Somalia Heat and Health Vulnerability and Capacity Assessment 2025

Evidence for Action on Heat-Health Risks

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International Medical Corps

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List of Abbreviations/Acronyms

CVD	Cardiovascular disease
CHW	Community health worker
DHIS	District Health Information Software
EMRO	Eastern Mediterranean Regional Office (WHO)
FGD	Focus group discussion
HISMS	Health Information Management System (Somalia)
HMIS	Health management information system
HSSP III	Health Sector Strategic Plan III (2022
IDP	Internally displaced person
KII	Key informant interview
MoH	Ministry of Health (Somalia)
ND-GAIN	Notre Dame Global Adaptation Initiative
NGO	Non-governmental organization
NRC	Norwegian Refugee Council
OCHA	Office for the Coordination of Humanitarian Affairs (UN)
SD	Standard deviation
SWALIM	Somalia Water and Land Information Management
UNEP GRID	United Nations Environment Programme Global Resource Information Database
UNHCR	United Nations High Commissioner for Refugees
WHO	World Health Organization

Executive Summary

Background and Purpose

Somalia faces intensifying heat-health risks driven by rising temperatures, high cardiovascular disease prevalence and fragile health systems. This vulnerability and capacity assessment examined how extreme heat affects health outcomes, identified at-risk populations, evaluated health system preparedness, and assessed institutional capacity to respond. The assessment covered four regions—Banadir, Bay, Middle Shabelle and Mudug—using household surveys (n = 474), health facility assessments (n = 17), focus group discussions, key informant interviews and analysis of routine health data.

Seventeen health facilities were assessed to capture regional and institutional diversity. In Banadir Region, eight facilities were included—*Madina Hospital, Kahda Health Center* and *Darkenta Health Center*, plus four additional facilities requested by the federal Ministry of Health: *Deynile Hospital, Banadir Hospital, Karan Health Center, De Martini Hospital* and *Hodan Health Center.* In Bay, assessments covered *Suqa Xollaha Health Center, Bay Regional Hospital* and *Bardale Health Facility.* In Middle Shabelle, they included *Jowhar Hospital, Kulmis Health Centre* and *Bullo Sheikh Health Centre,* while in Mudug, *Galkayo South Hospital, Galkayo Health Centre* and *Harhaar Primary Health Care Unit* were assessed.

Together, these facilities provide the first comprehensive baseline of heat-health service readiness across Somalia's major ecological and administrative zones, forming a foundation for evidence-based adaptation planning in the health sector.

Key Findings

Exposure is universal and intensifying.

Nearly all households (98.6%) experienced extreme heat events in the past year, with 53.9% facing three or more episodes. Three-quarters (75.1%) recognize rising temperatures over the past decade, with 91.6% identifying altered seasonal patterns—longer hot periods, earlier onset, reduced cooling between seasons. Projections confirm this trajectory: national temperatures have risen +1.0–1.5°C since 1991, with 20–90 additional very hot days (≥35°C) projected annually by the 2040s under moderate scenarios, and up to 150 additional days under extreme pathways. Coastal regions face compounding humidity risks with wet-bulb temperatures approaching physiological survival thresholds.

Health impacts are profound and uneven.

Heat drives widespread health consequences: 94.7% of individuals report heat-related symptoms, with common presentations including headache (46.7%), fatigue (35.3%), and skin rash (34.0%). One in six people (16.7%) becomes unable to carry out daily activities during extreme heat. Cardiovascular disease (CVD) emerges as both prevalent—affecting 20% of households—and highly heat-sensitive, with 41.3% of CVD patients reporting symptoms worsening during hot weather. Sleep disruption (96.2%) reduced work capacity, and social isolation extends impacts beyond physical health into economic and social functioning.

Vulnerability concentrates among specific populations. IDPs face nearly double the vulnerability of host communities (mean heat exposure 5.03 vs. 3.64) due to inadequate shelter (73.8% in poor structures), limited water access and minimal vegetation (80.1% have little or no shade). Women bear disproportionate burdens through domestic responsibilities, childcare during heat and pregnancy-related risks. Regional discrepancies are stark: Mudug combines the highest CVD burden (31.9% of households) with the lowest health system capacity, creating critical risk.

Adaptive capacity remains insufficient.

Despite strong experiential awareness of rising heat, adaptive capacity is weak. Only 2.3% of households have detailed adaptation plans, while 51% have made no plans at all. Current coping strategies are limited—47.9% use only one method, and 10.8% have no strategies. Paradoxically, those with the highest exposure employ the fewest coping methods. When asked about future capacity, 37.4% of households expect to be worse off in five to 10 years, indicating that heat risks are accelerating more quickly than household resilience.

Access to early warnings is minimal: only 48.4% of households ever receive heat warnings, and just 12.6% receive them regularly. Among those who receive warnings, radio (72.7%) and health workers (15.8%) are dominant channels, yet 51.6% never receive any warnings at all. This information gap leaves communities unable to prepare for predictable extreme heat events.

Health system is unprepared.

Health facilities demonstrate critical preparedness deficits across all domains. On a composite heat service readiness scale (0–5), facilities averaged only 1.29, indicating possession of fewer than one-third of core capacities. Only 5.9% have heat action plans, 11.8% have heat-illness SOPs, and 29.4% have trained staff. Physical infrastructure is inadequate: 52.9% lack proper shaded waiting areas, 40.8% have minimal cooling system functionality, and 52.9% report inadequate natural ventilation.

Cardiovascular disease services are severely limited despite the high burden. Only 29.4% of facilities provide CVD screening, 17.6% have emergency protocols and 41.2% offer medication management. This service gap is most severe in high-burden regions: Mudug (31.9% CVD prevalence) has zero screening capacity, while Bay (25.2% prevalence) similarly has no screening, despite documented need.

Pharmaceutical supply failures compound clinical capacity gaps. Among CVD household members requiring medications, 72.7% experience unavailability during hot weather—precisely when cardiovascular strain is highest. Facility managers acknowledge that supply chains fail during peak heat due to power outages affecting cold storage, transport delays and inadequate demand forecasting.

Health information systems cannot track heat-health patterns. While 70.6% of facilities (12 of 17) met WHO HMIS quality standards, only 41.2% of assessed facilities (7 of 17) had adequate DHIS data quality for CVD analysis, with 64.5% of CVD records missing even among these better-reporting facilities. Additionally, 88.2% of all facilities do not record heat illnesses separately. This surveillance blind spot masks the true burden, prevents evidence-based planning and leaves policymakers unable to recognize heat as a health priority.

Regional discrepancies in health system capacity mirror vulnerability patterns. Middle Shabelle demonstrates relatively stronger capacity (CVD readiness 3.0/5) with 100% of

facilities offering screening. Mudug shows the lowest readiness (0.33/5) with no screening, no heat training and minimal CVD services despite the highest burden. Bay has good cooling infrastructure (91.7% functionality) but lacks protocols and screening, creating "infrastructure without capacity." Banadir faces urban heat island effects with modest facility capacity but worst early warning access (82.1% never receive alerts).

Institutional and policy frameworks are inadequate.

Somalia has no standalone heat-health policy. National frameworks—including the National Adaptation Plan, Disaster Risk Management Policy and Health Sector Strategic Plan—subsume heat under generic "extreme weather" without specific guidance, protocols or resource allocation. This policy invisibility reflects and reinforces weak institutional coordination. Responsibilities for heat-health span multiple ministries (Health, Environment, Disaster Management) but existing coordination mechanisms and data-sharing arrangements remain limited and are still evolving.

Resource allocation mirrors this institutional fragmentation. Officials acknowledge that very few resources are allocated to address the effects of extreme weather (including heat) on health. Most resources support response activities (emergency water trucking, medical treatment) while prevention and preparedness remain chronically underfunded. Access to finance for weather hazards is minimal, with limited capacity to develop proposals for funds such as GCF or Adaptation Fund mechanisms.

Priority Recommendations

Community and household level: Upgrade shelter with heat-reflective materials and improved ventilation for IDPs in Mudug and Bay. Establish community cooling centers equipped with solar fans and water. Deliver culturally tailored awareness campaigns through radio (72.7% reach) and trusted health workers.

Health system level: Develop standardized heat-health clinical protocols adapted to Somalia's resource constraints. Establish National Heat-Health Early Warning Committee integrating meteorological warnings with facility preparedness. Install weather stations in target districts. Integrate heat-illness diagnostic codes into HMIS. Upgrade facility infrastructure with shade structures, solar fans and air conditioning in critical areas. Strengthen pharmaceutical supply through solar refrigeration, demand forecasting and buffer stocks. Train all health workers on heat-illness recognition. Expand CVD screening, especially in Mudug and Bay.

Policy and institutional level: Develop National Heat-Health Action Plan recognizing heat as a distinct hazard with clear institutional roles and resource allocation. Formalize inter-sectoral coordination through regular committee meetings across health, environment and disaster sectors. Integrate heat-health budget lines into MoH budgets and access relevant (non-humanitarian) finance mechanisms. Establish occupational health regulations for outdoor work during extreme heat.

Knowledge generation: Establish sentinel surveillance sites tracking heat-health trends. Conduct operational research on heat-attributable CVD burden, cost-effective cooling interventions and optimal early warning thresholds. Implement M&E framework tracking heat-illness incidence, CVD emergencies, mortality and medication availability.

Focus on Vulnerability: Target all interventions toward most vulnerable IDPs (2x vulnerability), CVD patients (72.7% medication gaps), children and elderly, and high-risk regions (Mudug critical, Bay high risk). Allocate resources based on vulnerability indices rather than equal regional distribution.

Conclusion

This assessment provides unambiguous evidence: extreme heat is already causing widespread suffering, overwhelming fragile health systems and deepening discrepancies in Somalia. Projections confirm that risks will intensify dramatically, with potentially catastrophic consequences if current trajectories persist. Yet the window for effective intervention remains open. Communities demonstrate strong experiential awareness, health workers express commitment despite constraints and institutional leaders acknowledge the need for action.

The choice is clear: invest in preparedness now through systematic, evidence-based interventions, or accept far higher costs in lives, health and development progress in the years ahead. This assessment provides the evidence base to make that investment wisely. The imperative for action is urgent, the pathways forward are clear, and the time to begin is now.

Chapter 1: Introduction & Assessment Background

1.1 Somalia's Heat and Health Context

Somalia is among the countries most exposed to the health risks of extreme weather and environmental stresses (ND-GAIN, 2022; UNEP GRID, 2023). Rising average temperatures and more frequent extreme heat events are creating new and under-recognized threats to public health (UNEP GRID, 2023; WHO, 2013). Heat-related illnesses—including heat exhaustion, heat stroke, dehydration and the worsening of cardiovascular conditions—are expected to increase, especially in fragile health systems (WHO, 2013).

The Somali context compounds these risks. Decades of fragility, conflict and recurrent displacement have left many with poor access to healthcare, weak infrastructure and limited capacity to adapt (Ahmed Dirie et al., 2024; SHDS, 2020). The urban poor, internally displaced persons (IDPs), the elderly, women, infants and those living with non-communicable diseases like cardiovascular disease (CVD) are particularly vulnerable (Vicedo-Cabrera et al., 2021 (Vicedo-Cabrera et al., 2021; WHO, 2023, 2024)—and these vulnerabilities remain under-documented in Somalia.

Although the federal Government of Somalia has integrated extreme weather and environmental stresses into frameworks such as the Health Sector Strategic Plan III (2022–2026), explicit recognition of extreme heat as a distinct health hazard is limited. Current frameworks typically refer to "extreme weather events" broadly, leaving operational gaps in heat-specific policy.

Recognizing these growing threats, International Medical Corps, with support from the Novo Nordisk Foundation and in collaboration with the federal Ministry of Health, is implementing the project *Supporting the Somali Health System to Respond to Increased Heat and Extreme Heat Events*. The project aims to improve the resilience of Somalia's health system to extreme heat by strengthening its ability to prevent and manage heat-related morbidities, with particular emphasis on cardiovascular diseases, while safeguarding continuity of care during weather shocks.

The initiative is structured around three outcomes:

1. improved recognition of heat-related vulnerabilities in policies and programming;
2. better health outcomes for individuals with cardiovascular morbidities during heat and extreme heat events; and
3. enhanced capacity of health facilities, health workers and communities to manage heat-health impacts while maintaining service quality.

Early capacity-building efforts have shown promising results. Clinician and district health team training in Mogadishu yielded over 80% knowledge improvement between pre- and post-tests, while community health worker (CHW) training in Jowhar showed a 53.9% increase. Sessions in Baidoa engaged men and women with culturally appropriate protection messages. These efforts demonstrate growing recognition of heat-health risks, though

systemic challenges remain—including limited CHW literacy, absence of facility protocols for recording heat illness and weak integration of heat-health into routine planning.

1.2 Assessment Scope and Objectives

This assessment builds on these foundations by moving beyond awareness-raising to provide systematic documentation of household vulnerabilities, facility readiness and institutional blind spots. It focuses specifically on the direct health impacts of elevated temperatures and extreme heat events on households and vulnerable subgroups in Bay, Banadir, Middle Shabelle and Mudug. Indirect effects—such as nutritional consequences of reduced crop yields or changes in vector-borne disease patterns—were excluded to maintain a sharp focus on temperature-related health risks.

The assessment pursues six interlinked objectives:

1. Evaluate the current and projected situation regarding heat and humidity in Somalia.
2. Assess the current burden of heat-sensitive health outcomes and vulnerabilities.
3. Examine the capacity of health and health-relevant systems to address heat-related outcomes.
4. Project future heat-health risks over the next 5–10 years.
5. Identify priority areas for adaptation and health-system strengthening.
6. Assess the suitability of WHO assessment tools in the Somali context and suggest adaptations.

The assessment used a mixed-methods approach. Household surveys captured demographic composition, self-reported heat-related symptoms and care-seeking; health facility assessments examined service readiness; and focus group discussions (FGDs), key informant interviews (KIIs) and health worker observations provided qualitative insights. Standard tools such as the Rose Angina Questionnaire and INTERHEART framework were applied to strengthen evidence on cardiovascular risk. Information related to historical temperatures was drawn from global reanalysis datasets (ERA5, NASA POWER, CHIRPS), given the absence of reliable observational records. Full methodological details are presented in the Annex.

The report is structured around guiding ToR questions aligned with WHO's vulnerability and adaptation (V&A) framework (WHO, 2013):

- What is Somalia's current and projected heat/humidity situation?
- Who is most vulnerable to heat, and why?
- What is the current burden of heat-sensitive health outcomes (especially CVD)?
- How prepared are health and disaster systems?
- What health impacts might arise in the next 5–10 years without adaptation?
- Which policies, programs and system changes are most needed?

Chapter 2: Heat Context

2.1 Data Availability and Limitations

Accurate heat profiling in Somalia is constrained by severe data gaps. The country has no functioning national meteorological observation network, and routine station-based temperature and humidity records are not available. Direct engagement with the Somalia Meteorological Department revealed that officials lacked internal capacity to provide historical records and referred the team to Somalia Water and Land Information Management (SWALIM) as the primary source. Attempts to extract temperature data from SWALIM's online platform consistently failed at the download stage, despite functioning user interfaces, across multiple devices and networks. An email to the official SWALIM contact remained unanswered.

Parallel attempts through the World Bank Portal (CMIP6 and CRU datasets) revealed further incompatibilities: absence of regional disaggregation suitable for district-level analysis, format issues limiting integration with health datasets and temporal aggregations unsuitable for health service planning cycles. Together, these impediments revealed a circular referral loop between national and international systems, marked by unclear institutional mandates, absent inter-agency data sharing protocols and non-functional technical infrastructure.

This assessment therefore draws on published heat-risk reviews and authoritative global portals from organizations such as University of Notre Dame, the World Bank, and the Red Cross and Red Crescent Society. These sources provide the best available evidence on temperature, humidity and projected trends but should be interpreted as modelled or secondary datasets rather than official national observations.

2.1.1 Implications for Heat-Health Correlation Analysis

The systematic inaccessibility of long-term weather data prevented the quantitative heat-health correlation analysis outlined in the project inception report. The inception report's phased methodological design anticipated three scenarios based on data quality: (1) sufficient data enabling statistical correlation, (2) partial data requiring exploratory analysis or (3) systematic data gaps necessitating reliance on qualitative evidence. Phase 1 assessment criteria—including 24 months of overlapping health and heat data, ≥70% health data completeness, ≤50km distance between facilities and meteorological stations, and consistent reporting protocols—were not met due to: (a) absence of functional weather stations within study districts, (b) incomplete and inconsistent HMIS cardiovascular reporting across facilities and (c) no mechanism to link temperature records with facility-level health events.

Following the pre-approved methodological framework, the assessment proceeded directly to Phase 3, which prioritized structured qualitative evidence. Key informant interviews with healthcare providers documented clinical observations of seasonal variations in cardiovascular presentations. Focus group discussions captured community perceptions of heat-health relationships. Facility managers provided insights into patient load variations during extreme heat periods. Health worker observations thus became not supplementary but primary evidence sources, documenting patterns that quantitative correlation analysis would have sought to establish (had data infrastructure permitted).

This methodological adaptation aligns with WHO VCA guidance and TOR specifications (Section IV, Footnote 2) recognizing that modeling of relations between long-term weather patterns and health outcomes is extremely complex and validating qualitative approaches where data infrastructure is insufficient. The approach also generated critical insights for institutional strengthening, including the need for: (1) information systems linking meteorological and health data, (2) technical capacity building in related institutions, (3) inter-sectoral coordination mechanisms and (4) community-based monitoring to fill persistent gaps.

2.2 National Heat and Humidity Trends

Somalia's environment is defined by consistently high temperatures, strong seasonality and wide regional variation in humidity. According to global assessments, temperatures in the country have increased by approximately +1.0 to +1.5°C since 1991, with most of the increase occurring after the collapse of systematic observation in the 1990s (Weathering Risk/PIK, 2022; World Bank CCKP, 2024). Current national average temperatures are estimated at ~27.3°C in 2024, compared to a long-term baseline of around 26°C (UNEP GRID, 2023; Weathering Risk/PIK, 2022).

Seasonal rainfall patterns remain bimodal: the Gu rains (April through June) and Deyr rains (October through December) separate two hot dry seasons—Jilaal (December through March) and Hagaa (July through September). However, the timing of peak heat varies regionally. In the south, the hottest months typically occur December through March, while in central and northern regions, June through September peaks dominate. This results in near year-round exposure to extreme heat across the country (RCCC, 2024; Weathering Risk/PIK, 2022).

Humidity patterns amplify health risks. Southern coastal and river-valley areas (e.g., Banadir, Middle Shabelle) sustain 70–80% relative humidity, creating high heat index values and occasional wet-bulb conditions where safe outdoor labor becomes physiologically constrained. Northern inland areas (e.g., Bay, Mudug) record lower humidity (40–60%) but face much higher air temperatures, regularly exceeding 35–40°C during hot seasons (RCCC, 2024; UNEP GRID, 2023).

