migrant workers significantly contribute to economic growth, often living in informal sectors. Government and stakeholders should develop policy frameworks, universal social protection, and strengthen industries employing them.
14.	NCB	2019	Report on Missing Women and Children in India	This study analyzes missing person's data from 36 States/UTs to identify areas prone to trafficking, including women and children. It reveals that low education, low employment prospects, and lack of opportunities contribute to these cases, with some returning unharmed.
15.	Chowdhury et al	2018	Vulnerabilities and risk of HIV inection among migrants in Thane district, India	A study in Maharashtra, India, reveals female migrants face higher HIV infection risks due to factors like alcohol consumption, access to bars, and brothel history.
16.	Chinchmalatpure A R.	2017	Reclamation and Management of Salt Affected Soils for Increasing Farm Productivity and Farmers' Income	Salt-affected soils require reclaim and management using specific technologies, involving stakeholders like farmers and public institutions for expansion, adoption, and awareness about available technologies.
17.	WHO	2016	Forcibly Displaced: Toward a Development Approach Supporting Refugees, the Internally Displaced, and Their Hosts	UNHCR report highlights Syrian refugee crisis as a global challenge, emphasizing collective action and sustainable growth for refugees, internally displaced persons, and their hosts.

Sl No.	Authors	Publication Year	Title of the Paper / Article	Highlights
18.	Curtis et al	2015	Recovery Migration After Hurricanes Katrina and Rita: Spatial Concentration and Intensification in the Migration System	Hurricanes Katrina and Rita disrupted Gulf of Mexico coastline counties, affecting migration systems and potentially causing more intense storms, impacting population recovery in disaster-affected areas.
19.	Abdulkader et al	2015	HIV-Risk Behavior Among the Male Migrant Factory Workers in a North Indian City	The study revealed that 21.5% of male migrant factory workers in India experienced non-spousal sexual intercourse in the last year, with 60% not using a condom.
20.	Balajinaika	2014	Lessons from African Normative Response to Internal Displacement: A Way Forward for South Asia.	The African Union Convention effectively addresses internal displacement issues, but the Asian region lacks normative and institutional mechanisms to safeguard IDPs' interests.
21.	McLeman	2014	Climate and Human Migration: Past Experiences, Future Challenges	Climate change is predicted to lead to millions of environmental refugees, impacting migration patterns and behavior. This book reviews past migrations, predicts future migrations, and offers policy options.
22.	IOM	2014	Human Mobility and HIV	The IOM is implementing HIV projects to promote health and assist migrants and mobile populations, addressing risks, vulnerabilities, and policymakers' concerns related to HIV and population mobility.
23.	Hadgkiss and Renzaho	2014	The physical health status, service utilisation and barriers to accessing care for asylum seekers residing in the community: a systematic review of the literature.	The study explores the health issues and healthcare utilization of asylum seekers in high-income countries, revealing complex health profiles, higher healthcare utilization, and significant barriers to care.
24.	Srinivasan & Ilango	2013	Occupational health problems of women migrant workers in Thogamalai, Karur District, Tamil Nadu, India	The study explores the occupational health issues faced by migrant women workers, including low wages, health hazards, sexual exploitation, and denial of fundamental rights.
25.	Saggurti et al	2012	Male Out-Migration: A Factor for the Spread of HIV Infection among Married Men and Women in Rural India	The study reveals that male out-migration significantly increases HIV prevalence in rural India, particularly among men with migration history and women with migrant husbands.
26.	Saggurti et al	2012	Male migration/mobility and HIV among married couples: cross-sectional analysis of nationally representative data from India	The study reveals a higher likelihood of HIV infection in migrant-mobile Indian married couples, emphasizing the need for prevention and transmission efforts.

Sl No.	Authors	Publication Year	Title of the Paper / Article	Highlights
27.	Renaud et al	2011	A Decision Framework for Environmentally Induced Migration	Environmental change impacts ecosystems, communities, and human migration. A decision framework categorizes stressor-related migration based on circumstances and coping capacities, aiding agencies in supporting displaced or migratory individuals.
28.	Zimmerman et al	2011	Migration and health: a framework for 21st century policy-making	Policy-making on migration and health can be effective when coordinated across borders and policy sectors, addressing the multiple phases of migration and providing health intervention opportunities.
29.	Mahapatra	2010	Patterns and Determinants of Female Migration in India: Insights from Census	The study reveals that economic factors significantly influence female migration in India, shifting from social to economic reasons, despite the underrepresentation of economic factors in migration research.
30.	Situation Report (International migration in south and south-west asia)	2010	Migration and HIV and AIDS	Migration and infectious disease spread are interconnected, with South and South-West Asia having the second highest HIV prevalence after sub-Saharan Africa, with India, Iran, Pakistan, and Nepal having the highest numbers.
31.	Naik and Asmita	2009	Migration, Environment and Climate Change: ASSESSING THE EVIDENCE	The book provides a comprehensive understanding of the complex relationship between migration and climate change, addressing key issues such as conceptualizing the relationship, data challenges, migration trends, and policy responses.
32.	Philip	2008	Natural Disasters and the Risk of Violent Civil Conflict	The study explores the impact of natural disasters on violent civil conflict risk in low- and middle-income countries, emphasizing the need to mitigate climate change risks through social variables such as migration, agricultural and economic decline, and the weakening of institutions.
33.	McLeman & Smit	2006	Migration as an Adaptation to Climate Change.	The article presents a model examining population migration as an adaptive response to climate change risks, based on vulnerability, exposure to risk, and adaptive capacity theories.

Sl No.	Authors	Publication Year	Title of the Paper / Article	Highlights
34.	Hunter	2005	Migration and Environmental Hazards	This paper reviews research on the association between migration and environmental hazards, highlighting that environmental factors influence migration decisions, particularly among vulnerable populations, and risk perception mediates these associations.
35.	Porter and Haslam	2005	Predisplacement and postdisplacement factors associated with mental health of refugees and internally displaced persons: A meta-analysis.	The meta-analysis indicates moderately poorer psychological outcomes among refugees, particularly those in institutional accommodation, restricted economic opportunities, internally displaced, or unresolved conflict.
36.	Fazel and Wheeler	2005	Prevalence of serious mental disorder in 7000 refugees resettled in western countries: a systematic review.	A survey reveals 13 million refugees worldwide, including former ones, are at higher risk of developing post-traumatic stress disorder, major depression, or psychotic illnesses, with 9% of adult refugees diagnosed.
37.	UNFPA	2004	Violence against Women in India	Every day: 337 case of crime against women are reported, 42women are raped and 18 caseof dowery death occure.
38.	UNHCR	2003	Sexual and gender-based violence against refugees, returnees and internally displaced persons	This study aims to develop strategies to address survivors of sexual and gender-based violence, including women empowerment, health services, and response action, due to the humanitarian crisis.
39.	Brock et al	2003	Public Response to a Tornado Disaster: The Case of Hoisington, Kansas.	This study reveals that disasters do not always cause out-migration, emergency aid can compensate for damage, and some arguments against relief provision may not be valid for all countries.
40.	Hazra et al	2002	Sea Level and associated changes in the Sundarbans	The Sundarbans island system, which relies on mangrove forests for livelihood, is also facing rapid degradation and environmental stress, potentially leading to large-scale migration.
41.	Kapadia-Kundu & Kanitkar	2002	Primary healthcare in urban slums.	The study examines the inadequate healthcare system in urban slums of Maharashtra and the disparities in healthcare delivery between rural and urban areas.
42.	Aral	2000	Behavioral aspects of sexually transmitted diseases: core groups and bridge populations.	Understanding sexual behavior patterns and risk factors is crucial for effective STI prevention, especially in core groups and bridge populations like men in certain occupations.

Sl No.	Authors	Publication Year	Title of the Paper / Article	Highlights
43.	Toole and Waldman	1997	The public health aspects of complex emergencies and refugee situations	Armed conflict-affected populations face severe public health consequences due to displacement, food scarcity, and health service collapse, necessitating effective measures like violence protection, food rations, and maternal and child health care.
44.	Lurie et al	1997	Migrancy and HIV/ STDs in South Africa–a rural perspective.	The proposed intervention in a mining center near Johannesburg should target not only mineworkers but also broader communities surrounding the goldmines, as addressing migration is crucial.
45.	Shanti	1991	Female Labour Migration in India: Insights From NSSO Data	The study explores the employment-oriented migration of females in India, revealing a significant increase in post-migration work participation and independent migration due to employment opportunities in export industries.
46.	Conell	1984	Status on subjugal women Migration and Development in the South Pacific. International Migration Review	Limited research on South Pacific migration, particularly women's migration and its impact, highlights the need for more comprehensive information, particularly in Melanesia and Papua New Guinea.
47.	NACO	Retrieved 22/9/2023	TIs for Bridge Population-National AIDS Control Programme	The NACP for migrants aims to cover 8.64 million temporary, short-term migrants, a crucial group due to their HIV mobility.
48.	IOM	Retrieved 22/9/2024	Gender and Migration	Gender significantly influences migration, requiring IOM's advocacy for equal rights, combating discrimination, understanding migration trends, responding to social services, ensuring diversity, and addressing gender roles and relations.
49.	MoSPI	Retrieved 22/9/2025	Periodic Labour Force Survey	The migration rate of women in India has been considerably greater than that of males for decades
50.	UN Women explainer	Retrieved 22/9/2025	How migration is gender equality issue	Half of the world's 272 million migrants, including women, are agents of change and leaders, contributing economically and socially to their countries of origin and destination.

Climate change, Health Infrastructure disruption, Governance and HIV response in India

Climate Change, Health Infrastructure Disruption, Governance and HIV Response in India

India has been traditionally vulnerable to natural disasters due to its unique geo-climatic conditions[1] that makes 68% of landmass susceptible to drought, 60% areas to earthquake, 40 million hectres to flood, and 8% areas to cyclone[2]. India has witnessed 16 major natural disasters with 12 health emergencies due to epidemic outbreaks during 2009-19[3]. These events, apart from health[4], also caused the public health infrastructure[5,6,7], including hospitals[8,9], by way of structural (buildings, etc.), non-structural (equipment and supplies), and external infrastructure (water supply, power, telecommunication, and transportation)[10], damages. Of around 1.6 lakhs public health facility in the country, 54% of them fall in moderate to high-risk seismic zone[8]. A notable transformation in the Indian landscape is the Gross Domestic Product (GDP) growth on the one side, and on the other, simultaneous emergence of unregulated urban growth, environmental degradation, inept sanitation and waste disposal systems. Massive rural to urban population flow in India has created regions known as 'census towns'[11]. These are places that satisfy the legal criteria of a town, but are not notified as statutory towns. This means that these are neither regulated by municipal by laws nor can the local authority make development decisions. Census towns constitute up to 49% of India's growing urban towns as of 2011[12]. In India, various tiers of development authorities are in charge of providing infrastructure services like power, water, sanitation, and hygiene. The centre, state, district and local levels (municipal and panchayat) are where power is exercised. At the lowest level, municipal authorities have the power to make service provisions within their legally notified boundaries, excluding the mushrooming census towns. Cumulative effect is felt with high rate of infectious diseases and pollution-induced illness causing increased health risks. Climate events interact with exposed and vulnerable human and natural system, that indirectly hampers health outcomes.