Recent analyses indicate a 20% increase in both extreme and severe heat stress events between the 1960–1991 and 1992–2023 periods, particularly in coastal districts where humidity interacts with rising air temperatures (Alasow et al., 2025; Weathering Risk/PIK, 2022). Notably, the most significant temperature increases have occurred at night, limiting opportunities for physiological recovery from daytime heat exposure (IPCC, 2023; RCCC, 2024).

Together, these trends underscore that Somalia is already operating beyond safe climatic thresholds for health, with both humid coastal heat and dry interior extremes posing escalating risks to households and health systems.

2.3 District Heat Profiles

The four study districts illustrate the diversity of Somalia's heat risks. While all experience dangerous conditions, the specific drivers of vulnerability differ between inland arid zones and coastal humid regions.

2.3.1 Mudug (Galkayo)

Mudug emerges as Somalia's heat epicenter. Annual mean temperatures are estimated at ~31°C, the highest among the study districts. Peak daily maxima reach 41°C during July and August, with more than 200 days annually exceeding 35°C. Humidity ranges from 45–62%, producing extended periods of heat index >40°C from May through October. With annual rainfall of only ~133 mm, high heat coincides with severe water scarcity

Health relevance: Extended (UNEP GRID, 2023; Weathering Risk/PIK, 2022) extreme heat seasons, scarce cooling infrastructure and limited water access place households and health facilities under persistent stress. IDP settlements in Mudug are particularly exposed due to makeshift shelter and weak service coverage (IPCC, 2023; RCCC, 2024).

2.3.2 Banadir (Mogadishu)

Banadir's environment is moderated by its coastal location, with an annual mean of ~26.4°C and peak air temperatures of 31–32°C in April. However, humidity levels of 69–79% amplify heat stress, creating heat index >40°C episodes in April and May and again in October and November. Urban heat island effects in Mogadishu elevate nighttime temperatures by several degrees above surrounding rural areas, reducing opportunities for recovery. With more than 2.4 million people—including large, displaced populations—the combination of high humidity and dense urban exposure creates uniquely dangerous conditions (UNEP GRID, 2023; Weathering Risk/PIK, 2022).

Health relevance: Humidity-driven stress and lack of nighttime relief increase risks of dehydration, exhaustion and cardiovascular strain. IDPs in dense urban settlements face compounding risks from poor housing, overcrowding and limited ventilation (UNEP GRID, 2023).

2.3.3 Bay (Baidoa)

Bay experiences some of the most extreme seasonal temperature swings. Annual ranges span 19–39°C, with peak conditions from February through April, when daily maxima reach ~39°C. The district records 60–90 days per year above 35°C, alongside the longest "muggy" period (~9 months), with May averaging ~28 muggy days (Weathering Risk/PIK, 2022).

Health relevance: Extended hot seasons align with key agricultural periods, creating severe occupational heat stress for farmers and laborers. Food security risks are compounded as extreme heat undermines crop and livestock productivity in this key agricultural region (IPCC, 2023; RCCC, 2024).

2.3.4 Middle Shabelle (Jowhar)

Jowhar has an annual range of 21–37°C, with March typically the hottest month, reaching ~37°C. The district sustains the longest muggy season among study areas (~9.5 months), with May averaging ~30 muggy days. High relative humidity elevates heat index >40°C risks, particularly from March through May (UNEP GRID, 2023; Weathering Risk/PIK, 2022).

Health relevance: Long humid seasons increase risk of heat stress for vulnerable groups (elderly, children and those with chronic conditions), while also reducing labor productivity. The combination of high humidity and recurrent riverine flooding creates compound health and livelihood pressures (IPCC, 2023; RCCC, 2024).

2.4 Future Heat Risks

Projections indicate that Somalia will experience substantial intensification of extreme heat events over the next three decades. Under moderate-emission pathways (SSP2-4.5), national temperatures are expected to rise by +1.5–2.0°C by the 2040s, while high-emission scenarios (SSP5-8.5) project increases of +2.5–3.5°C or more by mid-century (IPCC, 2023; RCCC, 2024; UNEP GRID, 2023; UNEP/GRID-Geneva, n.d.; World Bank CCKP, 2024).

The number of very hot days (≥35°C) is projected to rise sharply, particularly in central and interior regions such as Mudug and Bay. Modeling suggests an additional +20 to +90 very hot days per year by the 2040s, depending on scenario. Under extreme pathways, central Somalia could experience more than 150 additional very hot days annually by the 2050s, effectively creating year-round extreme heat conditions (RCCC, 2024; UNEP GRID, 2023; Weathering Risk/PIK, 2022).

Coastal regions (Banadir, Middle Shabelle) face a different but equally severe risk: the interaction of heat and humidity. By the 2040s, wet-bulb temperatures exceeding 31°C—the threshold beyond which safe physical labor becomes impossible—are expected to occur with increasing frequency. Under SSP5-8.5 scenarios by the 2050s, extreme events could approach the 35°C wet-bulb threshold, at which human survival without cooling becomes physiologically unsustainable (IPCC, 2023; RCCC, 2024).

Urbanization will amplify these risks. With Somalia's urban population projected to grow rapidly, Mogadishu and Baidoa are likely to experience intensified urban heat island effects, further raising nighttime temperatures and compounding health burdens for densely populated IDP settlements (UNEP GRID, 2023; Weathering Risk/PIK, 2022).

Health implications:

- Households and workers will face longer exposure periods and fewer hours of safe labor.
- Health facilities will experience higher caseloads of heat-sensitive conditions, including dehydration, renal stress and cardiovascular complications.
- Displaced and urban poor populations will face the highest risks, given overcrowding, poor housing and limited access to cooling or reliable water supplies.

2.5 Summary: Heat Context for Health

Somalia is already experiencing dangerous levels of heat stress, with a national increase in temperatures of +1.0–1.5°C since 1991 and a documented rise in extreme and severe heat stress events. Seasonal patterns expose different regions to peak heat at different times of year, creating near-continuous national exposure. Coastal districts face humidity-driven wet-bulb risks, while interior regions experience high-frequency very hot days, both of which threaten human health and productivity.

District profiles underscore this diversity:

- Mudug (Galkayo): the country's heat epicenter, with extreme frequency of very hot days.
- Banadir (Mogadishu): high humidity and urban heat island effects that magnify night-time stress.

- Bay (Baidoa): strong seasonal heat extremes overlapping with agricultural labor demands.
- Middle Shabelle (Jowhar): extended muggy periods with sustained heat index stress.

Looking ahead, mid-century projections indicate survival-threatening conditions, with 20–90 additional very hot days per year under moderate scenarios, and up to 150 additional days under extreme scenarios. Coastal wet-bulb thresholds may frequently exceed safe limits for outdoor labor, while urbanization will intensify exposure for millions living in Mogadishu, Baidoa and IDP settlements across the country.

For Somalia's health system, this heat context means that heat-sensitive conditions—including dehydration, renal stress, maternal and child complications and cardiovascular disease—will increase in frequency and severity. Vulnerable groups such as infants, the elderly, pregnant women, IDPs and those with chronic illnesses will bear disproportionate impacts. Without targeted adaptation measures, these risks will overwhelm already fragile facilities, disrupt continuity of care and increase mortality and morbidity from extreme heat.

📌 **Key Messages: Heat Context**

- **Severe data gaps:** Somalia has no national meteorological observation network; all analysis depends on modeled/secondary global datasets, rather than official national records.
- **Already hotter:** National temperature increases of **+1.0–1.5°C since 1991**, with current averages around **27.3°C**. Nighttime temperature increases are most pronounced, reducing recovery from daily heat stress.
- **Year-round exposure:** Different seasonal peaks across regions (December through March, south; June through September, central/north) mean there is almost continuous exposure to dangerous heat somewhere in the country.
- **Two dominant hazard types:** Coastal districts face **humid heat** and **wet-bulb risks**, while inland/arid regions face **dry extremes** with **prolonged very hot days**.
- **District contrasts:**
  - **Mudug (Galkayo):** Somalia's **heat epicenter** with ~31°C annual mean, >200 days ≥35°C, peaks to 41°C and severe water scarcity.
  - **Banadir (Mogadishu):** Coastal humidity (69–79%) plus **urban heat island** effects, producing heat index >40°C and hotter nights for dense urban/IDP populations.
  - **Bay (Baidoa):** Wide annual swing (19–39°C) with **60–90 very hot days/year**, overlapping with farming seasons—creating both health and livelihood stress.
  - **Middle Shabelle (Jowhar): 9.5-month muggy season**, frequent heat index >40°C, compounding risks with flooding and crop stress.
- **Trends worsening:** Since the 1990s, there has been a **20% increase in extreme/severe heat-stress events**, particularly in coastal areas.
- **Future escalation:** By the 2040s, **20–90 additional very hot days annually** are expected under moderate scenarios; under high emissions, **≥150 extra days** by the 2050s. Coastal wet-bulb levels may approach **physiological survival limits** (35°C).
- **Urbanization multiplier:** Rapid growth in Mogadishu and Baidoa will intensify **urban heat islands**, especially in crowded IDP settlements with poor housing and no cooling infrastructure.
- **Health implications:** Rising heat will reduce safe labor hours, increase dehydration, increase renal and cardiovascular strain, and raise maternal/child health risks—while fragile health systems face higher caseloads with limited readiness.

Overall interpretation: Somalia is already operating beyond safe heat thresholds. Dual threats of humid coastal heat and dry inland extremes, compounded by urbanization and nighttime temperature increases, will intensify health burdens. Without investment in monitoring, early warning and targeted adaptation, these pressures will overwhelm vulnerable households and fragile health systems.

Chapter 3: Vulnerability: Who is at Risk and Why?

Vulnerability to heat in Somalia emerges at the intersection of demographic characteristics, socioeconomic conditions and pre-existing health burdens. This chapter addresses three fundamental questions: Who is most vulnerable to heat? Why are they vulnerable? What percentage of the surveyed population do they represent?

3.1 Framing Vulnerability

Vulnerability to extreme heat in Somalia reflects the interplay of exposure, sensitivity and adaptive capacity. Exposure refers to how often and how intensely people face high temperatures and humidity. Sensitivity captures the characteristics that make heat more harmful—including age, pregnancy, pre-existing illness, displacement status and socio-economic conditions. Adaptive capacity is the set of resources—at household, community and system level—that allows people to prevent, withstand and recover from heat stress.

In fragile and displacement-affected settings, sensitivity is high and adaptive capacity is low. As a result, even modest increases in exposure can trigger disproportionate health impacts: disrupted sleep, dehydration, acute exacerbations of chronic disease and reduced ability to work. These pressures compound in households where young children, pregnant women and older adults live together, and where shelter materials, crowding, unreliable water and lack of electricity push indoor temperatures to unsafe levels.

This chapter focuses on sensitivity. We examine demographic vulnerability (particularly young children, pregnant women and older adults), socio-economic vulnerability (income insecurity, displacement and poor-quality housing) and health-related vulnerability (the diagnosed and undiagnosed burden of cardiovascular and metabolic conditions that heat exacerbates). Regional discrepancies in these vulnerabilities are then analyzed to show how risk is clustered geographically and systemically.

The analysis draws on multiple evidence sources: a household survey of 474 households across Bay, Banadir, Middle Shabelle and Mudug; facility assessments and key informant interviews with 27 health managers and frontline staff members from 17 facilities; and community perspectives gathered through FGDs with both IDP and host populations. These primary data are complemented by national demographic surveys (such as SHDS 2020) and global health literature, situating Somalia's heat-health vulnerabilities within broader scientific understanding.

3.2 Demographic Vulnerabilities

Certain population groups face inherently greater physiological susceptibility to heat stress due to demographic factors that create direct pathways from heat exposure to health impacts, independent of socioeconomic or environmental conditions.

3.2.1 Age-Based Vulnerabilities

Age is one of the strongest determinants of physiological susceptibility to heat. Both young children and older adults face reduced ability to regulate body temperature, making them especially vulnerable when ambient temperatures rise.

Children under 5 are the most consistently exposed group. Physiologically, they have higher metabolic rates, immature sweating mechanisms and a greater surface-area-to-body-mass ratio, all of which accelerate heat absorption. In the survey, children under 5 were present in **83.9%** of households, with an average of **1.77** per household. Nearly one-quarter **(22.8%)** of households contained three or more young children, creating heavy care burdens during heat events. Regional differences were marked: Mudug (mean 1.90) and Middle Shabelle (1.98) reported the highest concentrations, while Banadir had the lowest (1.37). These results align with broader demographic trends documented in SHDS (2020), where rural and pastoral households show higher fertility rates than urban centers (see **Table 3.1**).

Table 3.1: Household demographic vulnerability characteristics by region

Region	Avg HH Size	% HHs with Child <5	Mean # Children <5	% HHs with Elderly (60+)	Mean # Elderly	% HHs with Pregnant Woman	Mean # Pregnant Women
Bay	6.27	85%	1.81	32%	0.32	20%	0.20
Mudug	7.10	87%	1.90	17%	0.17	32%	0.32
Middle Shabelle	7.05	86%	1.98	30%	0.30	17%	0.17
Banadir	6.52	78%	1.37	10%	0.10	15%	0.15
Overall	**6.73**	**83.9%**	**1.77**	**17.5%**	**0.22**	**20.3%**	**0.21**

Although the routine surveillance data does not currently disaggregate outpatient data by age, health workers across all assessed facilities reported a noticeable seasonal rise in pediatric consultations during the hottest months—particularly for fever, dehydration and respiratory distress. These qualitative facility observations are consistent with the household data and community testimonies, suggesting that young children experience both higher exposure and greater clinical vulnerability during extreme heat.

Community narratives reinforced these findings. In Jowhar, women explained:

> *"During the hot season, children cry more and refuse to sleep. They develop fevers, skin rashes and breathing problems. Some need to go to the clinic."*
> *(Female FGD, Jowhar)*

Health facility staff members corroborated this, reporting increased pediatric consultations in the hottest months, especially for dehydration, fever and respiratory distress.

Older adults also face heightened risk. They have weaker thermoregulation and higher prevalence of chronic conditions such as cardiovascular disease, hypertension and diabetes. Elderly people (60+) were present in **17.5% of households**, with a mean of **0.22 per household**. Regional variation was pronounced: Bay (32%) and Middle Shabelle (30%) had the highest proportions, while Banadir had the lowest (10%) (see **Table 3.1**).

Focus group participants described these challenges:

> *"Elderly people are very weak during hot days. Their bodies do not cool down quickly, and many have heart problems or high blood pressure. They get dizzy or confused or cannot stand up." (FGD, Galkayo)*

Facility supervisors confirmed that elderly patients frequently presented with worsening cardiovascular symptoms during extreme heat, including confusion, weakness and chest pain.

Taken together, the results in **Table 3.1** and qualitative evidence from FGDs and KIIs show that very few Somali households are free from age-related vulnerability. As shown later in **Figure 3.1 (Section 3.2.4)**, these vulnerabilities rarely occur in isolation: most households include children under 5, elderly members or both, magnifying the care burden during heat events.

3.2.2 Vulnerabilities Specific to Men and Women

Heat vulnerability in Somalia is shaped by occupational exposures, social expectations and cultural norms. Women and men face distinct risks, which manifest in different ways but often converge within the same households.

Women's burdens arise primarily from domestic and reproductive roles. Among surveyed households, **60.9% reported childcare difficulties during hot weather**, with mothers explaining that children cry more and refuse to sleep at night. More than half (53.7%) cited increased domestic workload, often related to water collection and cooking in poorly ventilated shelters. **Pregnancy-related difficulties** were reported in 35.5% of households, while 42.3% noted mobility constraints and 16.5% highlighted cultural or clothing restrictions that limit women's ability to adapt. These results, presented in **Table 3.2**, demonstrate how multiple, overlapping constraints amplify women's vulnerability during heat events.

Table 3.2: Heat challenges specific to men and women (multiple response)

Challenge Type	Women (n=461)	Men (n=467)	Domain
Women's Challenges			
Childcare difficulties	60.9%	-	Care burden
Increased domestic workload	53.7%	-	Labor burden
Limited mobility/travel	42.3%	-	Social constraint
Pregnancy-related issues	35.5%	-	Maternal and newborn health
Clothing/cultural constraints	16.5%	-	Cultural impediment
Men's Challenges			
Outdoor work exposure	-	55.2%	Occupational
Income loss from heat	-	54.5%	Economic
Physical labor limitations	-	47.4%	Occupational
Dehydration from work	-	40.6%	Health
Heat exhaustion	-	17.8%	Health
No challenges reported	7.0%	4.0%	-

Note: Households with no women (2.5%) or no men (1.3%) excluded from respective analyses

Women in FGDs described the double burden vividly:

> *"During the hot season, it is hard to cook inside the shelter, but we have no choice—we suffer together with the children." (Female FGD, IDP settlement)*

Men's burdens were largely occupational and economic. Daily wage laborers and farmers emphasized direct outdoor exposure: **55.2% reported heat as a workplace risk**, while 54.5% linked it to lost income. Nearly half (47.4%) reported physical labor limitations, and 40.6% noted dehydration. One construction worker summarized the dilemma:

> *"If we stop work because of the heat, we lose the day's income, but if we continue, we get sick." (Male FGD, laborer)*

Comparative analysis (see **Table 3.3**) shows that men reported slightly higher heat symptom burdens (3.50 vs. 3.11, p=0.065) and significantly higher adaptive capacity (3.00 vs. 2.73, p=0.027). This suggests that while men experience greater direct exposure, they also have more resources and decision-making power to cope. Women, by contrast, remain constrained by cultural impediment and structural discrepancies that limit their ability to translate knowledge into action.

Table 3.3: Comparison of key heat-health indicators for men and women

Indicator	Male (n=105)	Female (n=368)	Difference	t-statistic	p-value	Interpretation
Health Impacts						
Heat symptoms (0-11)	3.50	3.11	+0.40	1.850	0.065	Marginally higher in men
Sleep disruption	83.8%	75.1%	+8.7%	χ^2=7.416	0.060	Trend toward male impact
Healthcare seeking	54.9%	45.9%	+9.0%	χ^2=2.319	0.128	Higher male utilization
Adaptive Capacity						
Adaptive capacity index	3.00	2.73	+0.27	2.223	0.027*	Significantly higher in men
Heat knowledge score	2.60	2.38	+0.22	1.440	0.150	Similar knowledge

Significant at $p < 0.05$

Despite these differences, health systems remain largely blind to the specific needs of women and pregnant women. Only three of the 17 facilities assessed (17.6%) had structured provisions for pregnant women during heat events, and just two facilities (11.8%) acknowledged risks specific to women in their planning. Where provisions were reported, they referred to basic measures such as shaded waiting areas, access to drinking water/fans or scheduling adjustments for antenatal care during peak heat. Occupational heat education for men was entirely absent (0%). Staff generally admitted that they only recognize heat-related problems once patients present, with no anticipatory measures in place.

In summary, the results from **Tables 3.2** and **3.3** confirm that men and women face distinct but overlapping vulnerabilities: men through direct exposure and economic loss, and women through reproductive roles, cultural constraints and disproportionate caregiving. These differences highlight the need for programming that addresses both physiological and social determinants of heat risk.