Disaster management is one of key policy areas in this country as disaster impede socio-economic growth, with further increase in misery of the poor and diverting scare resources away from development towards reconstruction and rehabilitation. Studies have indicated that natural disasters impacted adversely the livelihood of high-risk and vulnerable population to HIV. A study covering seven countries, including India, found that during pandemic situation Antenatal first care visit fell by 66%, consultation for under-5 services decreased by 74%, HIV testing fell by 41%, TB referral was down by 59%, and Malaria diagnosis fell by 56% and its treatment plummeted by 59% in 2020[13]. Disruption in the sexual and reproductive health (SRH) services, access to ARV drugs and HIV care[14], along with community-based testing[15] occurred. Studies in India, found additional morbidities of STDs, HIV and psychiatric disorders among commercial sex workers (CSWs) [16], with non-PLHIVs key population having faced challenges in accessing HIV antibody testing and experienced delayed CD4 and HIV RNA testing[17], Transgender Women and third gender individuals faced problems in admission to government health facility[18]; and people who inject drugs (PWID) were unable to access agonist medication and post-OST tapered detoxification[19]. Most people experiencing an emergency suffer from anxiety, sadness, depression, insomnia, irritability, or anger; and the same may in higher degree among immunocompromised peoples[20].

Disaster impact is not gender-neutral. The gender inequalities emerging from socioeconomic condition that exist are likely to be amplified in a disaster-induced social disruption, especially if gender is not properly understood as a factor. The gender asymmetry in vulnerability affect underprivileged women and girls more harshly, often make them succumb to such situations. A twenty-year study on gendered nature of natural disaster indicated that women succumb to disaster more in areas known for low socioeconomic status of women[21]. Studies have also reported injury and complicated reproductive outcomes[22], increase in the premature delivery[23] post-disaster psychopathology[24], and mental health consequences[25]. In India, 24% of pregnant women exposed to isocyanide during the 1984 Bhopal explosion had spontaneous abortions[26]. As found, there is a lack of general research on gender and gender differences in disaster vulnerability and impact. The limited data available from small-scale studies suggest that there is a gender-specific pattern at all stages of disaster response. Engaging and empowering women are beneficial means of strengthening resilience to disaster risks.

The infrastructure susceptibility in India hold three characteristics relevance, as dependencies on other infrastructure (such as transport, waste water management, telecommunications etc. are dependent on electricity and are thus negatively affected in case of electricity supply failure); dependencies on specialized staff (a hazard might prevent employees from coming to work or reduce environmental services), and dependencies on environmental services (eg. drought/dry spell might reduce the availability of water significantly) [27]. Another report stated that floods[28], over the past two decades, in several Indian cities had crippled the functioning of large hospitals causing health service disruption.

Governance, with effective leadership, is pivotal to counter the climatic disaster and its fall-out on citizens. Governance function entails strategic policy framework development with effective oversight, coalition-building, regulation, attention to system-design and accountability. Governance is the overreaching framework for disaster risk reduction and is essential for building resilience-capacities in society. Governance influences the capacity of national and state actors (governments, parliaments, civil society, media, and private sector) to coordinate their efforts to manage and mitigate disaster-related risks. Building climate resilient communities in disaster-risk countries would also include that the underlying risk factors in all relevant sectors are considered on a regular basis, risk reduction standards and actions are integrated into the planning and implementation of core development services and processes[29]. Studies have indicated that adaptation can reduce climate sensitivity with reducing disease burden, morbidity and mortality[30]; and mitigation through investing in health systems strengthening is one way to avert ill effects of climate change and infectious disease threats on population and individual health[31]. Also, adaption becomes a crucial matter of governance, apart from being a technical issue[32]. Governance is currently required to encompass 'Green Health Care'[33] initiative, through incorporation of environment friendly practices into healthcare delivery, on local scale within the walls of a health facility, research facility, or clinic, with green construction and operation that can protect patients, workers, and visitors. The concept however is fully applicable to health service systems at all stages of design/re-design, and operation. For India, the contemplated initiative holds significance, as because, the country's healthcare sector contributed 1.5 per cent to total carbon emission, as compared to Global average 4.4 per cent, and the country is among the top ten countries, accounting for 75% of healthcare's climate footprints[34].

India's policy response on climate change manifests itself in two forms: missions and programmes; and with the formulation of National Action Plan on Climate Change (NAPCC)[35], that effected directional shift with equal climate governance. responsibilities bestowed on Centre and the States[36]. The climate policy is spread across several policy documents, sector-specific strategies and laws that shape the energy landscape. Evidently, climate disasters, together with a wide-array of climate-related changes, affect vulnerable population to HIV and potentially affect all aspects of HIV response in India.

India's national HIV response has culminated through the National AIDS Control Program (NACP), that evolved methodically, with gradual integration of its programs with Government health systems (GHS); barring the targeted intervention and part of special group IEC and mainstreaming, that are implemented by CBOs/NGOs. The NACP had suitably responded to the recent pandemic crisis to successfully devise ART dispensation through the Home-delivery of medicines (where client consented or near-to-home dispensing) for PLHIV[37], and take-home dosing for opioid substitution therapy (OST) medicines for extend period allowed for People who inject drugs (PWID) [38]. Notably, suitable standard operating procedure (SOP) for supply chain management (SCM) of HIV/AIDS programme in India under NACP[39] was found to be in place, but unfortunately it did not have emergency supply chain plan. Also, no document on policy guidelines on disaster risk mitigation for its targeted intervention fields was available through the search.

It became evident, through the review, that integrating climate change mitigation, adaptation and sustainable development is an emerging challenge, for which further research to support strategies and actions will need to be considered. One of the initial steps is to enhance the ability to identify benefits, costs, opportunities and constraints of major mitigation and adaptation options with external impacts, allowing for a more in-depth assessment of integrated responses to climate change[40]. However, the dimension of climate change impacts on HIV/AIDS, and lessons learnt from managing the recent pandemic crisis, should provide the lead to building evidence-informed climate resilient HIV response in India.

Major Supporting Evidence

Sl No.	Authors	Publication Year	Title of the Paper / Article	Highlights
1.	Parchure et al	2023	Impact of COVID-19 Pandemic on HIV Testing Uptake Among Key Populations Enrolled in Targeted Intervention Program in Maharashtra, India	The COVID-19 pandemic significantly impacted HIV testing in Maharashtra, India, with sustained testing among female workers, men with men, transgender, and truckers, but a decline in migrants and IDU.
2.	Mahajan et al	2023	Assessment of COVID-19 Impact on Commercial Sex Workers in India: A Formative Research by Media Scanning	The COVID-19 pandemic has disproportionately affected vulnerable communities, including migrant workers, disabled individuals, and commercial sex workers in India, highlighting the need for further research and implementation.
3.	The Lancet	2022	THE LANCET World Report	The Lancet Countdown 2022 report highlights the global health, social, and economic impacts of the COVID-19 pandemic, Russia's invasion of Ukraine, and fossil fuel overdependence.
4.	Parikh et al	2022	Diseases and Disparities: The Impact of COVID-19 Disruptions on Sexual and Reproductive Health Services Among the HIV Community in India	Diseases and Disparities: The Impact of COVID-19 Disruptions on Sexual and Reproductive Health Services Among the HIV Community in India
5.	Pandya & Redcay	2022	Impact of COVID-19 on Transgender Women and Hijras: Insight from Gujarat, India	The study highlights the importance of protecting vulnerable populations like transgender women and hijra individuals during the COVID-19 pandemic, emphasizing the need for a human rights framework to ensure access to healthcare services and support.
6.	WHO	2022	Mental health in emergencies	Strategies for promoting, protecting, and restoring mental health are available, addressing individual, social, and structural stresses and vulnerabilities, ensuring our well-being.

Sl No.	Authors	Publication Year	Title of the Paper / Article	Highlights
7.	Maymon et al	2022	Change in prevalence of preterm birth in Israel following publication of national guidelines recommending routine sonographic cervical-length measurement at 19–25 weeks' gestation	ISOG guidelines suggest second-trimester sonographic cervical-length measurement at 19-25-week ultrasound anomaly scans reduce preterm birth prevalence in singleton pregnancies, suggesting screening can be incorporated into second-trimester anomaly scans.
8.	THE LANCET	2022	World Report	The Lancet Countdown 2022 report highlights the global health, social, and economic impacts of the COVID-19 pandemic, Russia's invasion of Ukraine, and fossil fuel overdependence.
9.	Lugten and Hariharan	2022	Strengthening Health Systems for Climate Adaptation and Health Security: Key Considerations for Policy and Programming	Health systems are crucial for resilience, and climate change requires better planning integration. Prioritizing primary healthcare and health security is essential for preventing adverse health outcomes.
10.	Global Fund Report (2022)	2022	THE IMPACT OF COVID-19 ON HIV, TB AND MALARIA SERVICES AND SYSTEMS FOR HEALTH	Antenatal first care visit fell by 66%, consultation for under-5 services decreased by 74%, HIV testing fell by 41%, TB referral was down by 59%, and Malaria diagnosis fell by 56% and its treatment plummeted by 59% in 2020
11.	Pollard et al	2021	HIV service delivery in the time of COVID-19: focus group discussion with key population in India	The study highlights the significant impact of COVID-19 on HIV service delivery strategies in low- and middle-income countries, emphasizing the need for community-based services and multi-month ART dispensing.
12.	Hoke et al	2021	How Home Delivery of Antiretroviral Drugs Ensured Uninterrupted HIV Treatment During COVID-19: Experiences From Indonesia, Laos, Nepal, and Nigeria	COVID-19 disrupted HIV treatment in Indonesia, Laos, Nepal, and Nigeria, leading to home delivery of ARVs, utilizing community health worker networks and private sector courier services.
13.	NIDM	2020	Kerala Floods 2018	Kerala experienced a severe flood in 2018, causing over 400 deaths and affecting all districts, displacing 1.4 million people and resulting in 449 deaths.