Women's pathway:

Heat exposure → Domestic burden (53.7%) → Mobility restrictions (42.3%) →

Limited healthcare access (45.9% seeking care) → Health impacts

Men's pathway:

Heat exposure → Occupational exposure (55.2%) → Income loss (54.5%) →

Higher healthcare utilization (54.9%) → Economic impacts

3.2.3 Pregnancy and Maternal and Newborn Health

Pregnancy represents a period of heightened physiological vulnerability to heat stress, driven by increased metabolic demands, reduced heat dissipation capacity and cardiovascular strain. In this assessment, pregnancy status was recorded at the household level—respondents were asked whether any household member was pregnant at the time of the survey. Pregnancy was reported in **20.3% of surveyed households** (mean 0.21 pregnant women per household), with regional variation ranging from 15% in Banadir to 32% in Mudug. IDP settlements showed marginally higher pregnancy prevalence (21.2%) compared to host communities (18.4%), though differences were not statistically significant ($p = 0.339$).[1]

Women frequently described heightened discomfort, disrupted sleep and increased health complications during late pregnancy in hot months. Focus group participants emphasized that heat worsens maternal fatigue and limits mobility, with some women reporting that they avoided markets or health visits during peak temperatures because of exhaustion and dizziness.

A woman in Jowhar highlighted the double burden of heat and domestic responsibilities:

> *"Pregnant women, babies and the sick are most affected, and women struggle more, as they must cook, care for children and fetch water, with kitchens and long walks becoming unbearable in the heat."*

These testimonies reflect epidemiological evidence from other settings linking maternal heat exposure to poor outcomes, including preterm birth and low birth weight. Even without clinical records, community observations in Somalia reveal a strong perceived connection between heat, maternal exhaustion and adverse pregnancy outcomes.

[1] The indicator reflects **household-level reporting**—that is, the proportion of surveyed households in which at least one member was pregnant at the time of the survey. The denominator therefore represents households, rather than individual women of reproductive age, and the figure should not be interpreted as population-level pregnancy prevalence.

Facility-level findings reinforce these accounts. Only three of the 17 health facilities assessed (17.6%) had structured provisions for pregnant women during heat, such as access to shaded or cooled waiting areas or priority consultation during extreme temperatures (**Table 3.4**). The absence of standardized protocols means that most expectant mothers must navigate high-risk conditions without tailored support. No facilities reported having specific guidelines for managing pregnancy-related heat stress, and clinical staff confirmed that cases were generally managed as routine rather than as high-risk emergencies.

The overlap of physiological vulnerability in pregnancy with gaps in service provision highlights a critical risk pathway. While women carry the dual burden of caring for young children and managing their own maternal health during heat events, the health system response remains reactive. Without proactive planning—including antenatal counseling on heat risks, provision of cool resting spaces and adapted triage protocols—pregnant women will continue to face preventable complications.

Table 3.4: Provisions for men and women in health facilities (n=17)

Indicator	Facilities with Provision	% of Total (n=17)
Provisions for pregnant women during heat	3	16.7%
Risk planning tailored to men's and women's needs	2	11.1%
Occupational heat education for men	0	0%

3.2.4 Clustering of Vulnerabilities at the Household Level

As shown in **Figure 3.1**, nearly nine in 10 households (89.4%) contained at least one heat-vulnerable member, and more than one-third (36.2%) hosted three or more. Vulnerabilities are therefore not experienced in isolation; caregivers, most often women, manage multiple dependents simultaneously during extreme heat.

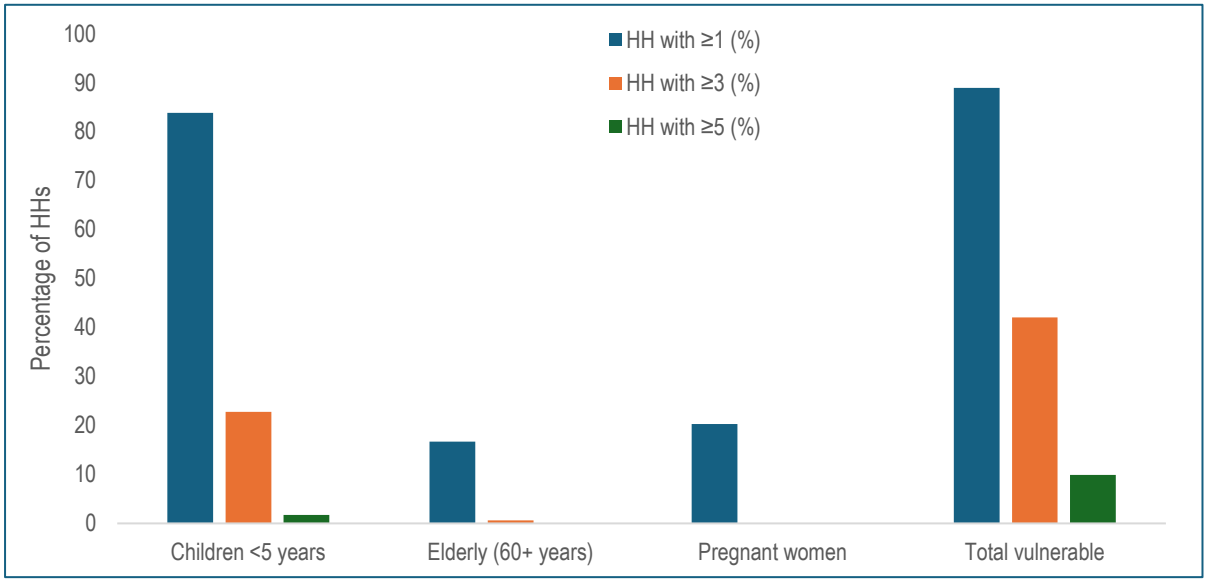

Figure 3.1: Distribution of vulnerable groups by household

The household survey data presented in **Tables 3.2** and **3.3** further illustrate how these risks intersect by age and gender, reinforcing the clustering pattern. This aligns with national demographic trends reported in the Somalia Health and Demographic Survey (2020), which highlight a predominantly young population, very few elderly and a large share of women of reproductive age. The challenge is further compounded by the fact that nearly one-third of Somali households (32.8%) are female-headed, magnifying women's responsibility for both income generation and caregiving during extreme heat.

Together, these dynamics confirm that demographic vulnerability is widespread and household clustered.

3.3 Socioeconomic Vulnerabilities

Socioeconomic factors shape heat vulnerability by determining access to protective infrastructure, resources for adaptation and the ability to recover from shocks. In Somalia, income insecurity, displacement status and housing quality form the main structural pathways through which extreme heat translates into health risks.

3.3.1 Income Sources and Livelihood Insecurity

Household income sources revealed a heavy reliance on a narrow set of livelihoods, with limited diversification overall. The most common primary income was daily wage labor (53.9%), followed by humanitarian assistance (34.9%). Traditional livelihood activities were much less common: farming/agriculture (12.5%), small business/trading (9.7%), and livestock rearing (4.4%). Formal employment was rare, reported by only 3.0% of households (**Figure 3.2**).

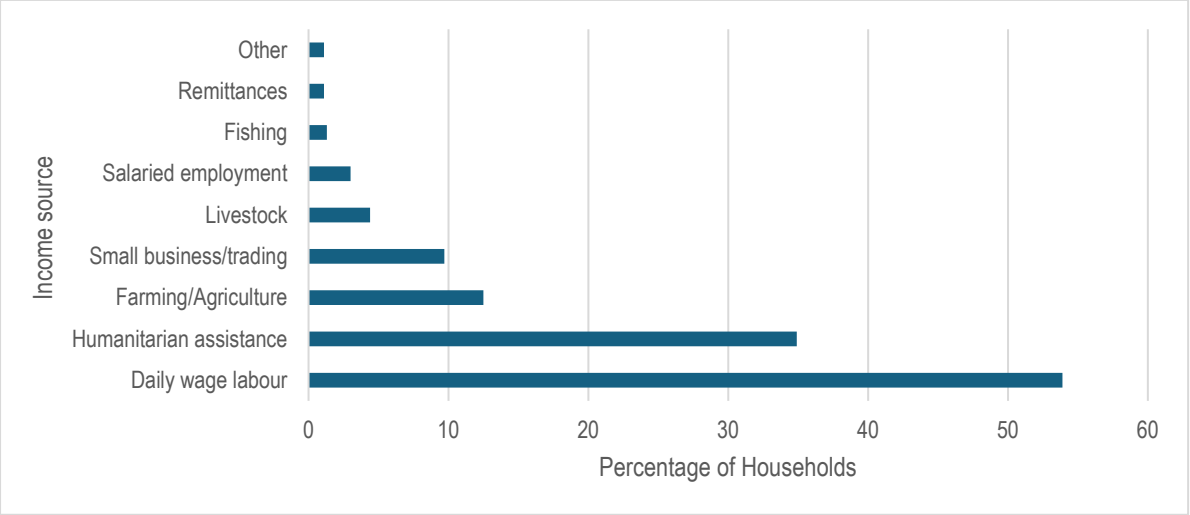

Figure 3.2: Distribution of household income sources

On average, households reported 1.22 income sources (SD = 0.43, range: 0–3). More than half (55.3%) relied on a single source, and 20.5% reported none. Regional differences were significant ($\chi^2 = 36.0$, $p < 0.001$): Banadir households showed the highest diversification (mean: 1.33), while Middle Shabelle had the lowest (mean: 1.08). Host households reported slightly greater diversification than IDPs (mean: 1.29 vs. 1.18, $\chi^2 = 10.6$, $p = 0.014$) (**Figure 3.3**).

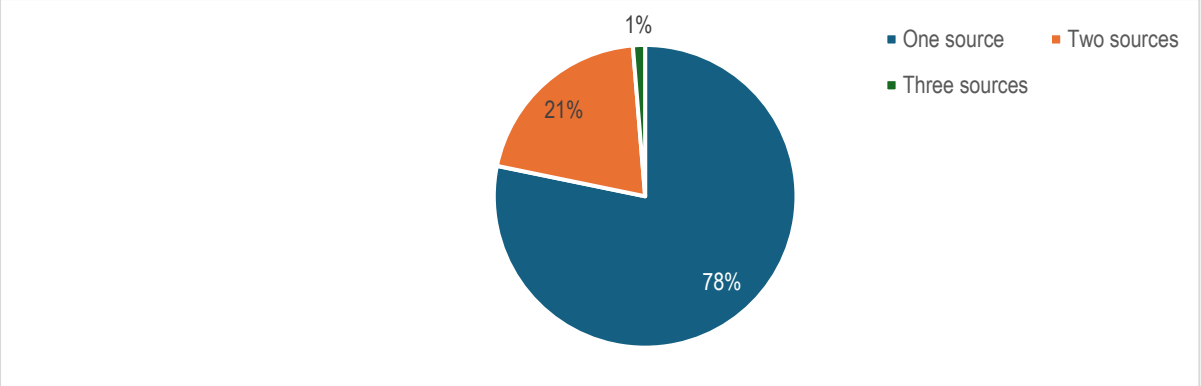

Figure 3.3: Distribution of households by number of incomes reported

Key informants confirmed these patterns, noting that prolonged hot periods and high temperatures undermine ecosystems and livelihoods. Crop failures and loss of pasture force many families to depend on food aid and reduce their income-generating options. Farmers and pastoralists described being "*caught in a cycle of dry soils, weak livestock and shrinking harvests*," which leaves incomes highly unstable. For daily wage laborers, heat reduced work capacity and income, creating a feedback loop that limited resources for cooling, shelter improvement or healthcare. As one FGD participant in Banadir explained: *"Without stable livelihoods, families are left sitting in houses made of plastic and iron sheets, which become very hot."*

3.3.2 Displacement Status and the IDP Penalty

The study sample included 66.7% IDP households and 33.3% host community households, deliberately oversampling displaced populations to capture conditions in displacement settings. This reflects Somalia's broader displacement crisis: as of 2023, Somalia hosts approximately 3.8 million internally displaced persons (UNHCR, 2025)—roughly 23% of the total population—making it one of the world's largest IDP populations.

Table 3.5 presents key infrastructure and service indicators by settlement type, revealing substantial discrepancies across all measured dimensions.

Table 3.5: Infrastructure access by settlement type

Infrastructure Component	Host Community	IDP Settlement
Housing		
Temporary shelter	46.5%	67.4%
Plastic sheeting roof	9.6%	63.9%
Concrete/stone house	21.7%	0.3%
Very hot indoors	30.4%	53.2%
Services		
No electricity	35.7%	90.8%
Consistent electricity	51.6%	2.2%
Reliable water during heat	62.4%	10.8%
Health Outcomes		
Mean heat symptoms (0-11)	2.84	3.36
Healthcare access during heat	68.8%	41.2%

As shown in **Table 3.5**, discrepancies between IDPs and host households were stark across all infrastructure and service indicators. Nearly two-thirds of IDPs (63.9%) relied on plastic sheeting for roofing compared to just 9.6% of hosts. More than 90% of IDPs had no electricity versus 35.7% of hosts, eliminating access to even basic cooling measures. Reliable water access was also far lower (10.8% vs. 62.4%).

These structural disadvantages translated directly into health impacts. IDPs reported higher symptom burdens (mean 3.36 vs. 2.84 on the 0–11 scale) and lower healthcare access during heat events (41.2% vs. 68.8%). The Heat Exposure Severity Index (HESI) (see Section 4.4.5 for methodology) confirmed the gap: IDP households scored 5.03 compared to 3.64 among hosts, representing 38% higher exposure (**Figure 3.4**).

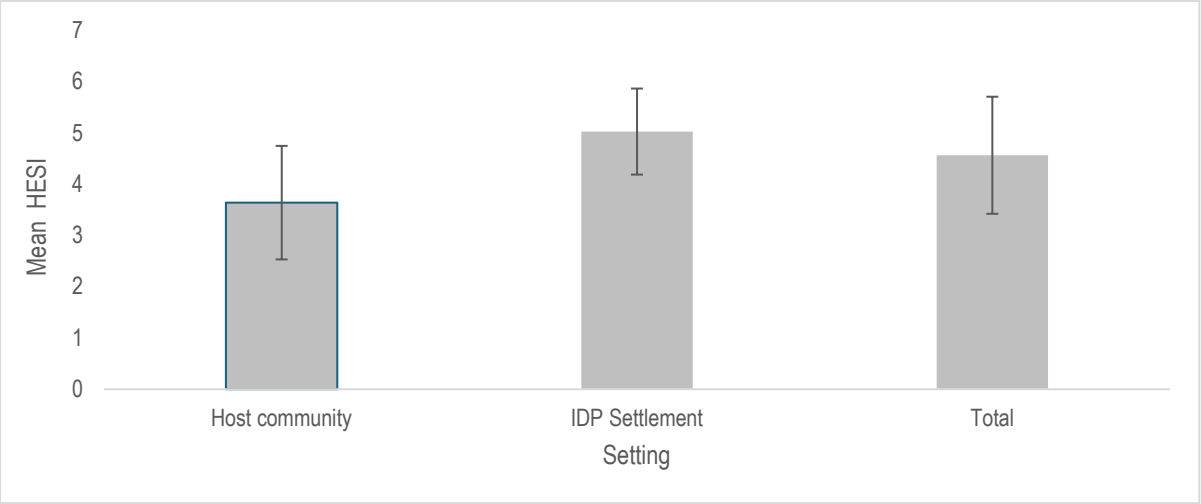

Figure 3.4: Mean heat exposure severity index by setting

Importantly, demographic profiles between the two groups were nearly identical: children under 5, the elderly and pregnant women were equally represented. This demonstrates that it is not household composition but displacement-linked deficits—poor housing, limited services, insecure livelihoods—that drive IDP vulnerability.

Lived experiences corroborated these findings. IDP residents in Baidoa described shelters of plastic that "become like fire inside," while women emphasized, *"We have no electricity to run even a fan…. When someone gets sick from the heat, the clinic is far, and we have no money for transport."* Health facility staff in Bay confirmed that IDPs, particularly children, elderly, pregnant women and laborers, were disproportionately affected during heat events.

3.3.3 Housing and Shelter Quality

Housing quality strongly mediates the translation of ambient temperatures into indoor thermal stress. Most households resided in temporary or substandard structures, with stark contrasts between IDP settlements and host communities. As shown in **Figure 3.5,** temporary shelters (barakaha/cariish) were most common overall (60.5%), followed by traditional Somali aqal/buul (15.6%). Only 7.4% of households lived in concrete or stone houses, while corrugated iron sheet dwellings were more common in host communities (25.5%) than IDP communities (12.0%) ($\chi^2 = 96.6$, $p < 0.001$).

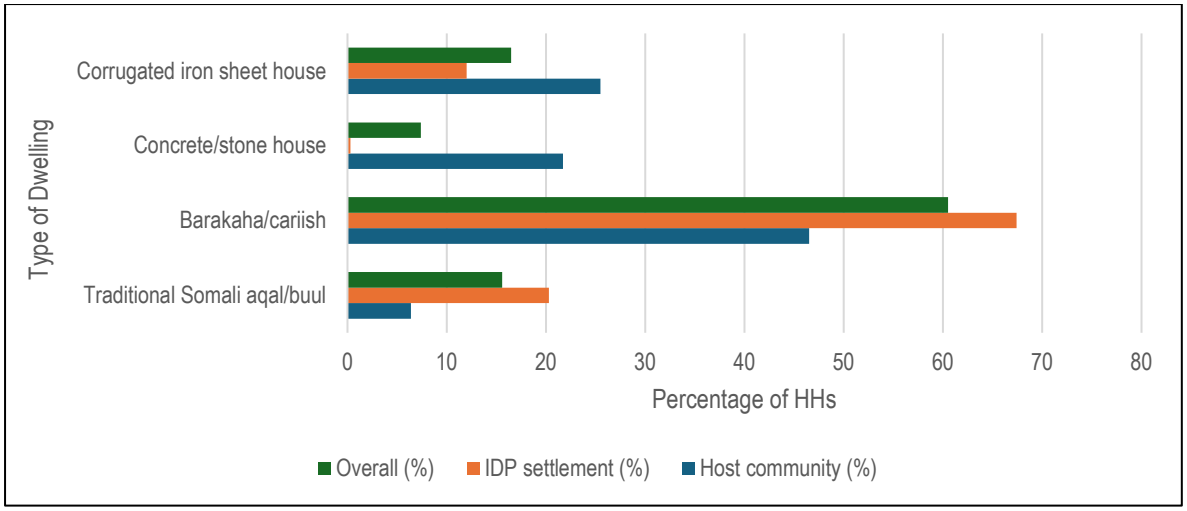

Figure 3.5: Distribution of main dwelling types

Roofing materials highlighted discrepancies: nearly two-thirds of IDP households (63.9%) relied on plastic sheeting, compared to just 9.6% of host households (**Figure 3.6**).

Conversely, 83.4% of host households used corrugated iron sheets, versus only 11.4% of IDPs ($\chi^2 = 246.3$, $p < 0.001$).