Sl No.	Authors	Publication Year	Title of the Paper / Article	Highlights
14.	Ghosh	2020	Covid-19 in India: Health implications and treatment needs of People Who Use Drugs (PWUD) and Patients with Substance Use Disorders (SUD).	The COVID-19 lockdown in India has caused panic among People Who Use Drugs (PWUD), with supply chain disruptions and public health concerns. With 2.6 crore users, 8.5 lakh injecting drug users, and 14.6% alcohol use, measures are needed to mitigate health service needs.
15.	Sharma & Hossain	2019	Strengthening public health partnership in India: Envisioning the role of law enforcement during public health emergencies	Collaboration between law enforcement and public health institutions is crucial for complex emergencies, involving policy advocacy, human resources sensitization, and evidence-based procedures.
16.	CPR	2018	Census Towns in India: Current Patterns and Future Discourses	The paper predicts the number of census towns (CTs) in India for the 2021 census using data from the 2001 census, addressing challenges like information scarcity and the need for integrated governance.
17.	Barnagarwala	2017	Mumbai rains: Govt hospitals flooded, patients face infection risk	Heavy rains flooded King Edward Memorial and Bai Jerbai Wadia hospitals in Parel, causing over 50 patients to be transferred to overcrowded wards and waterlogging at entrance gates.
18.	Termeer et al	2017	Transformational change: governance interventions for climate change adaption from a continuous change perspective	Transformational change, a new climate change adaptation topic, can be learned from organisational theory, involving continuous, in-depth, large-scale, and quick change, requiring modest leadership and intervention strategies.
19.	Norris et al	2014	60,000 Disaster Victims Speak: Part I. An Empirical Review of the Empirical Literature, 1981—2001	The study analyzed 160 disaster victim samples, revealing that youth, developing countries, and mass violence were more likely to experience impairment. Family factors were found to be primary in youth.
20.	UNDP	2012	UNDP; Disaster Risk Reduction, Governance & Mainstreaming	UNDP is promoting good governance and public awareness for disaster risk reduction (DRR) integration into sustainable development and poverty reduction policies.

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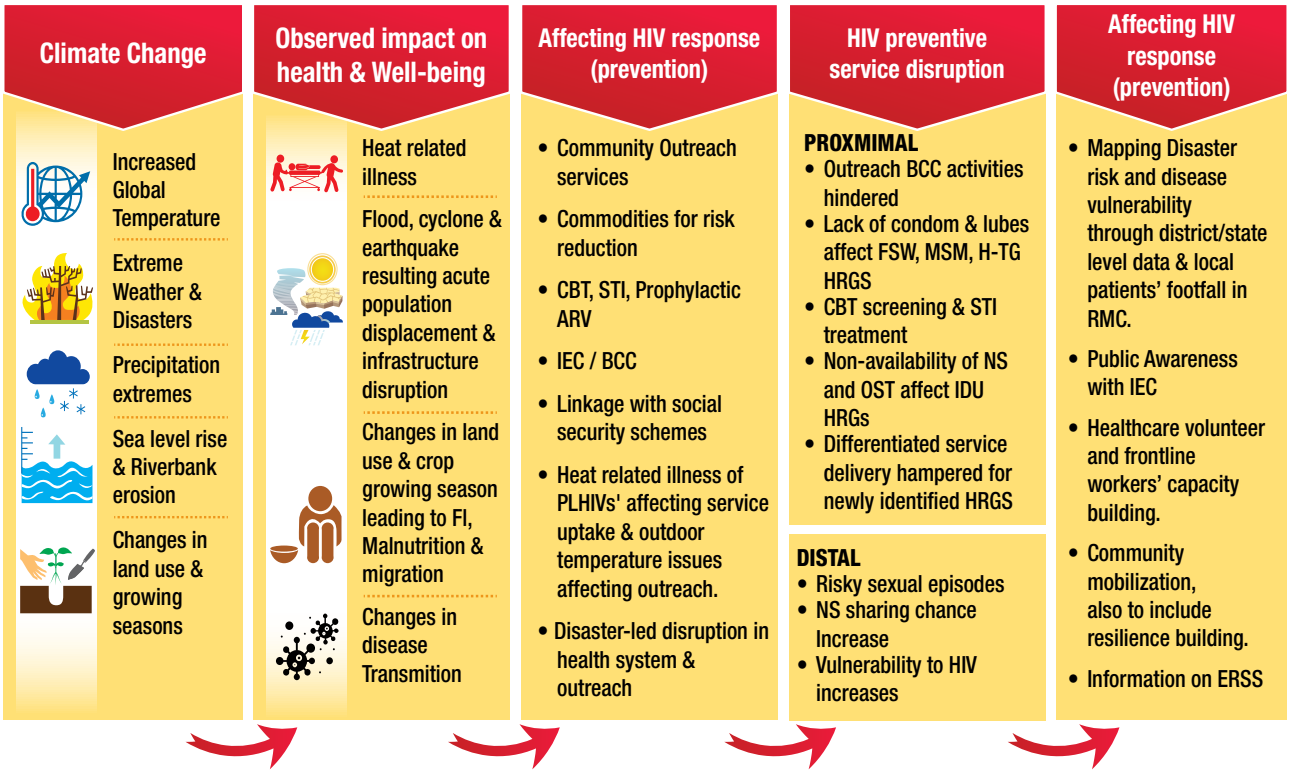
21.	Census India	2011		Census towns constitute up to 49% of India's growing urban towns as of 2011
22.	Wilbanks and Kates	2010	Beyond adapting to climate change: embedding adaptation in responses to multiple threats and stresses.	Climate change impacts are affecting all regions, particularly Arctic ones. Adaptation efforts are underway in the US, integrating hazards research, sustainability science, and community resilience. This approach helps understand impacts, promotes acceptance, and promotes resilience.
23.	Vesga-Lopez et al	2008	Psychiatric disorders in pregnant and postpartum women in the United States. Archives of general psychiatry	A US study reveals lower alcohol use, substance use, and mood disorders in pregnant and postpartum women, but higher risk of major depressive disorder.
24.	Akhtar et al	2007	Climate change and health and heat wave mortality in India	The paper discusses the impact of climate change and variability, including rainfall anomalies and rising temperatures, on human mortality patterns in India, highlighting historical and current studies.
25.	Neumayer and Plümper	2007	The Gendered Nature of Natural Disasters: The Impact of Catastrophic Events on the Gender Gap in Life Expectancy, 1981–2002.	The article explores the impact of natural disasters on women's life expectancy, revealing that stronger disasters lower women's life expectancy, while higher socioeconomic status weakens this effect.
26.	Institute of Medicine (US) Roundtable on Environmental Health Sciences, Research, and Medicine	2007	Green Healthcare Institutions: Health, Environment, and Economics	Green health care offers environmental protection, community leadership, education, and cost savings, appealing to health professionals and institutions for direct and indirect health promotion.
27.	Ebi et al	2006	Integration of public health with adaptation to climate change: lessons learned and new directions	Global climate change is expected to have significant negative health impacts, outweighing positive ones, and will persist for decades, despite effective mitigation measures.

Sl No.	Authors	Publication Year	Title of the Paper / Article	Highlights
28.	Asian Development Bank United Nations and World Bank	2005	India Post Tsunami Recovery Program Preliminary Damage and Needs Assessment	The joint assessment mission by the Asian Development Bank, United Nations, and World Bank assessed the 2004 tsunami's socioeconomic and environmental impact in India, estimating damages and losses.
29.	Rao	2004	Managing impact of natural disasters: some mental health issues	The Indian Psychiatric Society is focusing on restoring normalcy and rehabilitation, emphasizing the importance of 'here & now' mental health during natural disasters.
30.	UNDP	2004	Disaster Management in India- A status report	Disaster management in India requires a multidisciplinary approach, involving government, community, civil society, and media initiatives to reduce vulnerability, ensure rapid responses, and build capacities.
31.	Sharma	2001	India plans massive hospital rebuilding after earthquake.	Hospitals in Gujarat, India, are being demolished for rebuilding after an earthquake, with temporary facilities filling gaps in the Kutch district.
32.	Kimberley & Steven	2000	Public health impact of disasters	Disasters cause public health consequences, including physical, emotional, and chronic diseases, and can increase morbidity and mortality due to a weak public health system.
33.	Sue-Tang et al	1992	Effects of restricting uteroplacental blood flow on concentrations of corticotrophin-releasing hormone, adrenocorticotrophin, cortisol, and prostaglandin E2 in the sheep fetus during late pregnancy	The study investigates the impact of reduced uterine blood flow and prolonged fetal hypoxemia on hormone changes in the pituitary-adrenal axis in ovine fetus. Results show a transient peak in immunoreactive CRH, ACTH, PGE2, and cortisol, but no evidence for placental secretion of CRH or ACTH.
34.	Bhandari et al	1990	Pregnancy outcome in women exposed to toxic gas at Bhopal	The study found that pregnant women exposed to toxic gas in Bhopal experienced a higher incidence of spontaneous abortions (24.2%), still birth, congenital malformation, and higher perinatal and neonatal mortalities.

Sl No.	Authors	Publication Year	Title of the Paper / Article	Highlights
35.	NIDM	1990	Critical Infrastructure and Disaster Risk Reduction	India's infrastructure susceptibility is influenced by three key factors: dependence on electricity, specialized staff, and environmental services, which can be negatively affected by power supply failures.
36.	India Health Sector Emission Fact Sheet	Retrieved 26/9/2023		India's healthcare sector contributes 1.5% to global carbon emissions, accounting for 75% of climate footprints, making the concept applicable to health service systems at all stages.
37.	National Action Plan on Climate Change	Retrieved 26/9/2023		India's climate change policy includes missions, programs, and the National Action Plan on Climate Change (NAPCC), promoting equal climate governance responsibilities between the Centre and States.
38.	CONSTITUTION OF INDIA -laid out in Schedule VII MEA	Retrieved 26/9/2023		The seventh schedule of the Indian Constitution covers various aspects of the Union, including defence, citizenship, property, public debt, currency, trade, and international relations. It also covers the economy, industries, and institutions.
39.	NACO	Retrieved 26/9/2023	Guidance note for persons engaged in HIV/AIDS response under National AIDS Control Programme in view of the COVID-19 scenario	The National AIDS Control Programme (NACP) has issued guidelines for HIV/AIDS response personnel, emphasizing infection prevention, social distancing, and multi-month ARV drug dispensation to ensure uninterrupted ART supply during COVID-19.
40.	NACP Documents	Retrieved 26/9/2023	Standard Operating Procedure for Supply chain management	The National Action Plan for Combating Corruption (NACP) in India has been formulated as a suitable standard operating procedure for the supply chain management of the HIV/AIDS program.

Resilience-Focused HIV Preventive Intervention and Continuum of Care for People Living with HIV/AIDS in India – Illustrative Way Forward

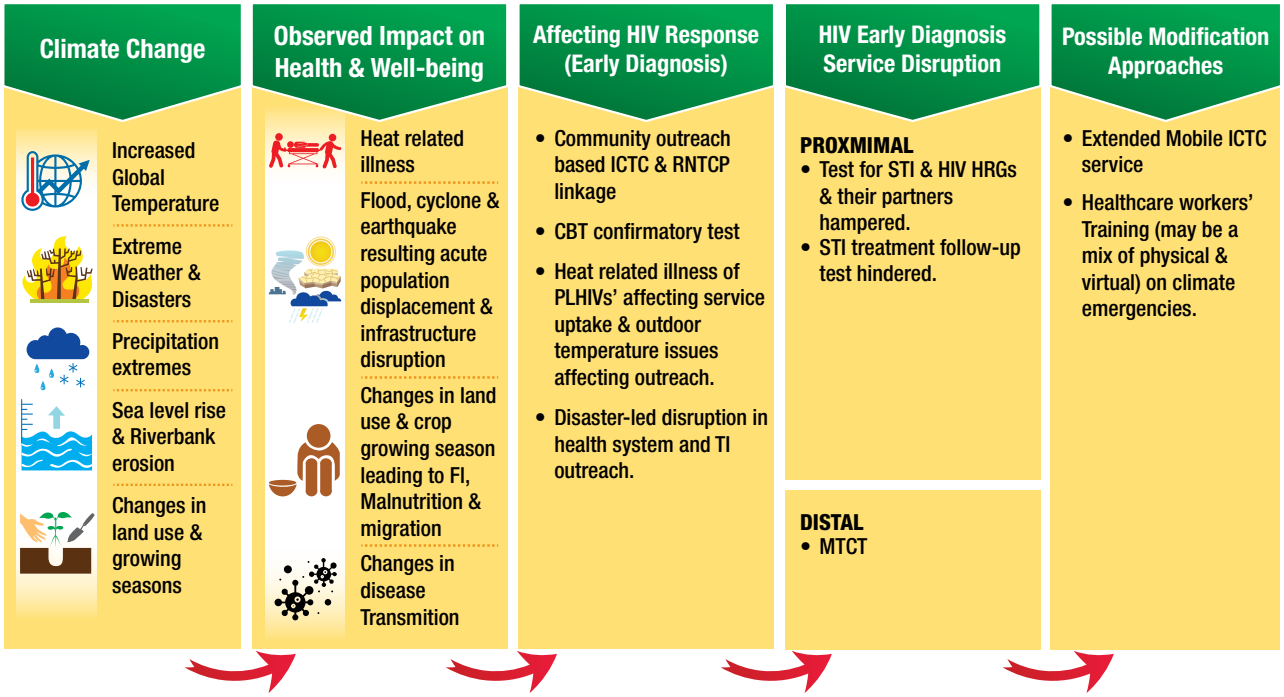
PREVENTION

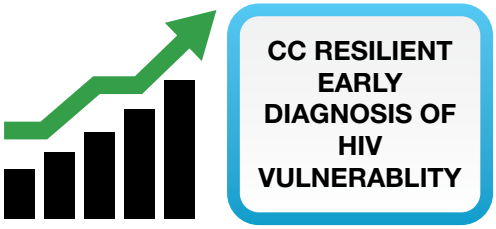


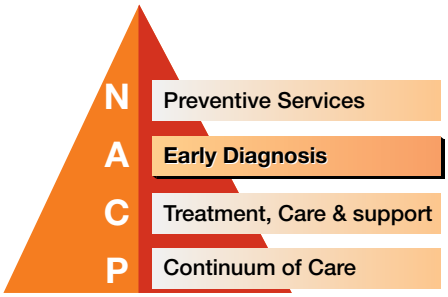
Figure

Hotspot level climate vulnerability and adaption assessment with establishing and strengthening a dynamic community of diverse stakeholder and peer support strengthening is likely to ensure climate resilient outreach system for NACP.

EARLY DIAGNOSIS

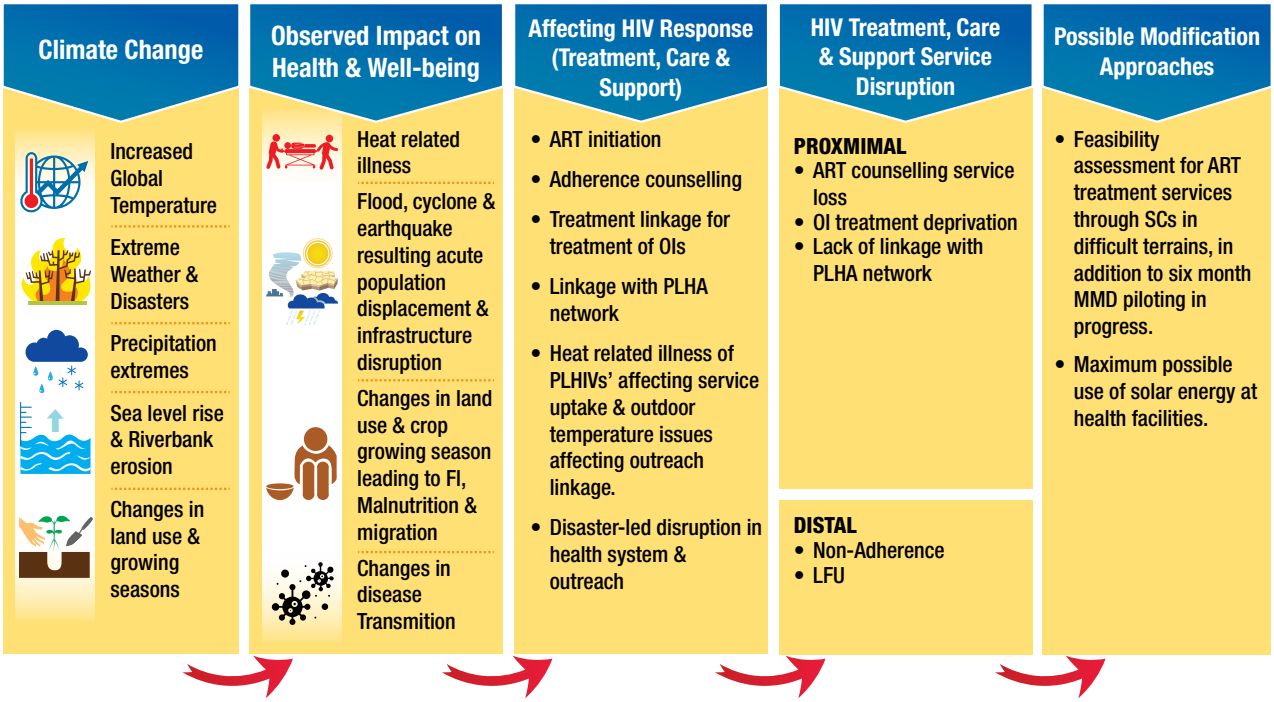


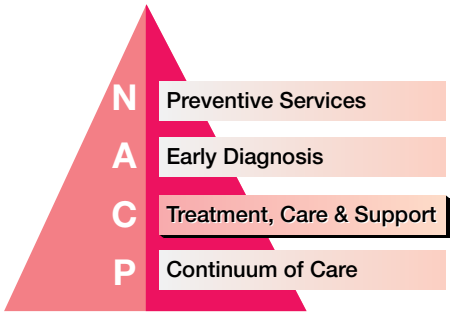




Figure

Reviewing health system fitness to meet the specific needs of climate extremities through digital data, differentiated service models, tele-consultation, developing a trained cadre equipped to boost understanding with health markers and mechanism with smart planning for stronger equity and justice.