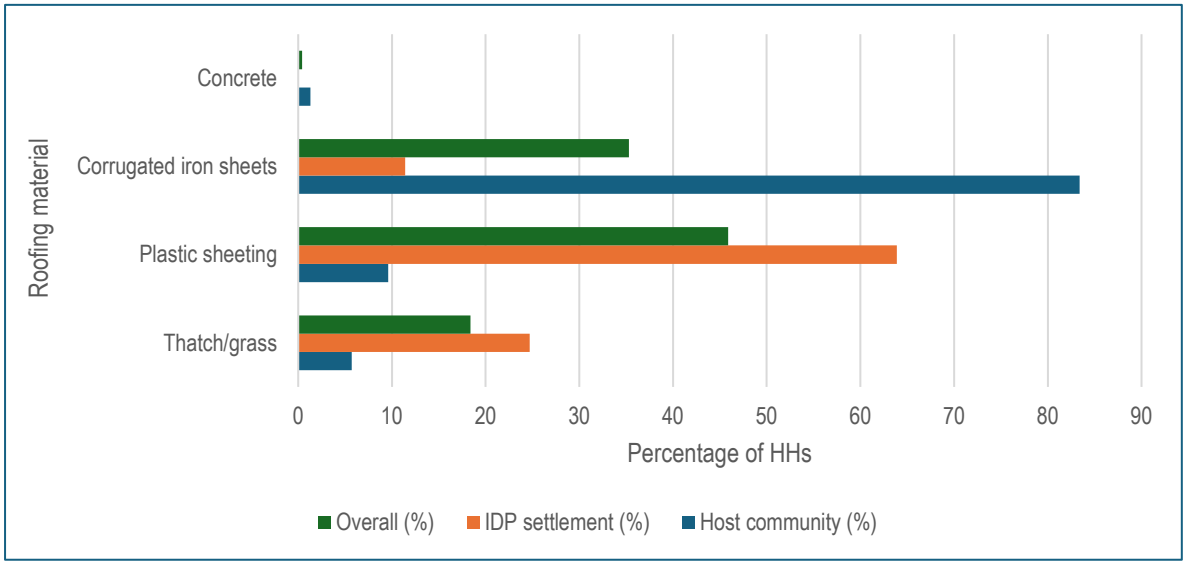

Figure 3.6: Type of roofing materials used in the main household dwelling

Perceived indoor conditions reflected these vulnerabilities: almost half of respondents (45.5%) described their homes as *very hot and unbearable* during peak daytime hours, and another 45.7% as *hot and uncomfortable*, while fewer than 9% considered them tolerable. Less than 1% experienced comfortable indoor temperatures, reflecting systemic housing inadequacy, rather than individual household circumstances (**Figure 3.7**).

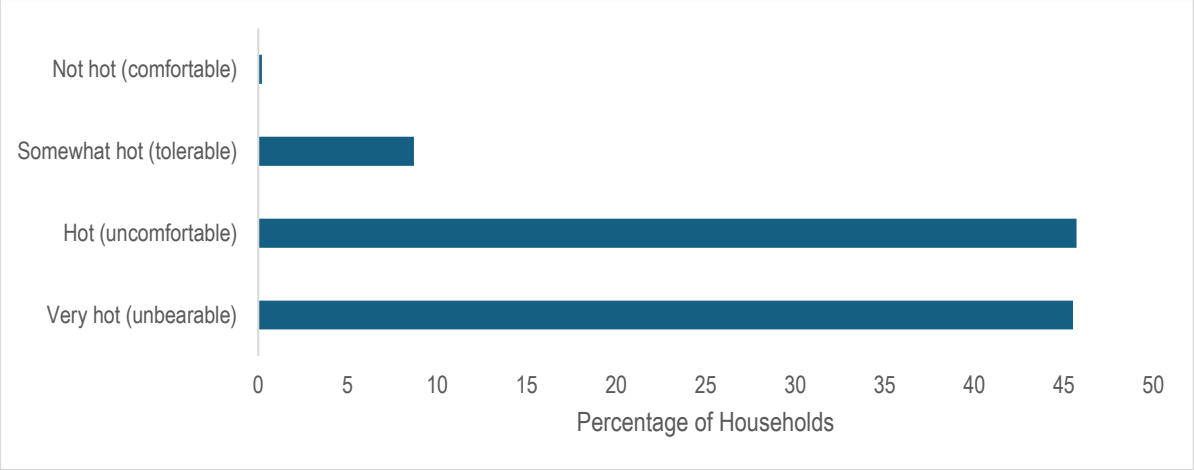

Figure 3.7: Household perceptions of indoor heat conditions during peak daytime temperatures

Space constraints compounded thermal stress. Households averaged just 2.06 rooms (range: 1–9), leading to high occupant density—an average of 3.37 persons per room—well above the WHO standard of less than three people per habitable room (WHO, 2018). Overcrowding limits ventilation, increases metabolic heat generation from multiple bodies in confined spaces, and magnifies health risks during temperature extremes. This was especially acute in temporary shelters, where families described having “no space to escape the heat” and children becoming “restless and sick from sleeping too close together in the heat.”

FGDs illustrated how these structural constraints are experienced daily. Women in Baidoa and Jowhar explained that families living in shelters made of plastic sheeting or iron sheets endured “trapped heat” that became unbearable by midday. Participants linked poor housing and overcrowding to heat-related health problems, noting frequent dehydration, rashes and exhaustion—particularly among children and pregnant women. Communities consistently highlighted overcrowding as a major aggravating factor, especially in IDP settlements where space was most limited.

Beyond dwelling structure, broader infrastructure deficits amplified exposure, as documented in **Table 3.5**. Electricity access was severely limited across the surveyed population: 72.5% of households had no electricity supply at all, while only 27.5% had any form of power, whether consistent, intermittent or solar. The host–IDP gap was particularly wide, with 51.6% of host households having consistent electricity, compared to only 2.2% of IDP households—a 49.4 percentage-point discrepancy. Without electricity, households cannot operate fans, refrigerate water for cooling, preserve medicines requiring cold storage or charge mobile devices for receiving weather alerts—leaving even basic cooling measures and heat-health information inaccessible.

Water access presented similar challenges. Among all surveyed households, 61.3% reported water sometimes unavailable during hot weather, 3.8% reported it often unavailable and 7.0% experienced persistent scarcity. The IDP gap was again substantial: only 10.8% of IDPs had reliable water access during heat, compared to 62.4% of hosts—a 51.6 percentage-point discrepancy shown in Table 3.5. Focus group participants emphasized that even when water was available, it often arrived hot and provided no cooling relief. Long

walks to water points during peak heat exposed women and children to additional health risks, as documented in Section 3.2.2 on vulnerabilities specific to men and women.

3.4 Health-Related Vulnerabilities

Pre-existing health conditions, particularly cardiovascular disease, diabetes and other metabolic disorders, create pathways through which heat exposure translates into acute illness or death. For many Somali households, the combined burden of diagnosed and undiagnosed disease, frequent medicine stockouts and weak facility readiness means that extreme heat magnifies already fragile health outcomes.

3.4.1 Cardiovascular and Metabolic Disease Burden

Hypertension was the most commonly reported heat-sensitive chronic condition, present in 17.8% of households, followed by heart disease (9.9%) and diabetes (8.3%) (**Figure 3.8**). When combined, one in five households (20.0%) reported at least one member with a cardiovascular or metabolic condition. Smaller shares reported high cholesterol (4.2%) or stroke (2.1%). At the individual level, 10.4% of adults had been diagnosed with hypertension, 5.1% with diabetes, 4.4% with heart disease, 2.5% with high cholesterol and 1.5% with stroke.

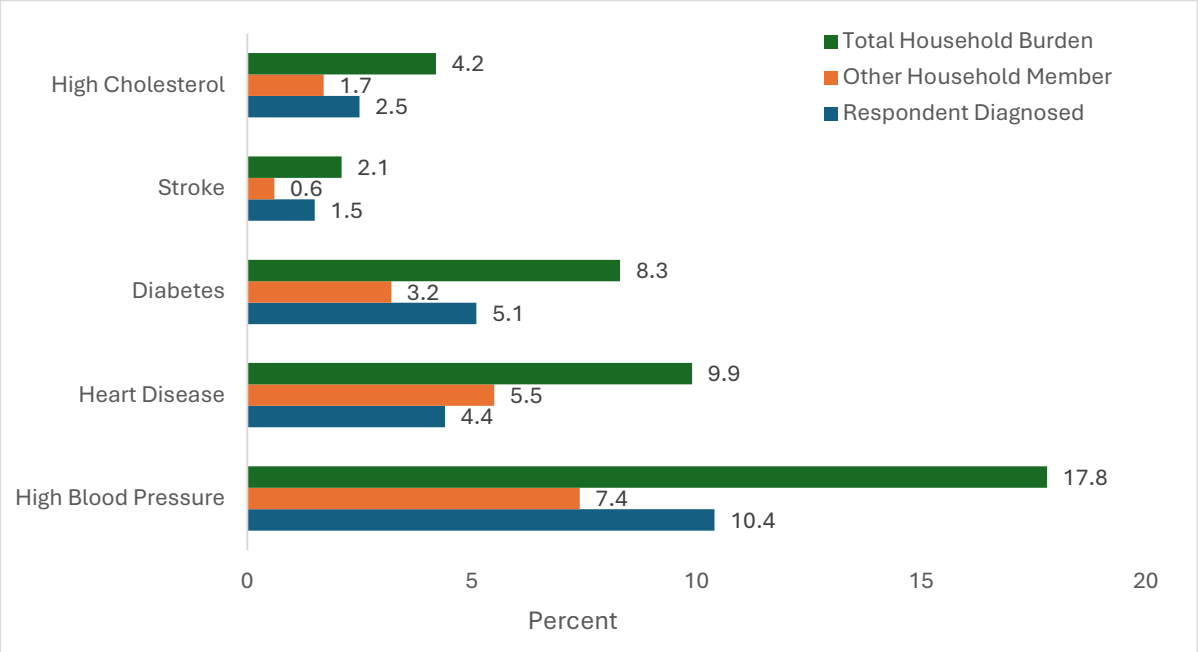

Figure 3.8: Prevalence of diagnosed CVD in the surveyed samples

The household-reported CVD prevalence in this study (20% overall, 31.9% in Mudug) substantially exceeds both the Somalia DHS 2020 estimates (4–7% NCDs) and Yousuf et al.'s recent finding of 7.1% CVD among adults over 35 (Yousuf et al., 2024). This discrepancy likely reflects several methodological differences:

i. **Household-level vs. individual reporting** — Our survey asked if *any* household member was affected, inflating prevalence compared to individual-level surveys.
ii. **Inclusion of undiagnosed cases** — As shown in **Section 3.4.2**, substantial hidden burden exists.

iii. **Possible over-reporting** — Hypertension may be over-reported in the absence of clinical confirmation.
iv. **Selection bias** — Our purposive sampling toward communities with poorer health access may have captured populations with higher disease burden.

These figures should therefore be interpreted as indicative of burden *patterns* and the scale of under-diagnosis, rather than precise epidemiological prevalence. ***The key finding is not the absolute percentage but the documented gap between community-reported burden and health system capacity to detect and manage CVD.***

Regional comparisons provide important context for interpreting these findings. In Kenya, the prevalence of raised blood pressure among adults ages 15–64 years was 23–25% in 2015, while diabetes prevalence stood at 3.1% in 2019, and cardiovascular disease accounted for 13.8% of all deaths (Mbau et al., 2021). In Tanzania, national surveys report a 25.9% prevalence of hypertension and 9.1% for diabetes among adults (Chillo et al., 2022). A broader multi-country study across East and West Africa reported hypertension prevalence of 25.4% (Okello et al., 2020).

Against this backdrop, *nationally representative* Somali estimates (4–7% from DHS, 7.1% from Yousuf et al.) appear substantially lower than regional neighbors, likely reflecting diagnostic gaps rather than genuinely lower disease burden. The higher prevalence detected in our community-based survey, while methodologically distinct, aligns more closely with regional patterns and suggests that true population-level CVD burden in Somalia may be substantially under-captured by existing surveillance systems. This diagnostic gap becomes particularly concerning in the context of heat-health interactions, as undiagnosed and unmanaged CVD patients face heightened risks during extreme heat events without awareness or treatment.

Regional Disparities and Diagnostic Capacity

Regional disparities within Somalia were pronounced ($\chi^2 = 22.6$, $p < 0.001$). Mudug reported the highest household CVD burden (31.9%), followed by Bay (25.2%), Banadir (12.6%) and Middle Shabelle (10.8%). These differences likely reflect both genuine variation in risk factors and unequal diagnostic capacity. This pattern likely reflects true variation in population disease burden driven by differential exposure to risk factors. Importantly, these household reports are independent of facility detection capacity. If facility clinical records were available, they would likely show the opposite pattern—more formally diagnosed cases where screening services exist. The critical finding is that screening services are systematically absent in the regions with highest community-reported burden (Mudug, Bay), creating a dual gap: high disease prevalence combined with no diagnostic or treatment capacity.

Health Facility CVD Service Capacity

Facility capacity was limited across all regions (**Table 3.6**). Only 29.4% of facilities provided CVD screening, 17.6% had follow-up care or emergency protocols and fewer than half (41.2%) offered consistent medication management. Patient education was even scarcer (23.5%). These gaps were sharpest in high-burden regions such as Mudug and Bay, where no facilities had screening services despite household-reported prevalence exceeding 25%.

Table 3.6: CVD service availability across health facilities (n=17)

CVD Service Component	Facilities Offering Service	Percentage
CVD screening	5/17	29.4%
CVD follow-up care	3/17	17.6%
CVD emergency protocols	3/17	17.6%
CVD medication management	7/17	41.2%
CVD patient education	4/17	23.5%

Community perspectives confirmed this picture. A female FGD participant in Jowhar echoed: *"During the hot season, patients with blood pressure and sugar problems get worse. They come to the clinic with chest pain, weakness and fainting."* In Baidoa, residents added: *"People with sugar disease become weak quickly in the heat, and without medicine they collapse."* And in Banadir, community members noted: *"Everyone talks about blood pressure problems here. It increases in hot months, but treatment is difficult because medicines are not available."*

Settlement Type Analysis

Settlement type analysis showed no significant difference in prevalence between host (23.4%) and IDP households (18.4%, p = 0.194). This contrasts with other vulnerability indicators, where IDPs faced disadvantages. Here, the lack of difference may reflect similar underlying risk but also possible under-diagnosis among IDPs due to poorer health access, masking a higher true burden.

3.4.2 Undiagnosed Disease Burden and Health System Blind Spots

Rose Angina screening showed that 14.4% of respondents reported exertional chest pain, with most describing heavy or tight pain triggered by physical activity, limiting daily tasks. While Rose Angina uses individual-level symptom screening and diagnosed heart disease is reported at household level (9.9%, see **Section 3.4**), the substantial prevalence of angina symptoms suggests considerable undiagnosed coronary disease burden in the population. This finding is consistent with documented health system weaknesses: only 29.4% of assessed facilities provide cardiovascular screening services, and diagnostic capacity is particularly limited in regions reporting highest disease burden. The resulting diagnostic gap creates a hidden vulnerable population—people with symptomatic but unrecognized coronary disease who lack appropriate risk counseling, medication or awareness of their heightened vulnerability during extreme heat events.

Diabetes presented a similar gap. While 5.1% of respondents reported a formal diagnosis, 9.8% had symptoms consistent with diabetes, implying that almost half of cases may be unidentified. Hypertension, too, showed treatment gaps: 10.4% reported ever being diagnosed, but nearly half of these were untreated. Together, these findings point to an "invisible vulnerable" group at high risk during heat episodes but absent from formal care systems (**Table 3.7**).

Table 3.7: Diagnosed vs. total disease burden

Condition	Diagnosed Prevalence	Estimated Total Burden	Undiagnosed Rate
Heart disease	9.9% (households)	~14.1% (individuals)	Substantial symptom burden suggests considerable undiagnosed disease*
Diabetes	5.1% (individuals)	~9.8% (individuals)	~47% potentially undiagnosed**
Hypertension	10.4% (individuals)	-	47% untreated among diagnosed

**Different denominators (household vs. individual) prevent precise calculation.*
***Symptom-based screening may include false positives.*

Community voices reflected this hidden burden. At Jowhar Regional Hospital, staff members explained: *"During hot seasons, we see many patients with chest pain, breathing problems and fainting. Some have never been told they have heart problems, but the symptoms are clear when they come during heat."* At Kulmis Health Centre, providers noted: *"Every hot season, people with breathing difficulties and heart symptoms visit more often. Many don't know they have these conditions until heat makes them worse."*

The large undiagnosed burden reflects systemic health system weaknesses documented through facility assessments. Only five of 17 facilities (29.4%) reported providing cardiovascular screening services, meaning two-thirds lacked even basic diagnostic capacity for hypertension, diabetes or cardiac disease. Follow-up care and emergency protocols were available in just 17.6% of facilities, while medication management was present in 41.2% and patient education in 23.5%. The absence of screening services was most acute in Bay and Mudug, where household prevalence was highest.

3.4.3 Clinical Management Gaps

Facility assessments reinforce the survey findings, highlighting systemic weaknesses in managing cardiovascular and metabolic disease during heat events (see **Table 3.6**). With only 29.4% of facilities providing screening services, 41.2% offering consistent medication management and fewer than one-fifth having follow-up care or emergency protocols, the health system demonstrates critical capacity gaps precisely where intervention is most needed.

Medicine shortages were a consistent concern across facilities and households. Nearly three-quarters (73%) of households with a member diagnosed with CVD or diabetes reported that medicines were unavailable during hot periods. This left patients at high risk during times when their conditions were most likely to deteriorate. A facility supervisor in Galkayo summarized the challenge: "*We know many people have blood pressure or sugar problems, but we often run out of medicines. During hot weather, these patients suffer more, but we cannot always help them.*"

Providers also emphasized the link between heat and psychosocial stress. A facility manager explained: "People become highly stressed and anxious in extreme heat, with poor sleep and fatigue worsening heart problems." Such stress compounds the physiological burden of chronic disease, increasing the likelihood of acute decompensation during heatwaves.

In sum, these gaps highlight the double vulnerability facing patients with chronic disease in Somalia: both the high underlying burden of disease and the inadequate system capacity to detect, monitor and treat cases consistently, particularly during heat extremes.

3.5 Implications for Programming

The evidence presented in Chapter 3 highlights both opportunities and gaps that should guide future heat-health programming in Somalia:

- **Household-centered approaches.** With nearly 90% of households containing at least one heat-vulnerable member, and more than one-third containing three or more, interventions must prioritize households as the unit of action. Support for caregivers—particularly women—will be essential to manage multiple dependents during heat extremes.
- **Displacement-sensitive strategies.** IDPs are structurally disadvantaged, living in hotter shelters with limited access to water and electricity. Programming must address this explicitly.
- **Strategies tailored to the needs of men and women.** Women face heightened risks from pregnancy, cultural constraints and caregiving burden, while men face occupational exposure and lost income.
- **Integration of chronic disease care.** Cardiovascular and metabolic conditions are widespread yet underdiagnosed and poorly managed. Expanding screening, ensuring consistent medicine supply and embedding heat-sensitive protocols into routine services are frontline measures for protecting lives.
- **Multi-sectoral integration.** Effective adaptation requires linking health, shelter, water and livelihoods. Embedding heat preparedness into maternal and child health, nutrition, IDP programming and noncommunicable disease (NCD) care will ensure responses are both scalable and sustainable.