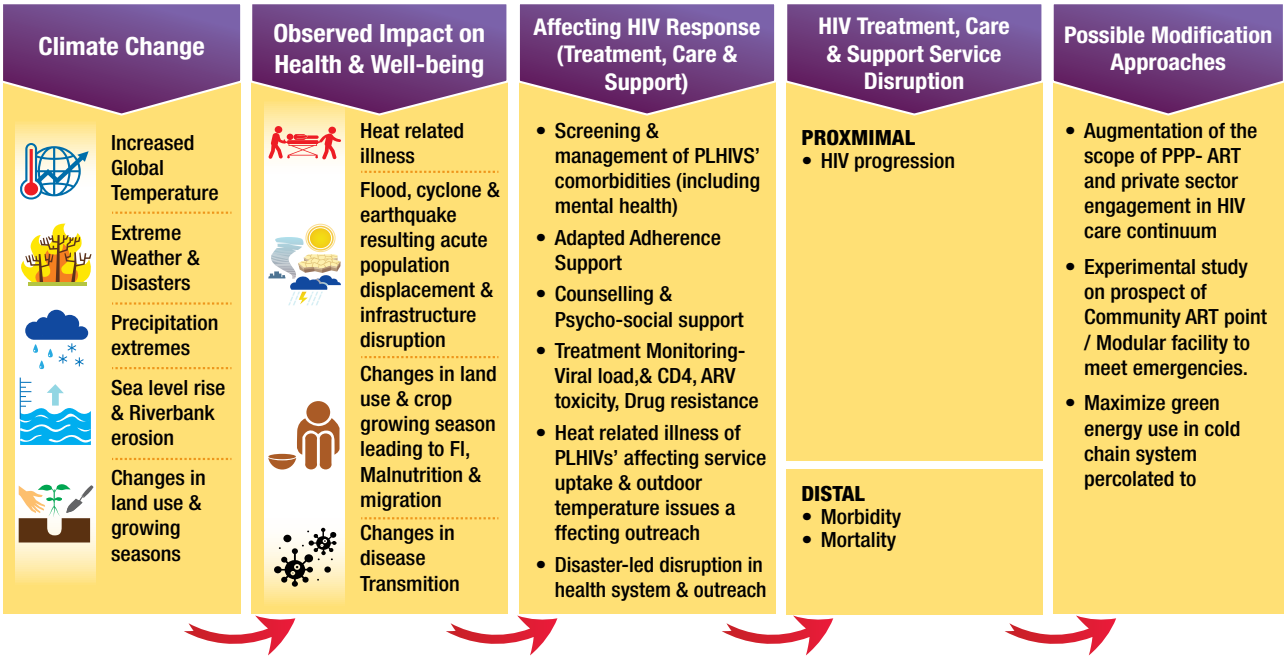


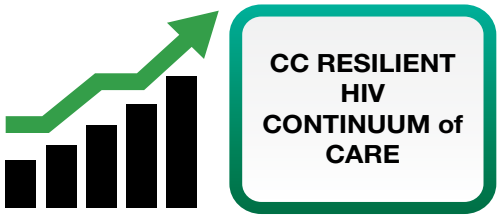


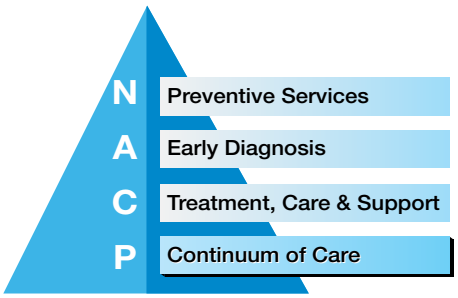
Figure

Resilience-focused HIV care and support might require adjustment in the traditional HIV care and support systems through incorporation of environment-friendly practices into healthcare delivery , on local scale within the health facility, clinic and patients' waiting areas.

CONTINUUM OF CARE







Figure

Resilience-focused HIV continuum of care require emancipation of health service providers through which individuals and families can be helped to develop resources in multiple dimensions of socio-ecological contextual levels asa multifaceted mechanism for adapting to and overcoming stressors and buffering social determinants of health (eg. Gender inequality, poverty) through internal (help in development of psychological strength, self-awareness levels and self-care), inter-personal (HIV related facilities, spirituality, social support systems), with overlap and some interdependence between levels.

Climate change and infectious diseases syndemics impacting HIV-AIDS

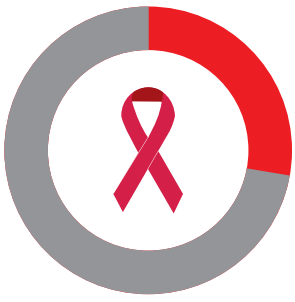
Climate Change And Infectious Diseases Syndemics Impacting HIV/AIDS

The term "syndemic" refers to aggregation of two or more ongoing/sequential epidemics or disease clusters having biological interactions resulting in exacerbation of conditions in terms of increased burden/altered prognosis[1] Climate change and evolving nature of infectious diseases have become major public health threats as these two synergistically affect other chronic infections like HIV[2].

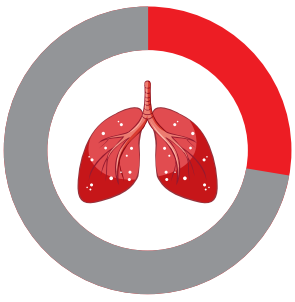
Climate Change over the years has altered the pattern of infectious disease transmission both Globally and as well as in India. Rise in temperature has made certain regions optimum for vector breeding, viral and bacterial multiplication thus augmenting increased transmission of vector borne diseases, other viral and bacterial infections & outbreaks such as diarrhoea, acute respiratory infections[3]. As poor viral suppression in HIV infection make the population vulnerable to opportunistic infections, thus climate alteration is actually impacting multiple epidemics both acute and chronic infections such as HIV, TB, Hepatitis, STI, the concurrent occurrence of all adversely affecting the clinical outcome of HIV patients[4]. HIV patients also suffer from multiple non-communicable comorbidities such as malnutrition, diabetes, dyslipidaemia which requires many other clinical services and medicines in addition to ART[5]. Thus natural calamity induced health service disruption makes the PLHIV suffer out of proportion to the non-HIV population as the interrupted supply of Food, ART, Medicines for other illnesses all lead to failure of viral suppression and thus increased opportunistic infection, as the microbial load and outbreaks also increases during climatic disaster[6]. Climate induced food crisis also leads to increased undernutrition in PLHIV which will further compromises their immunity thus make them further vulnerable to infections like TB, Diarrhoea, ARI[7].

Climate change induces acute and chronic displacements respectively owing to calamities like flood, draught, cyclone and crop failure and shrinkage of fertile and living land over the years. This leads to increased homelessness (displacement/eviction from stable housing), prolonged imprisonment (crowding and risky behavioural practices), and structural discrimination (minority stress and stigma for LGBTQ and PWIDs) precipitating psychiatric comorbidity, substance use, and risky sexual practices[8]. Socio-structural factors have been found in India to influence individual risk-taking behaviour among PWIDs and transactional sex among migratory female who inject drugs (FWID) was noted[9]. Since STI, Hepatitis B, C and HIV share common route of transmission the same pathways affect this Syndemic collectively. The COVID-19 pandemic increased this complexity and created a cluster of synergistic health contexts[10].

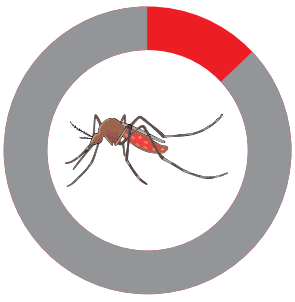
5.5 million from diebetes 2015 *IDF



1.5 million from HIV/AIDS 2013 WHO Global Health Observatory Data Responsibility



1.5 million from tuberculosis 2013 WHO Global Health Observatory Data Repository 2013



0.6 million from malaria 2013 WHO Global Health Observatory Data Repository 2013

Major Supporting Evidence

Sl No.	Authors	Publication Year	Title of the Paper / Article	Highlights
1.	Sharma et al	2022	Addressing the Syndemics of HIV, Mental Health, and COVID 19 Using the Health and Human Rights Framework among Youth Living with HIV, in Uganda: an Interpretive Phenomenological Study	The intersectional stigma of HIV and COVID-19 has worsened treatment adherence and mental health issues due to lack of access to critical needs.
2.	Ryan et al	2020	Shifting transmission risk for malaria in Africa with climate change: a framework for planning and intervention	The worst-case regional scenario of climate change predicted an additional 75.9 million people at risk from endemic (10-12 months) exposure to malaria transmission in Eastern and Southern Africa by the year 2080.
3.	Wandrekar et al	2020	What Do We Know About LGBTQIA + Mental Health in India? A Review of Research From 2009 to 2019	Prevalence studies reveal that LGBTQIA + individuals were found to show high rates of mental health concerns
4.	Glynnet et al	2019	High Levels of Syndemics and Their Association with Adherence, Viral Non-suppression, and Biobehavioral Transmission Risk in Miami, a U.S. City with an HIV/AIDS Epidemic	Syndemic theory proposes that multiple, psychosocial comorbidities synergistically fuel the HIV/AIDS epidemic
5.	Geoffrey et al	2019	Syndemic Characterization of HCV, HBV, and HIV Co-infections in a Large Population Based Cohort Study	The diverse syndemics of substance use, sexual practices, mental illness, socioeconomic marginalization, and co-infections highlight the unique needs of each population group.
6.	Agarwal et al	2014	Estimation of the Burden of Chronic and Allergic Pulmonary Aspergillosis in India	There is a significant burden of allergic bronchopulmonary aspergillosis (ABPA), SAFS and CPA in India as per emprical study.
7.	Worm et al	2009	Diabetes Mellitus, Preexisting Coronary Heart Disease, and the Risk of Subsequent Coronary Heart Disease Events in Patients Infected With Human Immunodeficiency Virus	DM and preexisting CHD are both important risk factors for CHD events in HIV infected individuals
8.	Attili et al	2006	Diarrhea, CD4 counts and enteric infections in a hospital – based cohort of HIV-infected patients around Varanasi, India	Diarrhea was most strongly associated with low CD4 counts

Sl No.	Authors	Publication Year	Title of the Paper / Article	Highlights
9.	Panda et al	2001	Interface between drug use and sex work in Manipur	The prevalence of HIV infection in injecting drug users was 57% (20/35) compared to 20% (5/25) among non-injecting drug users
10.	Toole et al	1997	The Public Health Aspects of Complex Emergencies and Refugee Situations	In Africa, crude mortality rates have been as high as 80 times baseline rates. The most common causes of death have been diarrheal diseases, measles, acute respiratory infections, and malaria

Cross-cutting issues in the climate change impact pathways and HIV response in India

Cross-Cutting Issues In The Climate Change Impact Pathways And HIV Response In India

Present review process led to coming across two topics, namely Mental issues and Gender dimension that intersect the identified pathways related to Climate change - induced HIV response in India. As posited, major pathways that tend to directly influence HIV response in India are food insecurity, climate migration and health infrastructure disruption & issue of governance. Observably, India's overall growth is linked intricately with climate risk. Such risks have a disproportionate impact on communities vulnerable to HIV infection and those infected by the virus already. Adaptive capacity in India varies by state, geographical region, and socioeconomic status. Managing climate risks on HIV response in India requires an enhanced understanding of the underlying drivers of hazards, exposure of regions and population; the sensitivity of regions and their resulting vulnerability; and also, the interactions between these components, including issues that dominates the pathways. Literature review highlighted that mental and gender inequality as cross-cutting themes which need to be integrated into all stages of programs, from planning to assessing the impact.

Cross-cutting theme 1:

Mental health - As per the present synthesis of evidences, quantum of mental health problems is higher, among both people vulnerable to acquiring HIV and those living with the HIV infection, compared to general population. Mental health problems can increase risk of HIV acquisition through both direct and indirect pathways. Although people with serious mental illness (SMI) tend to be less sexually active compared with the general population, sexually active adolescents and adults with SMI, evidentially pose higher risk/ unsafe sexual behavior, including inconsistent condom use, having multiple sexual partners, trading sex, and drinking alcohol before sex[1.1]. The relation between HIV and mental illness has been studied by examining HIV infection in those with mental illness, and mental illness in those with HIV. However, there are many common factors in both, such as homelessness, imprisonment, poverty and substance misuse. There is some evidence to suggest that HIV risk in people with severe mental illness is mediated through substance misuse [1.2]. HIV prevalence of 1.7% has been reported among psychiatric inpatients[1.3]. Patients with comorbid substance misuse are more likely to engage in HIV risk behavior; and lack of adequate knowledge about HIV contribute to it[1.4]. Women with severe mental illness have a higher prevalence of high-risk behavior, and particularly among those with a history of abuse[1.5]. Mental disorders can cause a substantial barrier to adequate engagement and retention in HIV primary care. Research has established links between the presence of psychiatric illness and poor rates of HIV care linkage and retention. Substance use disorders represent a distinct impediment to timely HIV care linkage, as well as sustained retention in care[1.6].

The spectrum of psychiatric comorbidity in HIV varies from minor cognitive deficits to severe psychosis. Since the early 1990s there have been efforts to document the neuropsychiatric aspects of HIV[1.7]. Psychiatric manifestations are more in HIV-affected individuals, than that of sexually transmitted infection (STI) among PLHIVs[1.8]. There is considerable evidence that depression and anxiety are prevalent diagnoses among those with HIV infection[1.9]. Cognitive deficits in HIV vary from subtle abnormalities in attention and concentration through to gross psychomotor retardation and dementia. It is well established that HIV associated dementia involves most cognitive domains, but evidence on early changes are less consistent[1.10]. Psychotic symptoms seen in HIV-infected individuals may be primary or secondary. Occasionally psychotic symptoms may be the presenting complaints of an HIV illness[1.11]. Depression is a prevalent comorbidity in HIV infection as well, and a recognized side-effect of antiviral drugs. It may also be the first presenting symptom in an HIV case[1.12]. Anxiety among PLHIV is a major cause of non-adherence to antiretroviral therapy[1.13], as found.

The earliest psychological impact of being diagnosed with HIV can be understood within the framework of 'Kübler-Ross cycle of grief'[1.14] that involve denial, anger, bargaining, depression and acceptance. However, the most important additional aspect in HIV/AIDS is the social stigma. The HIV infected patients often face life changes, including relationships and family, shortly after

becoming aware of their seropositive status. Disclosure of seropositive status can be a stressful decision. If the individual feels the need to disclose and the outcome of disclosure is positive, then this can be associated with better quality of life. Quality of life in the early asymptomatic stage of illness is usually better than early symptomatic or AIDS stage with impact on both physical and psychological domains. Quality of life can be influenced by educational status and income, as well[1.15].

Climate change causes extreme weather events that can be traumatic for everybody especially those living with HIV and mental health problems. Studies indicated that many people will experience more psychological distress as a result of climate change, and a small minority of people may develop more severe form of mental health issues, such as post-traumatic stress disorder (PTSD), depression, or substance abuse disorders. These have been suitably cited in the preceding chapters. Generally, warming nights erode human sleep globally and unevenly, with an effect that is three times greater for people in low- and middle-income countries[1.16]. It has been suggested that correlation between temperature increases and increased levels of crime and aggression subsist[1.17], with also an alliance between the rates of suicide due to drought and hot spells, as witnessed in India[1.18]. Heat waves have been linked to an increase in hospital admission for mental issues[1.19], that include mood disorder, anorexia nervosa, dementia, and anxiety related disorders[1.20]. Extreme heat exposure can cause both physical and psychological exhaustion. A study found that work-related heat stress was linked to increased psychological distress among workers[1.21], with other similar studies indicated an association between higher temperatures in the workplace and increased psychological distress.

Economic changes with climate change bear effect on mental health of poor and vulnerable population, as these can lead to economic hardship. The same results in an increase of mental health issues[1.22] with additional stressors as, strained social cohesion and community participation, particularly affecting women and young girls. Economic constraints can also have an adverse impact of healthcare seeking,[1.23] simultaneously minimizing the ability of the society to provide treatment. Migration and acculturation stress are another manifestation of climate change on individuals, as natural disasters are associated with forced migration of population. Mental health literatures attribute migration leading to acculturation stress, that in turn act in the genesis of psychiatric disorders[1.24]. Physical illness and immunocompromised state of health condition in individuals would see increasing trends with climate change; and occurrences of chronic physical disorders is likely to affect mental health directly or indirectly due to strain on coping. Mental health has been found to intricately linked with physical health[1.25]. However, vulnerability to climate change and mental health issues is context-dependent and understanding who is vulnerable and in what way requires targeted assessment to identify contextual factors[1.26]. The psychiatric sequelae of the Odisha super-cyclone in 1999 studied, found post-traumatic stress disorder (PTSD) among 44.3%, anxiety disorder in 57.5%, and depression in 52.7% among sampled population who experienced the disaster and simultaneous death. Post-disaster stress-related disorder tend to continue for month[1.27] for which there is need to carry out post-disaster mental health screening because of high prevalence of PTSD, as observed in Kerala flood 2018 victims[1.28]. Following Kashmir earthquake in 2005, victims faced adjustment disorders, depression, other stress reactions, and PTSD-like symptoms, five to six weeks following the earthquake[1.29]. A study paper on Uttarakhand landslides and disasters[1.30] highlighted prolonged psychological impacts on victims, that are often neglected by relief agencies and psychological needs not taken care of in disaster management plans; though mental health care principles stress upon the needs of interventions in different phases[1.31]. Besides, the general population, People living with HIV and their families face in greater degree, climate extremity related psychological stress.

Notably, WHO considers climate change a social determinant of mental health[1.32], and their comprehensive mental health action plan[1.33] identified that there is a huge unmet global need for more and better mental health support. Hence, WHO have urged countries to include mental health support in their response to the climate crisis. However, less than 0.5% of international climate change adaptation financing has been directed to climate adaptation to protect health[1.34] and the figure is much less for mental health and psychosocial well- being. In India, the total budget outlay for health and related programmes for the financial year 2023-24 amount to 2% of the fiscal outlay of the Union government. At Rupees 919 crore, the budget estimate for mental health is just above 1% of budget estimate of the Ministry of

Health and Family Welfare[1.35].

It is well documented that notable advances have been made in HIV prevention and treatment in India, but these gains tend to get impaired when significant mental and substance use problems among people vulnerable to acquiring or living with HIV are not addressed adequately. There is urgent need for integration of mental health screening and care into HIV prevention intervention. Cost-effective approaches like telephone-delivered and computer-assisted intervention can help scale mental healthcare. and support counsellors' intervention for high-risk groups and PLHIVs[1.36]. All in all, the emerging thinking around climate change and its impact on mental health, combined with the abundance of evidence about extreme events and their impact on psychiatric morbidity, provides a strong foundation for understanding how future mental health may be affected by climate change. Welcome as this knowledge is; however, the relationships between concepts have not been thoroughly analyzed, theories of behaviour responses have not been rigorously tested[1.37], the availability of information is limited[1.38], and better evidence is needed, urgently. Additionally, there is lack of recognition of the power difference between individual and collective action, which leads to inappropriate expectations. The focus on individual behaviour change has led to a neglect of social policy, and collective action.

A substantial limitation in the surveyed literature concerns the under-representation of research from low- and middle-income countries. The majority of studies. being conducted in developed countries, their findings may not be generalizable. There are also few studies that look at the relationship between mental health interventions and HIV care outcomes, other than some studies conducted on youth mental health interventions. Generally, research on the effect of climate change on mental health is challenged by the gathering and interpretation of highly subjective measures across different cultures and income settings[1.39]. The application of applied research has not matched the focus on characterizing and quantifying the linkages between climate change and mental health[1.40]. More than half of the studies were not designed or conducted by mental health researchers or published in mental health journals, which might point to a gap between research on climate change and meaningful clinical applications[1.41]. From a methodological point of view, it is difficult to conduct rigorous research on the link between climate change and climate-related mental health. No robust methodology for an annual indicator (mental health) has been reported. This is likely due to the complexity of the subject matter and the lack of data rather than the lack of relevance[1.42]. Evidently, climate change often occurs slowly and over a long period of time. Mental health changes associated with climate change can be hard to detect in the short term, making it difficult to find meaningful relationship between the two. Scientific literature on the relation between climate and mental health is increasing with theoretical models, analytical techniques, and datasets[1.43]. Given the scenario, future research is needed to understand the unequal effects of climate change on the mental health of vulnerable and marginalized groups in order to inform better prevention, planning, response, and adaptation tools and efforts.

Cross-cutting theme 2:

Gender is a cross-cutting lens that bridges climate change and its effect on HIV response in India. The climate change-induced pathways to impact HIV response in India hypothesized, gender appeared as a prominent marker in food insecurity, climate migration, and health service disruption and governance. These have been suitably discussed and cited in the concerned domains, to propose future research priorities for developing evidence-based plan-of-action to mitigate the adverse fall-out.

The HIV and AIDS epidemic is often described as 'a feminised epidemic'. The term refers to some features of the epidemiology, in that in many countries which are experiencing generalised epidemics[2.1]; the numbers of women infected are significantly higher than the numbers of men. The term 'feminised epidemic' is also sometimes used as shorthand to signal that disproportionate impact of HIV on men and women, as either cause or consequence. The use of the term in this context is being used within a broader examination of concepts of women and gender associated with research and policy on HIV and AIDS. There are three widely circulating, but generally undefined meanings associated with the term 'gender' in the context of discussions of HIV and AIDS. These have been defined as essentialism, which stresses that concern with women's vulnerability must lie at the heart of preventive responses to HIV; equality, bring forth the need to be concerned with addressing unequal gender power relations; and empowerment, the view that existing gender relations and identities need to be transformed,

entailing changes not only within communities but also in the wider society.

Over the years, various programs have been initiated by the Government of India for women's empowerment and to enhance their autonomy within and beyond the private sphere of the household. Undeniably, such programs have helped empower women and increased their participation in education, sports, politics, media, art and culture, the service sector, and science and technology[2.2]. Despite such positive initiatives, women in India are relatively more vulnerable to HIV as they are not only distanced from socio-economic opportunities, but are also denied equal access to health care services in many parts of the country[2.3]. Recently, India has been ranked at 135 out of 146 countries in its Global Gender Gap (GGG) Index for 2022[2.4] -which is a clear indication of the entrenched gender inequality in the society.