In sum, programming must move beyond individual-level interventions to address clustered vulnerabilities at the household level, while also closing systemic gaps in health services and infrastructure. Without such approaches, Somalia’s demographic realities and fragile systems will continue to magnify the health burden of extreme heat.

📌 **Key Messages: Vulnerability Assessment**

- **Widespread vulnerability:** Nearly 9 in 10 households (89%) host at least one heat-vulnerable member, and more than one-third (36%) host three or more.
- **Different risks for men and women:** Women face pregnancy-related strain, cultural constraints and caregiving burdens, while men are exposed through outdoor work and income loss.
- **Displacement penalty:** IDPs live in hotter shelters, lack electricity and water, and report higher symptom burdens and poorer healthcare access compared to host households.
- **Chronic disease burden:** One in five households reports cardiovascular or metabolic disease; many cases remain undiagnosed or untreated.
- **System capacity gaps:** Only one-third of facilities offer CVD screening, fewer than half manage medicines and 73% of affected households report stockouts during hot periods.
- **Household clustering:** Vulnerabilities overlap within households, creating compounded burdens that fall heavily on women as primary caregivers.

Overall interpretation: Heat-health vulnerability in Somalia is near-universal and compounded by displacement and chronic disease. Programs must act at the household level, address discrepancies and strengthen health system readiness to reduce risk.

Chapter 4: Current Burden of Heat-Sensitive Health Outcomes

Heat exposure in Somalia is already producing broad health impacts among individuals, households and the health system. This chapter addresses three questions: how is heat affecting health, to what degree and which groups are most affected. The analysis draws on household reports of symptoms and functional limitations (n=474), cardiovascular disease screening and risk profiling, health facility observations and routine surveillance data from Somalia's District Health Information System (DHIS, 2020-2025). Together, these sources document how rising temperatures are already creating substantial health burdens across the surveyed population.

4.1 Personal and Household Heat Symptom Burden

4.1.1 Prevalence and types of symptoms

The burden of heat-related health symptoms was widespread, with only 5.3% of respondents reporting no symptoms during hot weather in the past year, meaning 94.7% experienced some degree of heat-related health impact. The symptom distribution reveals a clear

hierarchy from common systemic effects (headache, fatigue, skin rash) to severe heat-illness manifestations. Systemic effects affected 35–47% of respondents, while severe heat-illness symptoms (confusion, nausea, breathing difficulties) affected 11–12% of the population—a concerning prevalence indicating that substantial numbers experience potentially dangerous heat-related health effects (**Table 4.1**).

Table 4.1: Personal heat symptom prevalence (n=473)

Symptom Category	Symptom Type	Prevalence	Severity Classification
Systemic Effects	Headache	46.7%	Common
	Fatigue/weakness	35.3%	Common
	Skin rash	34.0%	Common
Cardiovascular Signs	Fast heartbeat	18.0%	Moderate prevalence
	Dizziness/fainting	16.1%	Moderate prevalence
Severe Heat Illness	Confusion	12.3%	Concerning prevalence
	Nausea/vomiting	11.8%	Concerning prevalence
	Difficulty breathing	11.4%	Concerning prevalence
Heat Cramps	Muscle cramps	7.2%	Lower prevalence

On average, respondents reported 2.2 symptoms (SD = 1.96). At household level, nearly universal exposure was evident: only 5.7% of households reported no symptoms among any members. Household reports also amplified certain vulnerabilities, with higher prevalence of cardiovascular and respiratory signs (**Table 4.2**).

Table 4.2: Household vs. Personal Heat Symptom Comparison

Symptom Type	Personal Prevalence	Household Prevalence	Household Amplification
Headache	46.7%	44.8%	Consistent pattern
Skin rash	34.0%	36.4%	Household increase
Fast heartbeat	18.0%	21.6%	Household increase
Dizziness/fainting	16.1%	18.4%	Household increase
Difficulty breathing	11.4%	14.4%	Household increase
Nausea/vomiting	11.8%	13.3%	Household increase

Focus group participants across all regions described experiencing multiple simultaneous symptoms during heat exposure. In Galkayo, discussions revealed that extreme heat produces a constellation of symptoms including profuse sweating, dizziness, severe headaches and debilitating fatigue. Women in Jowhar emphasized that these symptoms are particularly severe among pregnant women and infants, who often develop high fevers, skin rashes and respiratory distress requiring clinical care. Male participants consistently reported experiencing work-limiting symptoms, with many describing episodes of near-collapse during peak heat hours.

Health facility data corroborate these symptom patterns. Supervisors in Jowhar reported seasonal spikes in diarrheal diseases and febrile illnesses during hot periods, with increases of approximately 40% compared to cooler months. Despite these increased caseloads, facility capacity remains severely constrained: only 25% of facilities had staff members trained in heat-illness management, and none possessed standard operating procedures for treating heat-related conditions.

These widespread symptoms translate into major impacts on daily life, livelihoods and well-being.

4.1.2 Functional Impacts on Daily Activities

Heat exposure translated into significant impairment of daily functioning. Only 14.1% of respondents reported no effect on activities during hot weather, while 85.9% experienced mild to severe impairment (**Figure 4.1**). Nearly half (48.9%) could perform only some activities, and 17.1% reported being unable to perform normal daily tasks altogether.

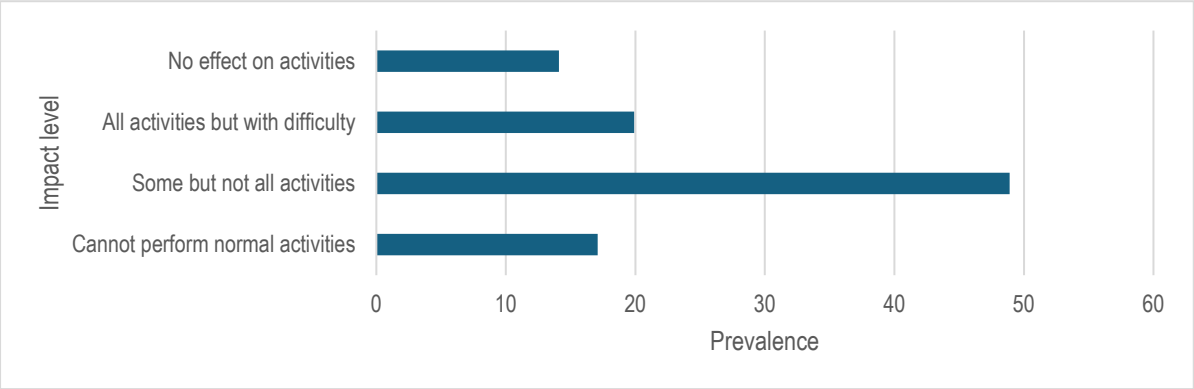

Figure 4.1: Heat impact on daily activities (n=462)

Community discussions revealed specific mechanisms through which heat disrupts daily life. Male laborers in Galkayo described being forced to cease work during midday hours, with several recounting incidents of heat-related collapse during agricultural work. Women in Jowhar explained how household routines are reorganized around heat exposure, with cooking and cleaning tasks shifted to early morning hours before temperatures become unbearable. Community leaders observed broader societal impacts, noting that market activity declines, agricultural productivity drops and social gatherings diminish during extreme heat periods, weakening both economic activity and social cohesion.

4.1.3 Economic and Livelihood Impacts

Economic impacts were also considerable: among those engaged in income-generating work, 47.7% reported moderate or major disruption due to heat, highlighting vulnerability of household livelihoods (**Figure 4.2**). More than half of working respondents experienced heat-related economic losses, indicating substantial household-level economic vulnerability to extreme heat events.

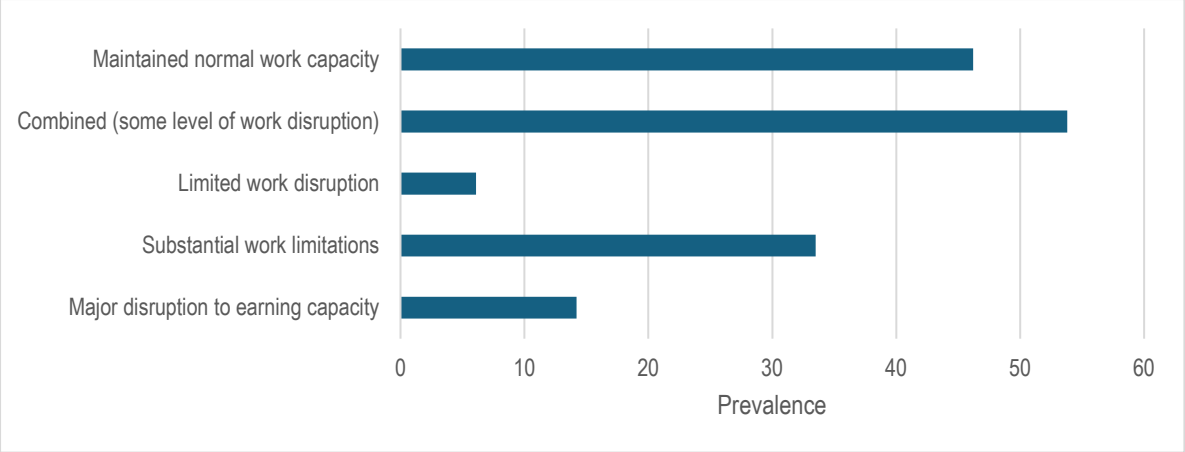

Figure 4.2: Heat impact on economic activities (n=394)

4.1.4 Sleep Disruption

Sleep disruption was nearly universal, affecting 96.2% of respondents, with 23.0% unable to sleep, 44.7% experiencing difficulty falling asleep and 28.5% waking frequently (**Table 4.3**). These findings were reinforced by the qualitative findings. Women in Banadir described long hot nights as a source of "restlessness, quarrels and poor health," while facility staff in Bay noted that sleep deprivation worsens fatigue and complicates chronic disease management. This pervasive loss of restorative sleep reduces resilience to further heat exposure and compounds health risks.

Table 4.3: Heat Impact on Sleep Quality (n=470)

Sleep Impact	Prevalence	Sleep Quality Description
Unable to sleep	23.0%	Severe sleep disruption
Difficulty falling asleep	44.7%	Moderate sleep disruption
Waking up frequently	28.5%	Moderate sleep disruption
No effect on sleep	3.8%	No sleep disruption

Qualitative findings emphasized that sleep disruption affects entire households. Women in Banadir described homes remaining unbearably hot throughout the night, preventing rest and recovery. Participants across multiple focus groups reported that children become restless and cry through the night, while elderly family members experience breathing difficulties when lying down in overheated rooms. This chronic sleep deprivation was linked to daytime fatigue, reduced productivity and increased irritability within households.

The near-universal disruption of restorative sleep represents a hidden but critical pathway through which heat undermines resilience—weakening immunity, worsening chronic disease and eroding daily productivity.

4.2 Healthcare-Seeking Behavior

4.2.1 Patterns of Care-Seeking

Nearly half of surveyed households (47.9%) reported seeking healthcare for heat-related symptoms in the past year, while 52.1% did not. This demonstrates that extreme heat

already drives substantial demand for formal care. Healthcare utilization was strongly associated with CVD: 68.6% of CVD-affected households sought care, compared to 42.6% of non-CVD households ($\chi^2 = 18.573$, $p < 0.001$), validating the project's focus on CVD as a heat-sensitive condition.

Symptom burden was a strong predictor of care-seeking: households with a single severe symptom had high utilization (62.3%), while those with multiple symptoms showed more variable patterns, reflecting both severity and constraints to access (**Figure 4.3**).

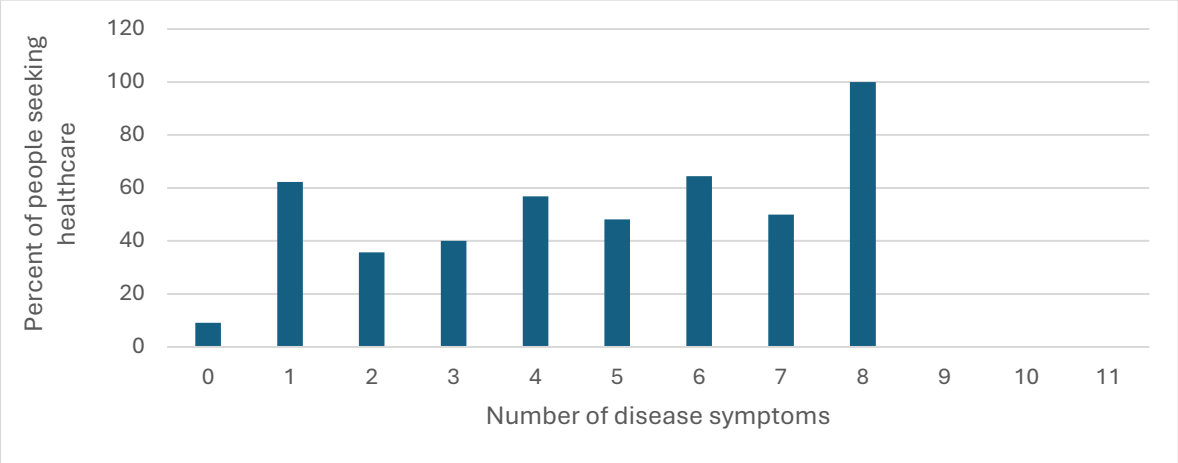

Figure 4.3: Household symptom burden and care-seeking

Among households that sought care (n=203), reliance on formal facilities was clear: 55.2% visited health centers and 52.7% hospitals, while only 14.8% used community health workers and less than 7% sought private providers (**Figure 4.4**).

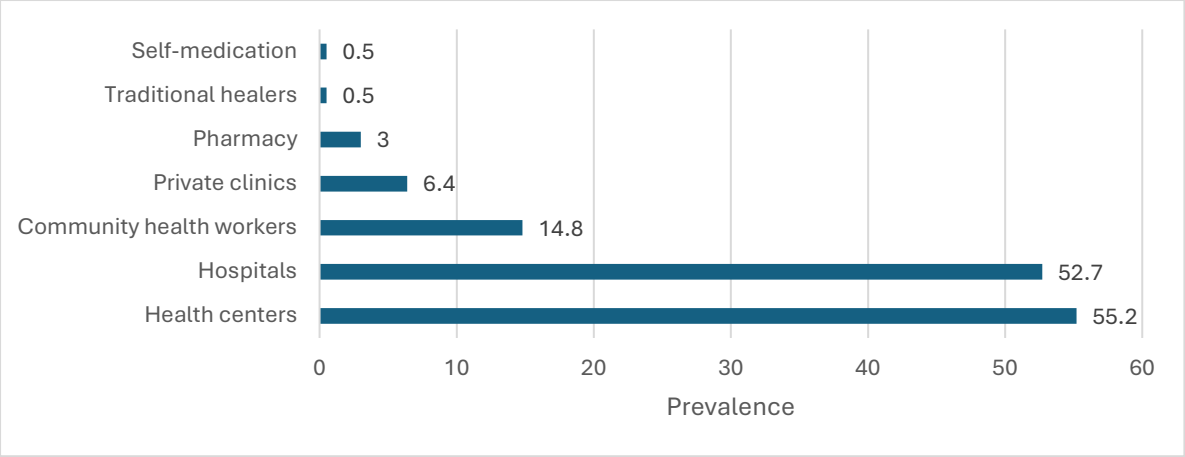

Figure 4.4: Healthcare Service Delivery Points

4.2.2 Impediments to Healthcare Access

Household access to healthcare during heat periods was constrained by a combination of financial, geographic, and social impediments. As shown in **Figure 4.5**, only one-third of households could reach a facility within 30 minutes, while nearly one-quarter faced travel times of more than an hour. Such delays are particularly concerning during acute heat emergencies, when timely intervention is critical to prevent progression from heat exhaustion to life-threatening heat stroke.

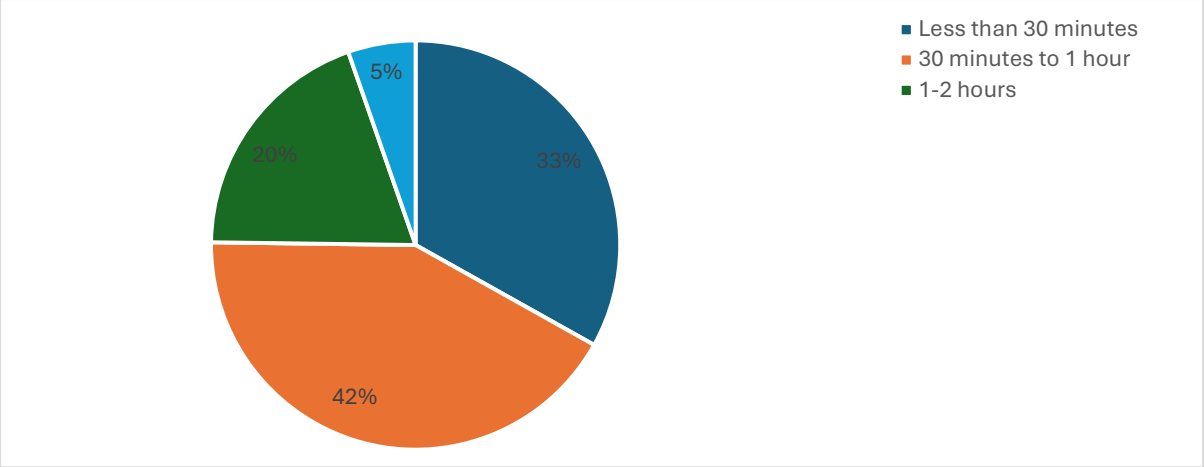

Figure 4.5: Time to reach nearest health facility

Among the 52.1% of households that did not seek care (n=221), financial burdens were the most common obstacle. More than half (57.9%) reported being unable to pay for services, while another 11.8% cited transport costs as prohibitive. Combined, nearly 70% of non-care-seeking households faced economic constraints. Other constraints included childcare responsibilities (18.6%), long distances to facilities (14.5%), and the absence of nearby services (10.0%). A smaller proportion (7.7%) reported that facilities closed during hot periods, reflecting preparedness challenges (**Table 4.4**).

Table 4.4: Healthcare access impediments

Barrier Type	Percentage	Barrier Category
Financial impediments	57.9%	Economic access
Childcare responsibilities	18.6%	Social impediments
Distance to facility	14.5%	Geographic access
No facility available	10.0%	Service availability
Transport costs	11.8%	Economic access
Facility closure during heat	7.7%	System preparedness

Community testimonies highlighted how these impediments compound. Women in Jowhar described having to choose between paying for transport to a health facility or buying food and water for their families during hot periods. Men in Galkayo explained that walking long distances under peak heat conditions was physically impossible, forcing delays in care until symptoms became severe. Community leaders added that some facilities reduced operating hours or closed entirely during extreme heat due to unbearable indoor conditions, further restricting access when demand was greatest.

Emergency Transport Constraints

The capacity to access emergency care during acute heat-illness episodes was severely constrained by limited transport options. The vast majority of households (68.5%) relied on walking as their primary means of reaching healthcare facilities during emergencies (Table 4.5). Only 15.2% could access public transportation, while just 3.2% had access to

ambulance services. Private vehicle ownership was minimal (1.5%), and 0.4% of households reported being completely unable to reach facilities during emergencies.

Table 4.5: Emergency Transport Methods

Transport Method	Percentage	Emergency Response Capability
Walking	68.5%	Primary household method
Public transportation	15.2%	Limited availability
Motorcycle/tuk-tuk	11.0%	Informal transport
Ambulance services	3.2%	Very limited
Private vehicle	1.5%	Minimal household capacity
Unable to reach facility	0.4%	Complete barrier

Focus group discussions revealed the dangerous consequences of this transport gap. Men in Galkayo described cases where individuals suffering from heat exhaustion or suspected heat stroke had to walk for over an hour to reach care, with symptoms worsening dramatically during the journey. One participant recounted: *"My neighbor collapsed from the heat while working. We had to carry him on our shoulders for 45 minutes to reach the clinic. By the time we arrived, he was unconscious. The doctor said if we had ambulance, maybe he would not be so bad."* Community leaders reported knowing of cases where people collapsed en route to facilities, and some died before reaching medical attention.

Financial Preparedness for Emergency Care

Financial preparedness for heat-related healthcare emergencies was equally precarious. Over a quarter of households (26.6%) reported they would be completely unable to pay for care during a heat emergency, while more than half (51.9%) would be forced to rely on borrowing money (25.3%), selling assets (1.9%) or community support (11.3%) (Table 4.6). Only 17.4% had personal savings adequate to cover emergency care, while 16.8% expected to access free services. Insurance coverage was virtually non-existent (0.6%).

Table 4.6: Financial preparedness for heat-related healthcare

Payment Method	Percentage	Financial Security Level
Unable to pay	26.6%	No financial preparedness
Borrow money	25.3%	Debt-based access
Personal savings	17.4%	Self-financed access
Free services	16.8%	Public safety net
Community support	11.3%	Social safety net
Sell assets	1.9%	Crisis coping
Insurance	0.6%	Formal protection

This financial vulnerability creates a three-tiered system of access: 26.6% cannot access emergency care regardless of severity; 51.9% can access care only by incurring debt or

depleting assets, risking household economic collapse; and only 17.4% possess adequate financial resilience through savings. The near-absence of insurance (0.6%) means there is no formal risk-pooling mechanism to protect households from catastrophic health expenditures during heat events.

Women in Jowhar described the impossible choices created by this financial vulnerability: *"When my child had fever and weakness from the heat, I had to choose between taking him to the clinic or having enough money for food that week. We borrowed from neighbors, but now we owe them, and next time I don't know what we will do."* Another woman explained: *"My husband needed IV drip when he fainted from heat, but it cost $15. We had to sell our goat to pay. Now we have no animal and no savings left."*

These geographic, transport and financial constraints mean that even when households recognize serious heat illness, accessing timely care remains beyond reach for most, contributing to preventable morbidity and mortality during extreme heat events. While households face significant barriers to care, equally important are the limitations in the preparedness and response capacity of health facilities themselves. These systemic gaps are examined in detail in **Chapter 5**.

4.2.3 Treatment and Clinical Response

Among those who accessed care, treatment practices varied considerably. Two-thirds (64.5%) of patients received medication, and 37.9% were given oral rehydration solutions. However, only 10.3% received intravenous fluids, and just 4.4% received specific cooling interventions such as ice packs, water immersion or fan-assisted cooling (Table 4.5). A further 9.4% received advice only, without any medication or rehydration support.

Table 4.7: Treatment Received for Heat-Related Illness (n=227)

Treatment Type	Percentage
Medication	64.5%
Oral rehydration	37.9%
IV fluids	10.3%
Advice only	9.4%
Cooling interventions	4.4%

The limited use of cooling interventions (4.4%) is notable given that these represent direct physical interventions to reduce body temperature. Community voices confirmed these treatment patterns. Participants described receiving medicines for headaches or fever but rarely receiving guidance on heat avoidance or active cooling strategies. One woman in Baidoa explained: *"They gave me tablets and told me to drink water, but I was still very hot when I went home."* Others noted that facilities often lacked cold water or ice. A man in Mudug added: *"The nurse said I needed to cool down, but there was nothing cold in the clinic. No ice, no fan working. She just told me to go home and rest in the shade."*

4.3 Relationship Between Heat and Cardiovascular Disease

4.3.1 CVD Symptoms Worsening During Heat

Analysis of CVD–heat interactions revealed that households with diagnosed cardiovascular conditions experienced substantially worse symptoms during hot weather. Among the 20.0% of households that reported at least one member with a cardiovascular or metabolic condition, 63.1% reported that symptoms became worse during hot weather, with 33.0% reporting symptoms became “much worse” and 30.1% “somewhat worse.” An additional 24.3% were uncertain about symptom changes, possibly reflecting irregular symptom patterns or recent diagnoses. Only 12.6% reported stable or improved symptoms during heat. These findings provide clear evidence that heat exposure exacerbates cardiovascular disease in the majority of affected households (**Figure 4.6**).

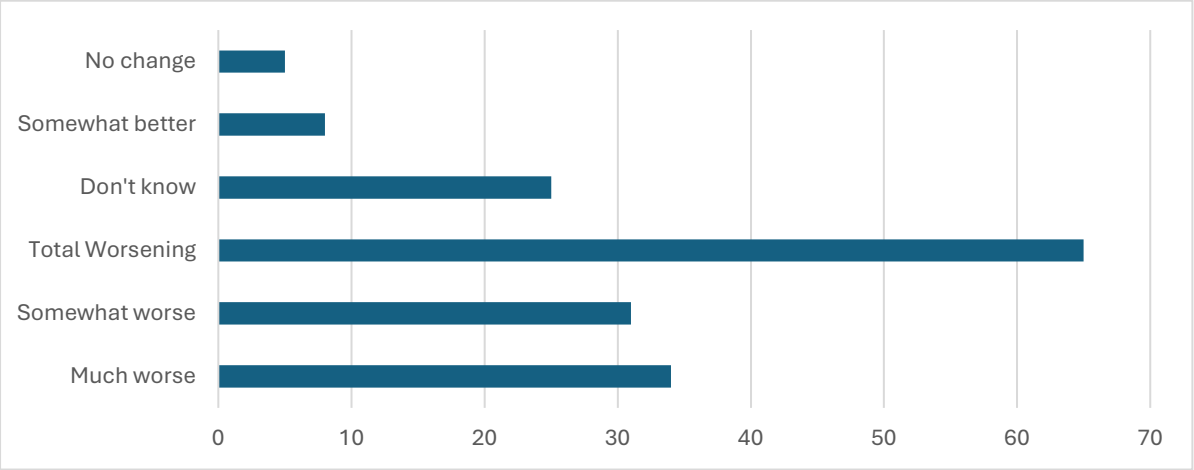

Figure 4.6: CVD symptoms during hot weather

Qualitative accounts illustrated how heat-CVD interactions manifest in daily life across the study regions. In Galkayo (Mudug), where CVD prevalence is highest (31.9%) and temperatures regularly exceed 40°C, women explained that “people experienced elevated heartbeat” during extreme heat, with “older people, pregnant women and young children suffering the most—they feel dizzy or sick, but there is no clinic near and no transport to go for health.” Male participants added that “old people and pregnant women suffer the most during the heat. They get tired quickly and sometimes faint.” In Baidoa (Bay), where temperatures exceed Middle Shabelle's, a woman expressed deep concern: “We are already suffering, and if it keeps getting worse in the future, I do not know how we will survive. I worry about my health but even more about my children—they get sick easily during the hot seasons.” In Jowhar (Middle Shabelle), women described fearing for their children due to intense heat, noting that “many women feel weak, and the community is unprepared with no support for heat-related illness.”

Focus group participants also reported that some patients discontinued medication during hot weather due to discomfort and perceived ineffectiveness. This medication non-adherence, combined with physiological heat stress, creates a dangerous combination that amplifies cardiovascular risk during extreme temperature events.

Health facility staff confirmed these patterns through clinical observations. At Bay Regional Hospital, providers noted that elderly patients, pregnant women and children from IDP settlements were disproportionately affected during heat events, with construction laborers

from displacement camps frequently presenting with severe dehydration. At Jowhar Regional Hospital, staff reported that during hot seasons, *"people with asthma and heart problems visit the health center more often,"* with cases peaking during the hottest months.

4.3.2 Healthcare Utilization Among CVD Households

CVD households showed substantially higher healthcare-seeking rates for heat-related symptoms compared to non-CVD households. Among CVD-affected households, 68.6% sought care for heat-related symptoms compared to 42.6% of non-CVD households (χ^2 = 18.573, $p < 0.001$). This differential indicates that CVD patients recognize the severity of heat-related symptoms and are more likely to attempt to access care, despite the barriers documented in **Section 4.2.** However, as will be shown in **Chapter 5**, even when CVD patients successfully reach facilities, critical gaps in pharmaceutical supply compromise their ability to maintain continuous treatment during periods of heightened cardiovascular stress.

4.4 Heat Symptom Burden by Demographic and Socioeconomic Factors

This section examines how heat-related symptom burden varies across key demographic and socioeconomic groups, addressing the question: Are particular populations disproportionately affected by heat?

4.4.1 Symptom Burden by Settlement Type: IDPs vs. Host Communities

Comparison between IDP settlements and host communities revealed clear discrepancies in heat symptom burden. IDP households reported a mean of 3.36 symptoms compared to 2.84 symptoms among host households, representing an 18% higher symptom burden among displaced populations (t = -2.74, p = 0.006). **Table 4.5** presents the detailed comparison of heat symptoms by settlement type.

Table 4.8: Heat symptom burden by settlement type

Indicator	Host Community (n=158)	IDP Settlement (n=316)	Difference	Statistical Test
Mean heat symptoms (0-11)	2.84	3.36	+0.52	t = -2.74, p = 0.006
Standard deviation	1.64	2.08	-	-
% with 5+ symptoms	13.9%	28.2%	+14.3pp	χ^2 = 11.91, p = 0.001

**Severe symptoms defined as confusion, difficulty breathing or fainting*

As shown in **Table 4.5,** IDPs not only reported higher mean symptom counts but were also significantly more likely to experience five or more symptoms (28.2% vs 13.9%, χ^2 = 11.911, p = 0.001). These differences persist even though IDPs and hosts have similar demographic profiles (**as documented in Chapter 3**), demonstrating that displacement-related structural disadvantages—inadequate shelter, poor service access and resource constraints—directly translate into worse health outcomes during heat events.

Focus group participants in IDP settlements vividly described this discrepancy. Residents explained: *"Our shelters of plastic become like fire inside. There is no shade, no breeze, and the sun beats down on the plastic all day. At night it is still hot, and children cannot sleep."* In

contrast, host community participants more often described having concrete or corrugated iron houses with some thermal protection, along with better access to electricity for fans and reliable water supplies.

4.4.2 Symptom Burden for Men and Women

Comparison revealed modest differences in heat symptom patterns among men and women, though most did not reach statistical significance. Table **4.6** presents heat symptom burden for men and women.

Table 4.9: Heat symptom burden for men and women

Indicator	Male (n=105)	Female (n=368)	Difference	Statistical Test
Mean heat symptoms (0-11)	3.50	3.11	+0.40	t = 1.85, p = 0.065
Standard deviation	1.82	1.98	-	-
% with 5+ symptoms	28.6%	22.0%	+6.6pp	$\chi^2 = 1.96$, p = 0.162
Healthcare seeking (%)	54.9%	45.9%	+9.0pp	$\chi^2 = 2.32$, p = 0.128

Male respondents reported marginally higher symptom counts (3.50 vs 3.11, p = 0.065), higher proportions with five or more symptoms (28.6% vs 22.0%, p = 0.162) and higher healthcare-seeking rates (54.9% vs 45.9%, p = 0.128), though none of these differences reached statistical significance at the 0.05 level.

These patterns likely reflect exposure pathways documented in Chapter 3: men's higher symptom burden corresponds with outdoor occupational exposure (reported by 55.2% of households), while women's constraints include childcare burdens (60.9%) and limited mobility (42.3%) that may reduce both exposure intensity and ability to seek care.

Focus group discussions provided additional context. Men emphasized work-related heat exposure and episodes of near collapse during outdoor labor, while women described managing multiple heat-related stressors simultaneously—caring for children, cooking in hot shelters and fetching water—that produce chronic but diffuse impacts rather than acute symptom clusters.

4.4.3 Symptom Burden Among Pregnant Women

Pregnant women represented a particularly heat-vulnerable group. Among surveyed households, 67.9% reported having at least one pregnant woman at some point during the past year (with 20.3% currently pregnant at time of survey), while 32.1% reported no pregnancy during this period. Among households with pregnant women, multiple heat-related challenges were reported during hot weather periods. **Table 4.7** presents the distribution of pregnancy-related heat challenges reported by households.

Table 4.10: Pregnancy-related heat challenges (n=473)

Challenge	Households Reporting	Percentage
Difficulty sleeping	221	46.7%
Increased fatigue	158	33.4%
Reduced appetite	148	31.3%
Increased medical visits	58	12.3%
Work limitations	58	12.3%
None	27	5.7%

Difficulty sleeping was the most commonly reported challenge (46.7%), followed by increased fatigue (33.4%) and reduced appetite (31.3%). Increased medical visits and work limitations were each reported by 12.3% of households. Only 5.7% of households with pregnant women reported no heat-related challenges, indicating near-universal impact.

On average, households reported 1.74 pregnancy-related challenges (SD = 1.01), with 58.6% reporting a single challenge, 16.9% reporting two challenges and 24.5% reporting three or more challenges. This clustering demonstrates that pregnant women face multiple simultaneous heat stressors, rather than isolated impacts.

Focus group discussions emphasized the compounded vulnerability of pregnant women. Participants in Jowhar explained that pregnant women often become dizzy and weak during severe heat but must continue performing domestic tasks including water collection and childcare. One woman described: *"During the hot season, pregnant women suffer most because they become weak but still must work. Some faint while fetching water."*

Health facility staff confirmed higher presentation rates of pregnant women with heat-related complications during hot periods, though systematic tracking was absent due to lack of heat-specific diagnostic categories in routine surveillance systems.

4.4.4 Symptom Burden by Age Groups

Analysis of age-related patterns in heat symptom burden showed a gradient, with elderly persons reporting higher burdens than younger adults. Among respondents, 92.8% were adults aged 18–59 years, while 7.2% were elderly (60+ years).

Table 4.11: Heat symptom burden by age group

Age Group	n	Mean Symptoms	SD	Statistical Test
Adults 18–59 years	439	3.17	1.94	Reference
Elderly 60+ years	34	3.50	2.14	t = -0.95, p = 0.344

Elderly people reported 10% higher symptom burden (3.50 vs 3.17), though this difference did not reach statistical significance (p = 0.344), likely due to the small elderly sample size (n=34).

More detailed age analysis showed a progressive increase in symptoms with age: 18–34 years (2.98), 35–44 years (3.27), 45–59 years (3.40), and 60+ years (3.50), though overall differences were not statistically significant (F = 1.45, p = 0.228).

Focus group participants consistently identified elderly people as among the most affected by heat. In Bay, participants explained: *"Old people cannot breathe well and become confused during extreme heat. They need help, but often there is no one to care for them during the day when it is hottest."*

Health facility staff members confirmed that elderly patients represent a substantial proportion of severe heat-related presentations, often presenting with dehydration, confusion and an exacerbation of chronic conditions during heat events.

4.4.5 Symptom Burden Among CVD-Affected Households

Comparison of symptom burden between households with and without CVD members showed modest differences. CVD-affected households reported a mean of 3.36 symptoms compared to 3.16 among non-CVD households, though this difference was not statistically significant (t = -0.77, p = 0.442).

Table 4.12: Heat symptom burden by CVD status

CVD Status	n	Mean Symptoms	SD
No CVD	407	3.16	1.94
Has CVD	67	3.36	2.07
Difference	-	+0.20	-

While overall symptom counts were similar, **Section 4.3** documented that CVD households were five times more likely to report symptom *worsening* specifically (41.3% vs 8.0%), indicating that heat affects the entire population broadly, but CVD patients experience qualitatively different and more dangerous manifestations—cardiovascular strain, chest pain, breathing difficulty—that require medical management even when absolute symptom counts are comparable to the general population.

4.5 Seasonal Health Patterns

4.5.1 Community-Reported Seasonal Variation

Analysis of seasonal health patterns revealed clear temporal clustering of health problems. Respondents were asked to identify which months experienced the greatest health burden in their households. **Table 4.11** presents the distribution of peak health problem periods.

Table 4.13: Seasonal distribution of peak health problems (n=474)

Season Period	Months	Percentage Reporting Peak Problems	Seasonal Classification
Hot dry season	January–March	64.3%	Primary burden period
Hot wet transition	April–June	25.8%	Secondary burden period
Wet season	July–September	7.4%	Low burden period
Cool dry season	October–December	1.7%	Minimal burden period

The majority of households (90.1%) identified the hot season months (January through June) as the period of greatest health burden. Nearly two-thirds (64.3%) specifically identified January through March—the hottest and driest period—as when health problems peak. By contrast, fewer than 10% reported peak problems during the cooler and wetter months (July through December).

This pronounced seasonal concentration provides clear evidence that health burdens cluster during high-temperature periods, creating predictable waves of illness that the health system must be prepared to manage.

Regional differences in seasonal health clustering were evident. Middle Shabelle showed the most pronounced concentration from January through March (78.3%), while Bay showed more distributed patterns with 52.1% reporting January-through-March peaks and 38.7% reporting April-through-June peaks. Mudug (68.1%) and Banadir (62.2%) fell between these extremes.

These regional differences likely reflect variation in long-term weather patterns, with Middle Shabelle's riverine location creating more distinct seasonal contrasts, while Bay's highland geography produces more variable temperature patterns throughout the year.

Health facility staff members corroborated community reports of seasonal health clustering through their clinical observations. During key informant interviews and focus group discussions, facility supervisors consistently described predictable surges in heat-related presentations during hot months.

Staff in Jowhar reported that during hot seasons, *"cases of diarrhea and fever rise by almost 40%"* compared to cooler periods. At Madina Hospital in Banadir, staff members documented treating more than 35 heat stroke cases within just a two-week period in March—illustrating the acute concentration of severe heat illness during peak temperature months.

At Bay Regional Hospital, providers noted that elderly patients, pregnant women and children from IDP settlements were disproportionately affected during heat events. Staff members described recognizing heat impacts *"only once patients begin arriving with dehydration, fainting or fevers,"* confirming that facilities operate reactively rather than anticipating seasonal surges.

Staff members at Kulmis Health Centre in Middle Shabelle observed that *"every hot season, people with breathing difficulties and heart symptoms visit more often,"* with cases peaking during the hottest months in each of the past two years. This consistent annual pattern demonstrates the predictability of heat-health seasonality.