The HIV vulnerability of women can be attributed to anatomical context as well. Social norms that promote gender inequality create harmful power dynamics between men and women. These prevent women from being able to protect their health, including from HIV. In India, HIV prevalence among adult women (15-49 years) was 0.20 percent[2.5], that indicated that there is a narrowing gender gap in the prevalence of HIV. Women continue to account for 39 percent of people living with HIV infection in the country[2.6]. According to the World Bank report on AIDS, extensive poverty and unequal distribution of income among the genders appears to stimulate the spread of HIV. More and more research indicated that the rising spread of HIV/AIDS from urban to rural areas in India[2.7], with about 60% of the HIV cases prevailing in rural areas[2.8]. Studies have indicated that poorest household affected by HIV/AIDS have fewer resources to adapt to the effects of climate change, as the need for adopting new strategies for crops, irrigation, and cattle rearing is more acute by household headed by women. Disaster arising due to climate change, increase school dropout among girls, enhanced chances of child marriage, sexual harassment, trafficking and prostitution; lead to risk of transmitting sexually transmitted diseases, including HIV infection among females. Also, migration following climate change increases the risk of HIV infection, as women are forced to crowd together in vulnerable situation owing to separation from family[2.9]. Studies have also linked low HIV awareness, poverty, and gender inequality to the rising HIV/AIDS epidemic in rural India[2.10]. Vulnerability to HIV infection among rural women stem from their lack of knowledge about the risk of transmission and lack of access to healthcare information[2.11], and they are more exposed to HIV because of the social and cultural taboos that inhibit them about talking of sex or sexuality openly[2.12]. Women may also be unable to protect themselves from potentially dangerous sexual activity with their spouse[2.13]. In terms of adherence to antiretroviral therapy by the women, lack of finances[2.14] to visit ART centres, and the fear of taking antiretroviral therapy[2.15] are reasons women become noncompliant with medical therapy. Studies have indicated that lack of social support is also associated with lower antiretroviral therapy adherence[2.16].

Stigma related to HIV is a major issue and with high levels of HIV stigma, that inhibit women to come forward with their HIV status because of fear of discrimination[2.17]. Women living with AIDS face other challenges when it comes to accessing health care, such as lack of transportation, financial constraints, and inability to provide care for a sick spouse or children[2.18]. Many Indian women with HIV report depression as a problem[2.19]. When it comes to care of the people living with HIV and AIDS, women account for more than 70 percent of the care givers. More alarmingly 20 percent of these care givers are HIV-positive themselves. The most daunting finding is that nearly 60 percent of the HIV-positive widows were less than 30 years of age and staying with their natal families[2.20].

In the context of gender and climate vulnerability in India, a critical matter for women is the enormous technological and financial disparity they face when they have to deal with climate change. An analysis of the development process made from gender perspective explains why and how the effects of climate change and gender inequality are closely linked, and these relationships are measured by consideration of environment, social, economic, cultural and political contexts, and therefore vary between regions, countries, and within countries. Social inequalities, in particular, have serious repercussions on many women's lives, limiting their access to land ownership, housing, education, health-care and participation in policy-making and decision-making. The process culminates in limiting their human freedoms and options. The Millennium Declaration states that gender equality is both a goal in itself (MDG3) and a condition to combat poverty, hunger, and disease and achieve all

other goals[2.21]. However, climate change impacts depend on the characteristics of natural and human systems, their development pathways and their specific locations matter[2.22].

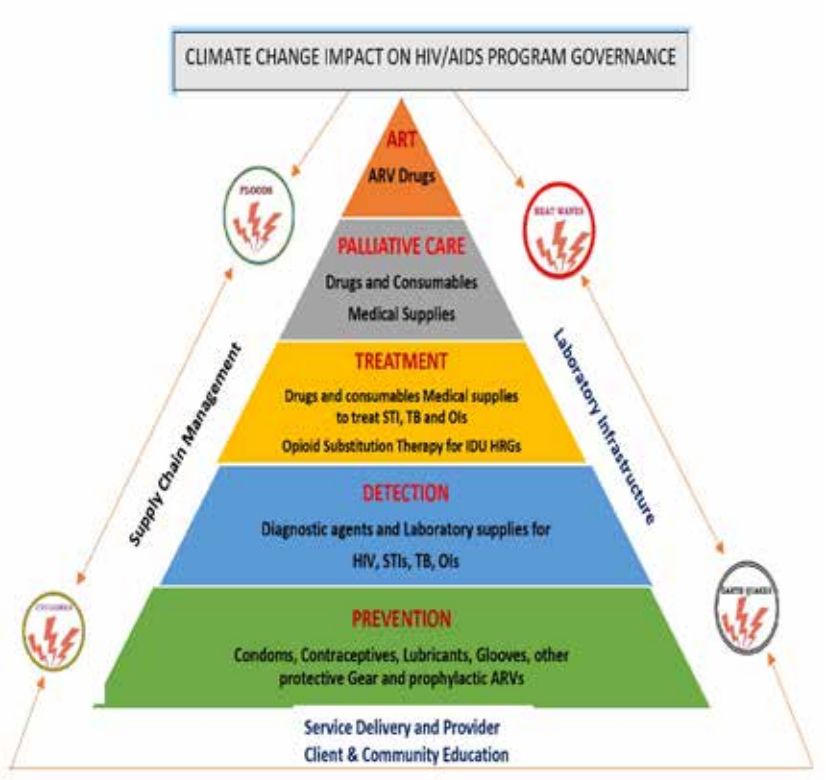
With regard to climate extremity outcomes, women differ from men in the physiologic compensation to elevated temperature, that contributes to their biologic vulnerability. They dissipate less heat by sweating, having a higher working metabolic rate, and have thicker subcutaneous fat which decrease radiative cooling[2.23]. Cultural vulnerabilities, culturally prescribed heavy clothing garments limit evaporative cooling. Psychogenic fever, in which young women develop extremely high core body temperature (up to 41oC) when they are exposed to emotional events[2.24] are witnessed. Again, pregnancy outcomes get adversely affected due to high temperature[2.25] and pregnancy complications arise[2.26] with poor neonatal outcomes[2.27].

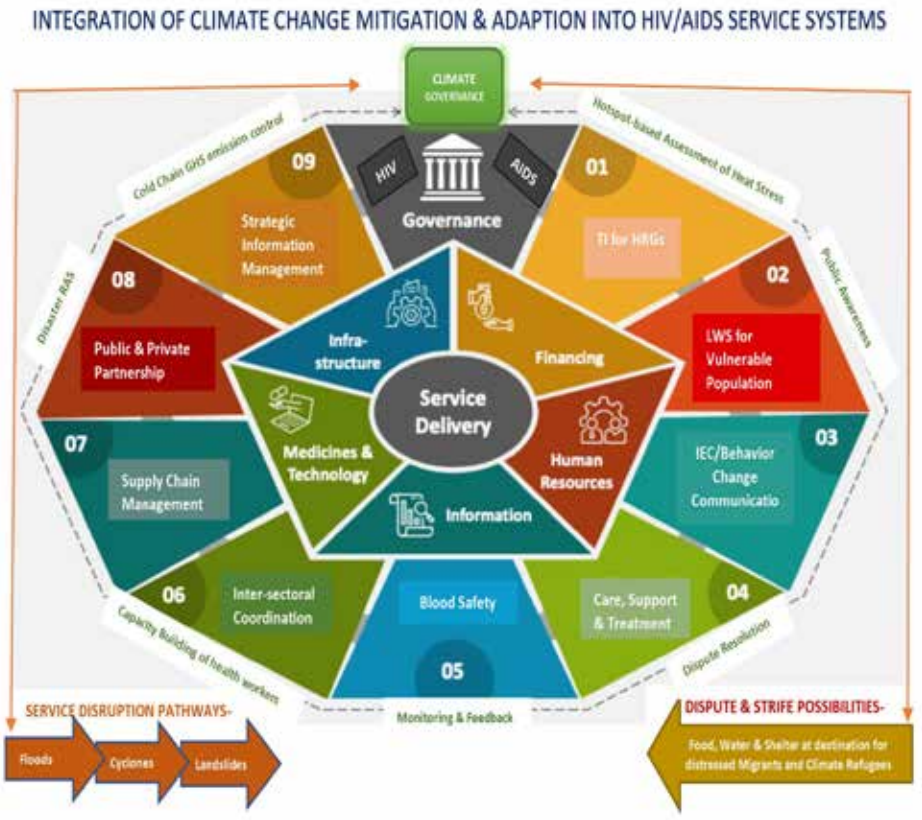
Women are more likely to die in disaster situation and gender difference in mortality has been found to be larger among women who are from a lower socioeconomic status[2.28]. Women, as well as their families living along coastal regions of India are extremely vulnerable[2.29]. Other research suggests that cultural factors contribute to vulnerability when women are homebound caring for children and elderly while waiting for relatives to return from a disaster-related evacuation. If public warnings do not consider, women's access to information and the possibility that homebound women in remote areas only speak a minority language, women will not be able to appropriately take steps to safeguard their lives[2.30]. Physically, women of all ages are more calorie-deficient and poor baseline nutritional status and physical health may prevent escape and survival in the acute phase of disaster[2.31]. Poor, single, elderly women, adolescent girls, and women with disabilities are often at greatest risk because they have fewer personal, family, economic, and educational resources from which to draw protection, assistance, and support. Additionally, these same risk factors correlate with a comparatively higher risk for mood disorders, such as depression and anxiety[2.32]. Poor nutritional status with resulting anemia, prevalent among women in India, are associated with their cognitive impairments, including poor attention span, diminished working memory, emotional and behavioral issues, and impaired sensory perception[2.33]. Maternal undernutrition holds profound effects on neonatal development, and in places where iron-deficiency anemia is prevalent, the risk of women dying during childbirth is increased by as much as 20%[2.34].

Traditionally, women, as the nurturer of the family, is expected to fetch water for the family and there is an increased risk of contracting water borne diseases among primary water handlers[2.35]. Water scarcity also equates to women spending more time harvesting water and less time spent on other activities of livelihood. It is estimated that during the dry season in India, in water stressed areas, 30% or more of a woman's daily energy expenditure is spent harvesting water[2.36]. Additionally, the manual labor involved in water harvesting places women to travel long distances for fetching water, that also increases exposure to heat stress and threatens women's personal safety[2.37]. Lack of clean water and proper sanitation infrastructure also poses serious health challenges to women, especially during menstruation and pregnancy[2.38]. Miscarriage in Uttarakhand, India, is 30% higher than the national average, and is associated with rural women having to walk distance locations to carry water and firewood, with their inherent obesity[2.39]. Reportedly 17 percent of India is under forest cover and 84 percent of rural women have been affected by fuelwood scarcity[2.40]. Women are vulnerable to infectious disease, and pregnant women are at heightened risk for contracting vectors[2.41]. Loss of access to, and local availability of medicinal plants, that women use to treat various ailments, is another impediment to their indigenous knowledge-based self or family members' treatment options.