4.5.2 DHIS Surveillance Data: Seasonal Trends in CVD Consultations

Despite consistent clinical testimonies of heat impacts, systematic surveillance tracking remains severely limited by data quality constraints. Analysis of routine DHIS data was restricted to the seven facilities (of 17 assessed) meeting minimum reporting standards (≥70% monthly completeness over the 66-month study period, January 2020 to June 2025). These seven facilities provided 425 facility-months of observation, but CVD consultations were documented in only 151 facility-months (35.5%), with 64.5% of records missing even among facilities meeting minimum quality thresholds

Contrary to expectations based on community and facility testimonies, no seasonal difference emerged between hot months (January through March) and cooler months (April

through December). Mean CVD consultations were 8.15 (SD=9.36) during hot months versus 10.91 (SD=14.64) during cooler months—essentially equivalent and, if anything, slightly lower during the peak heat period (**Table 4.15**). Hypertension consultations showed a similar pattern: 80.52 cases in hot months versus 84.00 in cooler months. Statistical testing was not possible due to data structure limitations, but descriptive comparisons reveal no meaningful seasonal differentiation using this hot/cool categorization.

Table 4.14: Seasonal comparison of CVD and hypertension consultations (7 facilities, 2020–2025 DHIS data)

Outcome	Cooler Months (Apr–Dec) Mean (SD)	Hot Months (Jan–Mar) Mean (SD)	n (Months)
CVD consultations	10.91 (14.64)	8.15 (9.36)	151
Hypertension consultations	84.00 (115.60)	80.52 (108.60)	347

Note: Only 35.5% of facility-months had CVD data recorded; 81.6% had hypertension data. Analysis limited to seven facilities with ≥70% DHIS reporting completeness.

However, quarterly analysis revealed statistically significant variation (F=2.93, p=0.036), with the highest CVD burden occurring in Q4 (October through December, mean=14.61 consultations) and the lowest in Q2 (April through June, mean=6.54). Post-hoc comparisons confirmed that Q4 differed significantly from Q2 (p=0.049). At the monthly scale, peaks were evident in October (18.92 consultations), July (15.07) and November (13.57), while March—typically the hottest month—recorded the lowest average (4.73 consultations) (**Figure 4.7**).

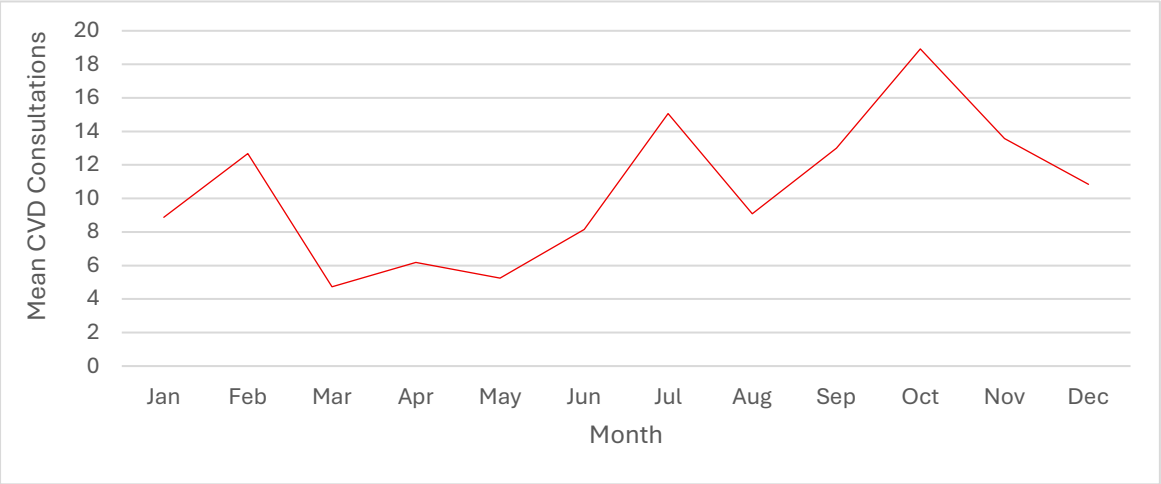

Figure 4.7: Mean CVD consultations by month across seven DHIS facilities, 2020–2025

The lack of a clear January-through-March CVD spike—and the paradoxically low March caseload—contradicts both community testimonies and facility manager reports of severe heat impacts during this period. Several interconnected explanations may account for this surveillance blind spot:

1. **Health-seeking delays and access barriers**—Households may postpone facility visits during the most difficult months due to financial constraints (26.6% unable to pay for care), geographic barriers during peak heat or reduced facility accessibility when staff members themselves struggle with heat stress. Cumulative health needs

may manifest as consultations only in subsequent months when conditions worsen or resources become available.

2. **Unmeasured seasonal stressors**—The August-through-October rise may reflect compounding stressors beyond heat alone: late dry season food insecurity, water scarcity, infectious disease transmission and post-harvest economic stress. These factors likely interact with residual heat exposure to drive cardiovascular decompensation, creating a delayed rather than concurrent signal.
3. **Diagnostic and coding limitations**—DHIS lacks heat-specific diagnostic codes. Heat-exacerbated cardiovascular presentations are logged under general CVD or symptom categories without heat attribution. Facilities reported that 88.2% do not record heat illnesses separately **(Chapter 5),** rendering heat-health links invisible in routine data even when clinically recognized.
4. **Systematic data quality gaps**—The exclusion of 10 of 17 facilities due to poor DHIS completeness (<70%) creates systemic bias. Excluded facilities had significantly worse reporting in high-burden regions: Bay Regional Hospital (59.1% completeness), Galkayo Health Center (37.9%) and six Banadir facilities below threshold. This structural exclusion removes precisely the facilities serving populations with highest heat vulnerability, potentially masking true seasonal patterns in underserved areas.
5. **Temporal resolution mismatch**—Monthly aggregation may obscure short-duration heat events. Severe heatwaves lasting days to weeks could drive acute CVD presentations that are diluted when averaged across entire months, especially in months with variable temperatures.

Data Quality as the Fundamental Constraint

These findings must be interpreted within the context of profound surveillance weaknesses documented in **Chapter 5.** Of the 17 assessed facilities:

- Only 41.2% (seven facilities) met minimum DHIS quality standards for this analysis.
- 64.5% of CVD consultation records were missing, even among included facilities.
- 88.2% of all facilities do not record heat illnesses separately, preventing attribution.
- 58.8% lacked adequate DHIS reporting to support any seasonal analysis.

The absence of heat signals in DHIS records is not evidence that heat-CVD associations do not exist. Rather, it reflects systemic surveillance blind spots: limited diagnostic specificity, incomplete data capture, exclusion of vulnerable populations from analysis due to poor facility-level reporting infrastructure, and fundamental gaps in heat-health coding systems.

The disconnect between strong community/facility perceptions of heat-CVD associations (documented in **Sections 4.2** and **5.3**) and the absence of DHIS signals emphasize a critical gap: routine surveillance systems are not designed to detect, record or track environmentally sensitive health outcomes. This invisibility has policy implications—heat-health burdens that remain unmeasured in official statistics are deprioritized in resource allocation and preparedness planning, perpetuating cycles of vulnerability.

Strengthening surveillance requires: (1) integration of heat-illness codes into DHIS, (2) facility-level capacity building for accurate diagnosis and data entry, (3) systematic linkage

between meteorological alerts and health facility reporting, (4) inclusion of community-reported symptom surveillance to complement facility data and (5) data quality improvements in underserved regions where surveillance gaps are widest. Only through such reforms can policy and planning respond to the true scale, timing and geographic distribution of seasonal heat-health burdens.

📌 **Key Messages: Current Burden of Heat-Sensitive Health Outcomes**

- **Heat is already a widespread health burden**: 95% of respondents reported heat-related symptoms, averaging more than three per person, including severe manifestations such as confusion, fainting and breathing difficulty.
- **Daily functioning and livelihoods are disrupted**: Nearly 9 in 10 experienced activity limitations, half reported economic disruption and more than 96% suffered sleep loss—undermining resilience, productivity and wellbeing.
- **Healthcare demand is substantial but constrained**: Almost half of households sought care for heat symptoms, yet financial, distance and service barriers prevented many from accessing timely treatment, especially during acute episodes.
- **Cardiovascular disease is a critical vulnerability**: CVD households were five times more likely to report symptom worsening during heat, with increased healthcare-seeking but no protocols or preparedness in facilities.
- **Discrepancies are prevalent**: IDPs face an 18% higher symptom burden than hosts, pregnant women experience near-universal challenges, elderly persons report the heaviest symptom loads and households in poor housing conditions (high HESI scores) show clear dose-response increases in illness.
- **Seasonal patterns are recognized but invisible in surveillance**: Households and providers consistently identify January through June as the peak health burden period, but DHIS data show no corresponding signal, reflecting diagnostic blind spots, suppressed access and reporting gaps.
- **Surveillance systems structurally underestimate environmentally sensitive health risks**: Without integrating community-reported symptoms, provider observations and heat-sensitive diagnostic categories, routine health information systems will continue to miss the true scale and timing of heat-health burdens.

Overall interpretation: Heat is not a distant threat but a present crisis. It affects nearly every household, disrupts livelihoods and disproportionately harms vulnerable groups. Yet surveillance systems are too weak to detect these patterns—leaving health systems reactive, underprepared and unable to target interventions to populations and periods of highest need.

Chapter 5: Health System Capacity and Heat Preparedness

While Chapters 3 and 4 documented heat exposure and health impacts, the capacity of communities and health systems to prevent, recognize and respond to heat-health challenges remains critical to understanding vulnerability. This chapter examines preparedness across four domains: (1) community-level adaptive capacity and knowledge, (2) early warning and information systems, (3) health system readiness and (4) institutional and policy frameworks.

The analysis draws on household surveys (n=474), facility assessments (n=17), key informant interviews with health providers (n=24) and policy stakeholders (n=12), and review of existing policies and protocols. Findings reveal substantial gaps between documented heat-health burdens and system capacity to address them.

This chapter addresses the research question: *What capacity exists within communities, health systems and institutions to prevent, detect and respond to heat-related health impacts in Somalia?*

5.1 Household and Community Capacities

Households and communities form the first line of defense against extreme heat, relying on knowledge, perceptions and daily practices to manage risk. This section examines capacity across three dimensions following the Knowledge-Attitudes-Practices (KAP) framework: (1) knowledge of heat-health risks, (2) perceptions of vulnerability and risk severity and (3) prevention and adaptation practices. The analysis integrates household survey data (n=474), focus group discussions and key informant interviews to assess both individual household capacity and collective community resilience.

5.1.1 Knowledge of Health Risks

Household knowledge of heat-related health problems showed strong recognition of some risks but critical gaps in others. Nearly nine in 10 respondents (89.9%) identified dehydration as a key risk, indicating a solid foundational awareness. By contrast, awareness of more severe or indirect risks was far lower: only 41.2% recognized heat exhaustion or stroke, 36.8% identified respiratory problems and 36.2% linked heat to worsening of chronic conditions. Very few associated heat with cardiovascular complications (17.3%), kidney damage (16.7%) or death (5.1%) (**Table 5.1**). On average, households recognized 2.43 out of seven possible risks, reflecting moderate overall literacy but dangerous blind spots on the severity of heat illness.

Table 5.1: Heat-health risk knowledge

Health Risk	Recognition Rate	Knowledge Level	Clinical Significance
Dehydration	89.9%	Excellent knowledge	Primary heat effect
Heat exhaustion/heat stroke	41.2%	Moderate knowledge	Critical heat illness
Worsening of existing conditions	36.2%	Limited knowledge	Chronic disease exacerbation
Respiratory problems	36.8%	Limited knowledge	Secondary heat effect
Cardiovascular problems	17.3%	Poor knowledge	Project focus condition
Kidney problems	16.7%	Poor knowledge	Heat-related organ damage
Death	5.1%	Very poor knowledge	Severe heat consequence

These findings show that while communities possess strong experiential awareness of dehydration, they have limited recognition of more severe or systemic health impacts. Critical knowledge gaps on cardiovascular, kidney and mortality risks mean households often underestimate the dangers of extreme heat, leaving them underprepared to prevent or respond to life-threatening conditions.

Patterns of heat-health knowledge varied across demographic and regional groups. Interestingly, respondents with no formal education demonstrated higher average knowledge (2.62) than those with primary education (2.12), while those with secondary or higher education showed the strongest scores (**Figure 5.1**).

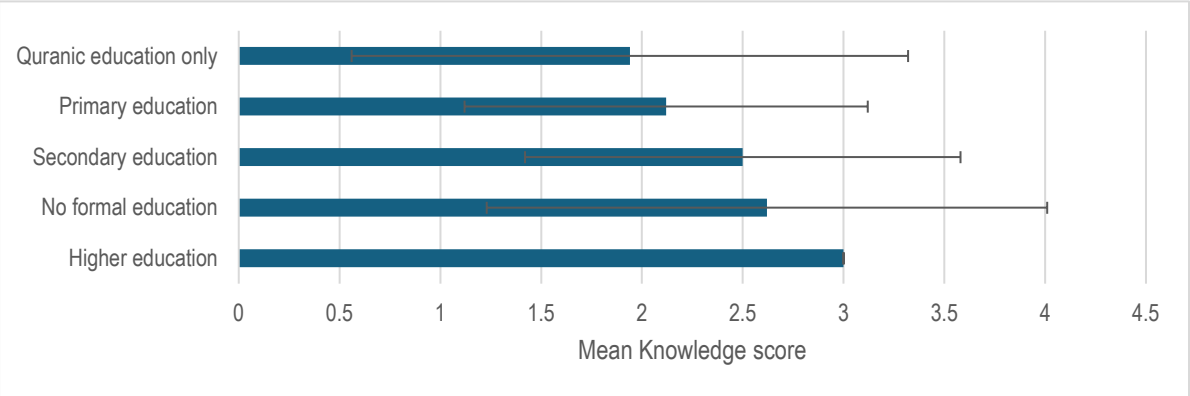

Figure 5.1: Heat knowledge by education level

Regionally, knowledge was highest in Bay (2.66) and Mudug (2.56), moderate in Banadir (2.30) and lowest in Middle Shabelle (2.19) (**Figure 5.2**).

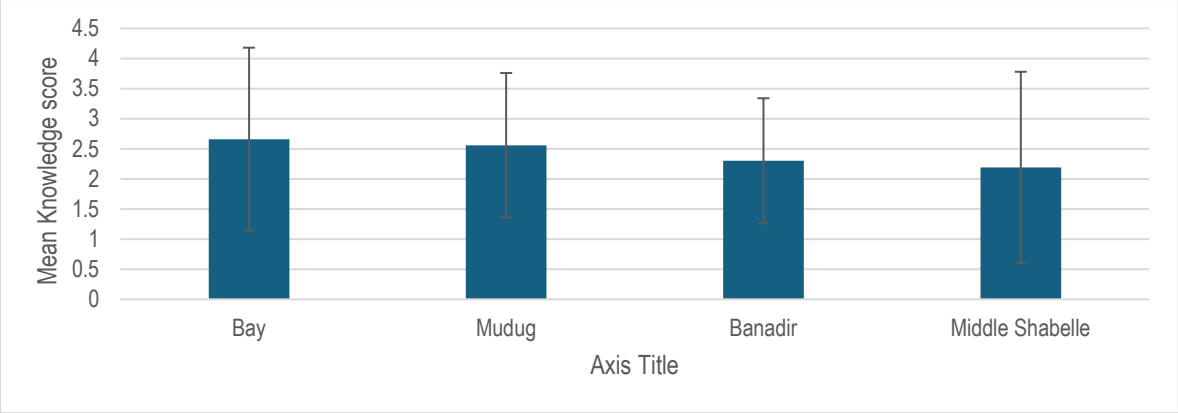

Figure 5.2: Heat knowledge by region

Focus group discussions reinforced these patterns while revealing how knowledge is constructed and transmitted within communities. While dehydration was universally understood across all community groups, participants rarely connected chronic conditions to heat. In Banadir, one health worker explained: *"People come with fainting, high blood pressure and kidney complaints during hot days, but they don't see it as caused by heat."* Women in Baidoa similarly noted that while they feared children fainting from the sun, few recognized longer-term risks such as heart strain or heat stroke.

Qualitative findings revealed that elders in Bay and Mudug demonstrated detailed experiential knowledge, drawing on direct observation of animals, plants and winds. One elder explained: *"We know when extreme heat is coming by watching the behavior of livestock and the drying of certain plants."* This knowledge, passed through generations, provides practical early warning but lacks the technical understanding of physiological mechanisms that would enable better prevention.

Urban respondents in Banadir, despite higher formal education levels, often downplayed heat risks, viewing them as normal seasonal conditions rather than health threats. This normalization of risk was particularly evident among younger urban residents who had not experienced the historical context of changing long-term weather patterns described by elders.

These findings highlight that lived exposure drives knowledge more strongly than formal schooling alone, underscoring the critical role of experiential and community-led learning in building heat-health awareness. However, the gaps in technical knowledge about severe outcomes point to the need for structured health education that builds on existing experiential knowledge while addressing critical blind spots.

5.1.2 Perceptions of Vulnerability and Risk Severity

Beyond understanding heat risks generally, recognizing which groups face the greatest danger is essential for targeted protection. Awareness of demographic vulnerabilities was high, with 79.9% citing young children, 69.1% citing the elderly and 64.3% citing pregnant women as most at risk (Table 4.36). However, fewer households recognized chronic illness (31.1%), poverty (23.3%) or occupational exposure (20.9%) as significant vulnerabilities, despite their documented relevance. A small proportion (16.5%) believed everyone is equally affected.

Table 5.2: Vulnerable group recognition

Vulnerable Group	Recognition Rate	Vulnerability Awareness Level	Targeting Implications
Young children	79.9%	Excellent recognition	Strong targeting foundation
Elderly	69.1%	Good recognition	Good targeting foundation
Pregnant women	64.3%	Good recognition	Good targeting foundation
People with chronic illness	31.1%	Limited recognition	Education needed
Poor people	23.3%	Limited recognition	Socioeconomic education needed
Outdoor workers	20.9%	Limited recognition	Occupational education needed
Everyone equally	16.5%	Misconception	Targeted education needed

Community voices reinforced these perceptions while revealing how vulnerability is understood at the collective level. Mothers in FGDs frequently expressed fear of children fainting in the sun, describing how they modify daily routines to protect young children during peak heat hours. Older participants described exhaustion during hot spells and their increasing difficulty coping with prolonged heat periods.

Yet occupational and structural vulnerabilities were less recognized at the community level. Outdoor workers reported: *"We cannot stop working, even when it is too hot; if we stop, we lose our income."* This economic imperative was widely understood but not framed as a vulnerability requiring collective or institutional response. Instead, workers described heat exposure as an inevitable consequence of livelihood rather than a preventable occupational hazard.

Facility key informants similarly highlighted that public health education rarely addresses work-related risks or the compounding effects of poverty and chronic disease. One health worker noted: *"We tell people to rest during hot weather, but we don't acknowledge that many cannot afford to rest."*

While awareness of demographic vulnerability is strong, recognition of structural and occupational risks remains weak, leaving critical gaps in community-targeted protection strategies. Communities possess intuitive understanding of who suffers most but lack frameworks for understanding why these vulnerabilities exist or how they might be addressed.