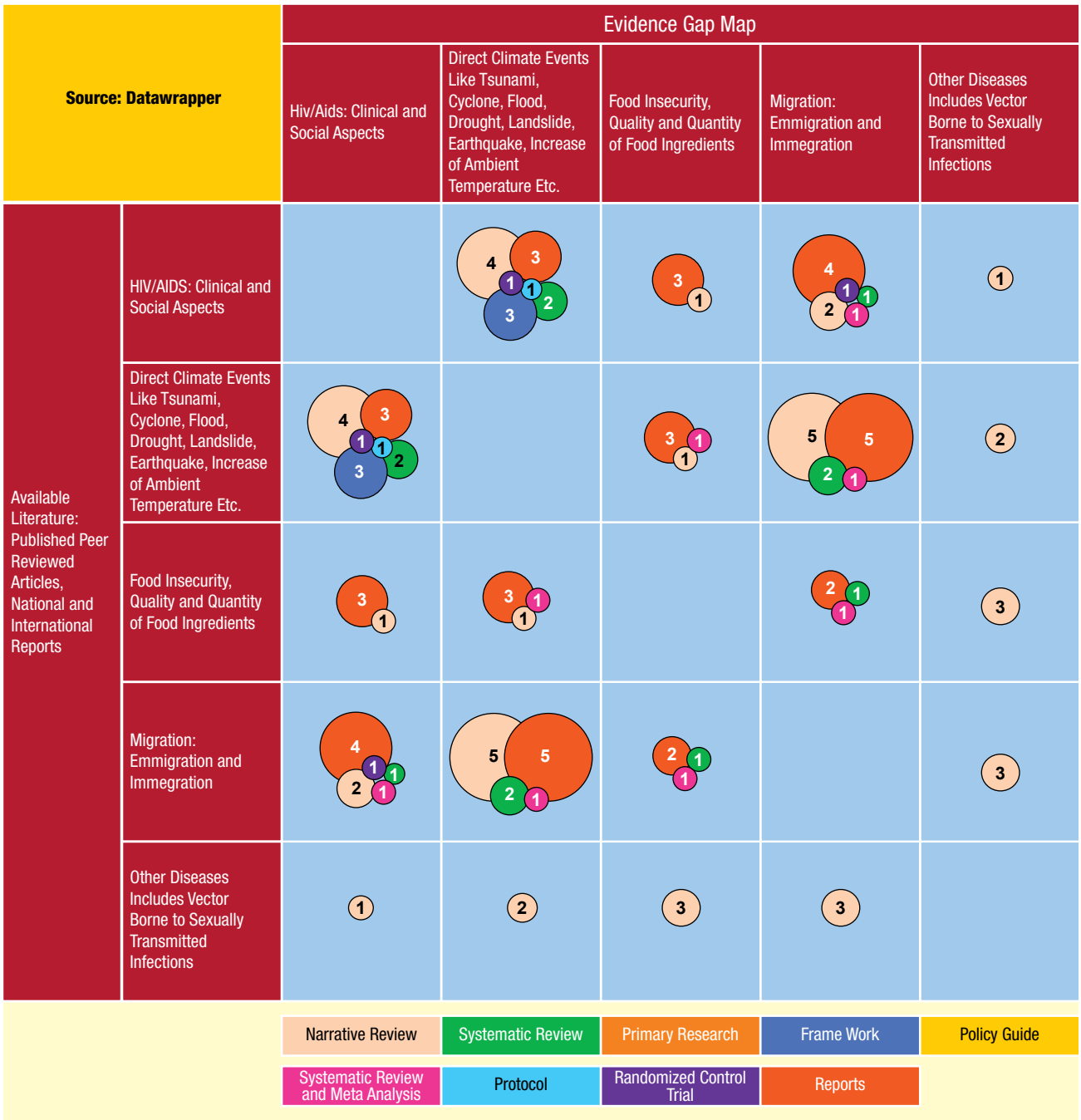
To sum up, gender approach when integrated into climate change analysis tends to support an understanding of how the gender identity of women and men determines different vulnerability and capacities to address climate change. When integrated into development debates, the gender approach seeks to analyze and understand the various roles and responsibilities of women and men, the degree and quality of their involvement in decision-making and their needs and perspectives. India has a wide range of social, geographical, political and environmental realities that expose all citizens, but particularly women, to climate change. Gender dimension has become prominent in climate policy. However, in India, progress has been slow. Local solutions are the starting point for implementation that need to be scaled up. Women represent a primary source for adaption through their experience, responsibilities and strength. Integrating more women into climate

action through active investment strategies, multisectoral coordination, and high-level political engagement, should help in incorporating a gendered perspective in national, state and local level climate adjustment plans; and the same should be considered ass the path forward. Incidentally, many studies, both in international and Indian context, are on gender and climate change, or focused on gender dimension of HIV/AIDS, are available. Some reviews and reports are also available linking climate change, gender and HIV/AIDS. The observations made in these documents necessitates reviewing the correlation between climate change, gender and HIV/AIDS, to plan appropriate future intervention on the issue.





Evidence Gap Map (Global)



Research Priorities Identified

Theme	Suggested Research Topics
Food Insecurity	• To understand and address factors contributing to experience of food insecurity in diverse HIV-infected population groups in both rural and urban resource settings. • To evaluate relationship between food insecurity and mother-to-child transmission (MCTC), and the mechanism through which food insecurity might increase risk for MTCT. • To evaluate whether and the extent to which food insecurity may predispose to HIV transmission through mechanisms other than risky sex. • To assess the role of targeted food assistance and income generation programs in decreasing HIV transmission risk, particularly for women who appear to bear the greatest burden. • To understand the need for and development of matrixes for food security screenings as part of health assessment of high-risk groups under the NACP for appropriate inter-sectoral intervention. • To compare by setting up two group of ART patients, one group had adequate access to food; and the other group with inadequate access to food to assess the outcome in terms of CD4 cell count, viral load suppression, and adherence. • Factors that contribute to food insecurity owing to climate change and its effect on HIV /AIDS response in a community before and after natural disaster – community-based trial (before and after comparison). • Measuring the nutritional value of culturally significant indigenous food in India, and assess their prospective role in CD4 cell count growth and viral suppression among PLHIVs. • Longitudinal data using scaled, validated measures that will permit a better understanding of the causal pathways and mediating factors between food insecurity and HIV transmission and how they are modified by gender. **NUTRITION:** • Identify locally appropriate, sustainable ways of increasing dietary intake by 10%, among adult and children, who are detected HIV positive but as yet are asymptomatic. • Development of tools to identify best combination of macronutrient/micronutrient mixes in the prevention of progression of HIV related illness, and maintenance of immunity. • To what extent use anthropometric variables, integrated with conventional method (BMI, MUAC) of deriving nutritional status of PLHIV, yield greater accuracy.
Migration	• Mapping state-wise areas witnessing climate process *(slow climatic process)* and climatic events *(sudden & dramatic hazards)* leading to internal migration and environmental triggers that pre-dispose individuals to contracting HIV. • Study on life-course perspective of climate migration and integration in HIV preventive intervention under NACP. • Exploration of the structure of sexual networks in general population and the position of HIV positive individuals within these networks to infer HIV prevalence among migrants. • Investigation of MTCT status in high out migration states. • Assessment of the feasibility of NACP intervention along corridors of migration.

Theme	Suggested Research Topics
Health Service Disruption & Governance	• Exploration of the methodology towards integration of climatic catastrophe situation management (mitigation & adaption) and capacity building of the issue in the community system strengthening component. • Identification of infrastructural and governance system improvement to ensure universal screening of annual pregnancies, in both public and private healthcare set ups for mother to child transmission (MTCT) at the behest of NACO through MoHFW. • Development of modalities, including road map, for strengthening of cold chain management system to provide the services to key population close to home to improve testing. • Identification of the mechanism through new infections among those at risk to contracting HIV through virtual platforms (dating site, social media and internet) can be brought under NACP. • Identify cost-effective and purposeful health workforce capacity building approaches (can be mix of physical and virtual) for future primary prevention of climate emergency situation. • Inquisition of best possible risk communication approaches for future pandemic/ disaster situation – from the learnings of COVID-19 responses. • Exploration of mechanism for decentralization of ART related diagnosis and counselling closer to PLHIVs' homes/residences. • Cross-examination of feasible ART refurbishment models for provision of ART services to all PLHIVs under differentiated care services. • Inquest the best approaches to enlarge the scope of PPP-ART and system for private sector engagement across HIV care continuum. • Research towards identification of feasible 'last mile solution' of HIV/AIDS supply chain through segmentation & integration of all commodities, allocation of resources for procurement of equipment including cold chain equipment use, by maintaining maximum possible green norms. • Operational research to identify effects on access to care for PLHIV and adherence to ART regimen during natural disaster-induced situation, as compared to normal times. • Study to determine resultant effects of extreme heat weather on most at-risk population to HIV in terms of their risk and vulnerability, deviation from routine activities, utilization of risk reduction services for HRGs under NACP.
Syndemics of IDs	• Inquiry into the role of multiple syndemic factors and their interactive functions in promoting disease clustering. • Exploration to what extent syndemic factors impact health-related quality of life of PLHIV in India. • Probing the harmful interactions in adverse socioeconomic and behavioral circumstances that affect HIV preventive intervention in India. • Study that characterizes and integrates both communicable and non-communicable diseases using syndemic lens to understand social, behavioral, political and ecological factors of these diseases on PLHIVs. • Modelling studies to recognize how syndemics, including minority stress, housing and prolonged imprisonment, impact risk for PWIDs and LGBTQ communities in India. • Inspection of the levels of HIV risk through the presence of resilience-promoting (eg. social support, mental strength and coping abilities) or resilience-diminishing (eg. stigma, internalized homophobia) factors.

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Introduction

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Cross-Cutting Issues in the Climate Change Impact Pathways and HIV Response in India

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A World of Thanks!

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