5.1.3 Prevention and Adaptation Practices

Household Prevention Practices

Most households reported practicing at least one form of prevention, though behaviors were skewed toward basic measures. Drinking more water (77.4%) and staying in shade or indoors during peak heat (56.7%) were the most common strategies, followed by wearing light clothing (27.3%) and reducing physical activity (26.0%). By contrast, more resource-intensive or occupational measures were much less common: only 17.8% used cooling methods such as fans or wet cloths, and just 7.2% reported taking regular breaks while

working outdoors (**Figure 5.3**). About 5.3% reported doing nothing, leaving a small proportion completely unprotected.

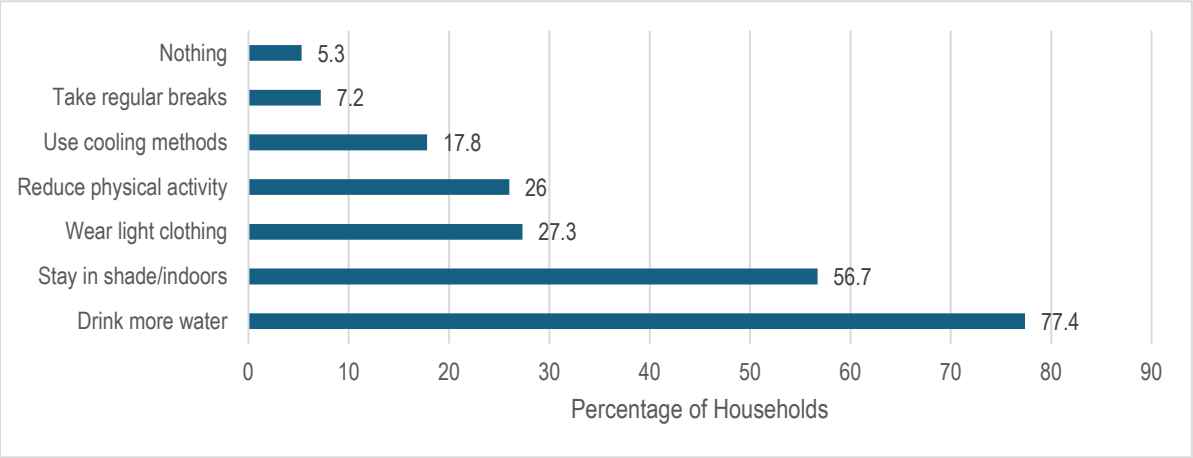

Figure 5.3: Prevalence of heat prevention practices

Correlation analysis revealed that knowledge is strongly shaped by lived experience of heat symptoms and moderately associated with protective behaviors. Households with higher knowledge scores were significantly more likely to report experiencing personal heat-related symptoms ($r = 0.617$, $p < 0.001$), suggesting that experiential learning plays a central role. Knowledge was also positively correlated with use of cooling methods ($r = 0.282$, $p < 0.001$), though the modest strength of this relationship points to barriers beyond awareness. Similarly, symptoms were correlated with adoption of cooling methods ($r = 0.330$, $p < 0.001$), reinforcing the finding that experience drives adaptation. These patterns demonstrate that preventive behaviors remain basic, shaped more by economic constraints and lived experience than by structured health education.

Household Cooling Strategies

Households reported a variety of strategies to cope with hot weather, though reliance was heavily skewed toward low-cost behavioral measures rather than technology-dependent solutions. The most frequently reported methods included opening windows or doors (37.0%), staying in shade (37.0%), moving to a cooler location (28.5%) and use of traditional handheld fans (23.0%). Some households reported wetting clothes or bathing (16.9%). Access to powered cooling was minimal: only 4.7% reported using an electric fan and 4.2% reported access to air conditioning. Notably, 10.8% of households reported doing nothing in response to heat, indicating a complete absence of adaptive capacity (**Table 5.3**).

Table 5.3: Reported cooling strategies among surveyed households

Cooling Method	Households Using	Percentage	Adaptive Capacity Category
Opening windows/doors	175	37.0%	Passive ventilation
Staying in shade	175	37.0%	Behavioral adaptation
Moving to cooler location	135	28.5%	Spatial adaptation
Traditional handheld fan	109	23.0%	Low-tech cooling
Wet clothes/bathing	80	16.9%	Evaporative cooling
Nothing/no methods	51	10.8%	No adaptive capacity
Electric fan	22	4.7%	Powered cooling
Air conditioning	20	4.2%	Advanced cooling
Other methods	0	0.0%	-

On average, households employed only 1.51 strategies (SD = 0.92). Nearly half (47.9%) reported using no more than a single method, while only 16.4% reported three or more strategies.

Analysis by HESI highlighted a critical paradox: households at moderate exposure (HESI 4–5) reported the highest number of strategies (mean 1.65–1.68), while those at the extreme end (HESI 6) reported fewer (mean 1.05). This indicates that the most exposed, predominantly IDPs in poorly constructed shelters, also have the least capacity to adapt (**Figure 5.4**).

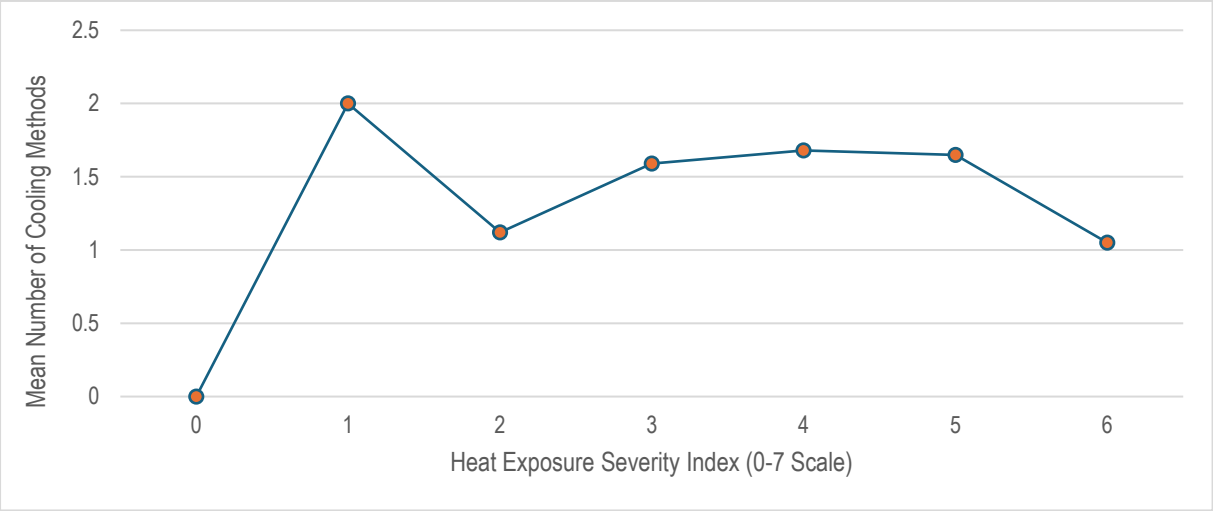

Figure 5.4: Number of cooling strategies by heat exposure severity index

Community-Level Adaptation Practices

Qualitative accounts illustrated how adaptation strategies play out at both household and community levels. Women in Jowhar described adjusting daily routines, such as completing chores early in the morning to avoid afternoon heat. Male casual laborers in Galkayo reported halting work at midday due to unbearable conditions, one recalling how he

"collapsed while farming" and now avoids peak hours. Others in Banadir explained: *"When the house becomes too hot, we just sit under a tree; there is nothing else to do."*

Communities also described broader social adjustments during extreme heat periods. In Jowhar, participants explained that during the hottest times, farmers reduce afternoon fieldwork, markets slow down and social gatherings decline. While this minimizes exposure, it also reduces social support and weakens community cohesion. One community leader noted: *"When it is very hot, people stay isolated in their homes or under trees. We lose the community activities that normally help us support each other."*

Women described struggling to fetch water in extreme heat, while men reported losing income from shortened work hours. One participant explained simply: *"Casual laborers cannot work under the hot sun, so we lose income."* Key informants also linked exposure and adaptation to broader livelihood impacts, emphasizing that prolonged heat has damaged crops, dried up pasture and weakened livestock, pushing families to rely more heavily on aid and undermining their ability to invest in coping measures. Others noted that prolonged heat increases sickness—including headaches, fainting and worsening chronic disease symptoms—which further reduces productivity.

These findings demonstrate how environmental and economic constraints converge, creating a feedback loop where households most at risk are also least able to adapt. Households rely overwhelmingly on low-cost behavioral coping strategies, with minimal access to powered cooling. This leaves those most exposed to heat—particularly IDPs—least able to protect themselves. The households with the highest heat exposure severity also report the fewest coping options, highlighting a critical adaptation gap. Without improved shelter, electricity access and affordable cooling solutions, existing strategies will remain insufficient to safeguard health and livelihoods.

5.1.4 Future Adaptation Planning and Priorities

Anticipated Coping Capacity

When asked about their household's ability to cope with heat in the next five to 10 years, nearly two in five respondents (37.4%) anticipated being worse off. Only 41.6% believed they would cope better, while 20.9% expected no change (Figure 5.6). This prevailing pessimism suggests communities recognize that heat risks are accelerating faster than current resilience strategies.

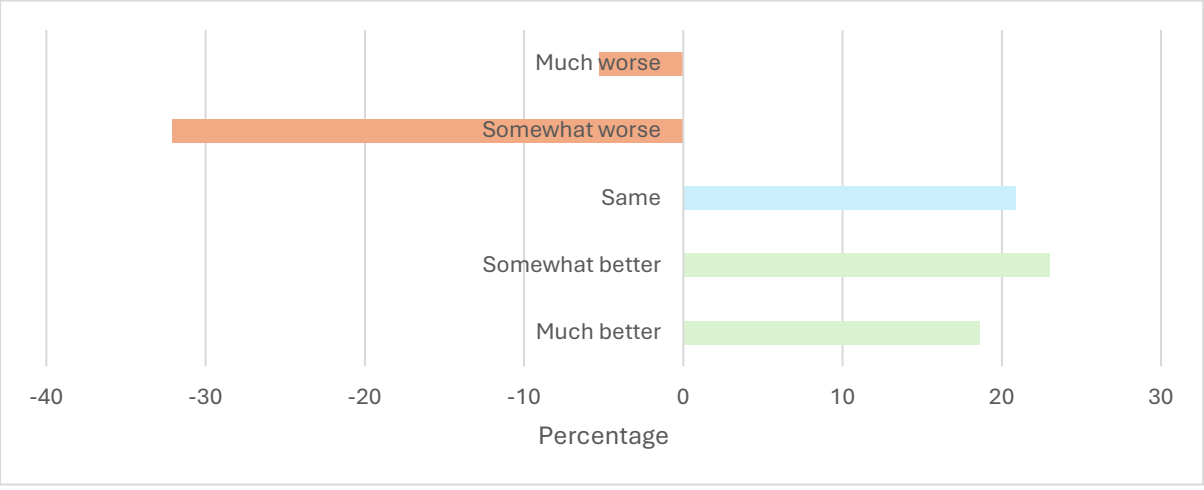

Figure 5.5: Community perception of future coping capacity projections

Despite these concerns, forward planning was rare. Only 2.3% of households had detailed adaptation plans, while 18.0% had basic plans. The majority were either still “thinking about it” (28.8%) or had made no plans at all (51.0%) (**Figure 5.6**). These results highlight a critical awareness–action gap, in which recognition of heat risks rarely translates into preparedness.

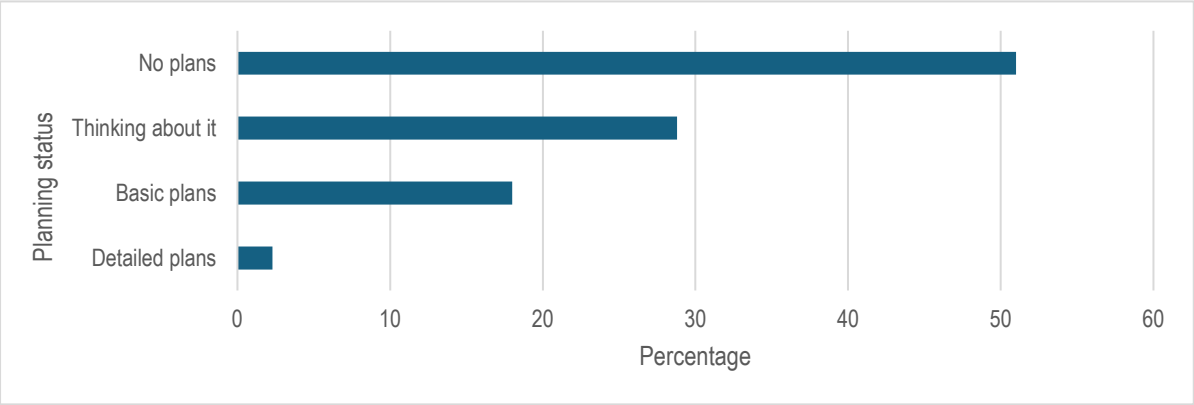

Figure 5.6: Household adaptation planning status

FGDs confirmed this pattern: participants frequently noted they think about ways to cope, such as fetching water earlier, but few described long-term preparations. Many emphasized that they lacked resources for improved housing, electricity or water storage, leaving them dependent on short-term improvisation. Many households expect to be less able to cope with future heat, yet few have concrete adaptation plans. This awareness–action gap, driven by resource constraints, leaves families reliant on short-term coping and vulnerable to rising risks.

Community adaptation priorities

When asked what would most help them cope, households prioritized better housing materials (79.9%), water storage (46.9%) and reliable electricity (46.1%). Fewer emphasized early warning systems (31.3%), health education (16.9%) or cooling centers (15.2%). Health insurance ranked lowest at 7.2% (**Table 5.4**).

Table 5.4: Top 3 household selections of adaptation priorities

Adaptation Priority	Frequency	Percentage	Priority Rank	Investment Type
Better housing materials	378	79.9%	1	Infrastructure
Water storage	222	46.9%	2	Infrastructure
Reliable electricity	218	46.1%	3	Infrastructure
Early warning systems	148	31.3%	4	Information
Heat-health education	80	16.9%	5	Knowledge
Community cooling centers	72	15.2%	6	Community infrastructure
Health insurance	34	7.2%	7	Financial protection
Other	13	2.7%	8	Various

This preference for infrastructure reflects both the practical realities of exposure and the limitations of current coping strategies. Communities overwhelmingly prioritize tangible infrastructure—better housing, water storage and reliable electricity—as their main heat adaptation needs, while placing far less emphasis on early warning, education or financial protection. This reflects both the immediacy of daily exposure and the limited effectiveness of current coping strategies.

5.1.5 Household Adaptive Capacity

To assess resilience at the household level, an Adaptive Capacity Index was constructed across six domains: education (≥primary), reliable electricity supply, water security, healthcare accessibility (≤30 minutes), early warning access and income diversification (≥2 sources). Each domain contributed one point, producing a 0–6 scale of household capacity.

The mean adaptive capacity score across households was 2.78 (SD = 1.12), indicating that most households possess fewer than half of the resources needed to withstand and respond effectively to heat stress (**Table 5.5**). Only 8.3% achieved high adaptive capacity (scores 5–6), while more than 40% scored low (0–2), underscoring widespread resilience deficits.

Table 5.5: Adaptive capacity index distribution

Capacity Score	Frequency	Percentage	Capacity Level
0	12	2.5%	No capacity
1	48	10.1%	Very low
2	137	28.9%	Low
3	163	34.4%	Moderate
4	75	15.8%	Good
5	33	7.0%	High
6	6	1.3%	Very high
Mean (±DS)	2.78 (±1.12)		Moderate

Disaggregation highlights clear discrepancies across both population groups and regions. Host communities reported significantly higher adaptive capacity (mean = 3.50) compared to IDP settlements (mean = 2.42; $p < 0.001$), reflecting structural disadvantages in displaced settings. Regional discrepancies were equally pronounced ($F = 19.23$, $p < 0.001$): Middle Shabelle demonstrated the strongest adaptive capacity (mean = 3.36), while Mudug registered the lowest (mean = 2.41) (**Figure 5.8**).

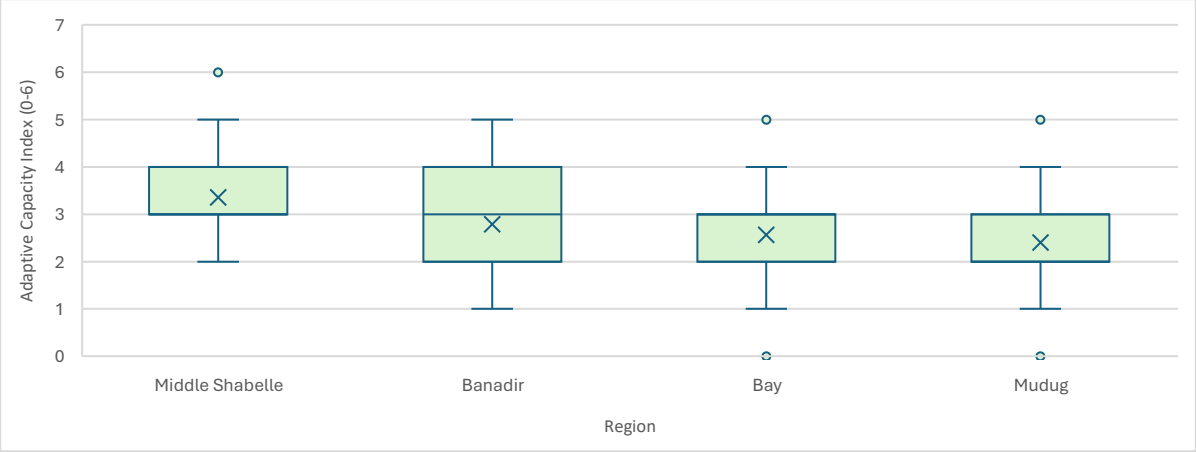

Figure 5.7: Regional adaptive capacity comparison

Middle Shabelle's higher capacity aligns with its better warning coverage (80%) and heat awareness, while Mudug's lowest capacity (2.41) corresponds with zero regular warning access and high CVD burden (31.9%).

Correlation analysis reveals interconnected relationships between adaptive capacity, heat exposure and health outcomes (Table 5.6).

Table 5.6: Correlation matrix of key resilience indicators

Variable Pair	r	Significance	Interpretation
Adaptive capacity ↔ Heat exposure	-0.432**	p < 0.001	Strong inverse
Adaptive capacity ↔ Heat symptoms	-0.287**	p < 0.001	Inverse protective effect
Adaptive capacity ↔ Warning access	0.451**	p < 0.001	Enabling relationship

**All correlations significant at p < 0.01 level*

The strong negative correlation between adaptive capacity and heat exposure (r = -0.432) indicates that households with fewer resources face greater environmental risks. The inverse relationship with heat symptoms (r = -0.287) may demonstrate that adaptive capacity provides measurable protection against heat-health impacts.

FGDs illustrated these gaps vividly. Residents highlighted the absence of electricity to power fans, unreliable water during hot weather and long distances to clinics. IDP participants stressed their particular disadvantage: fewer income sources, weaker access to services and crowded shelters in treeless areas. One participant explained: *"We just endure the heat with nothing but shade and water—if water is even available."*

Household adaptive capacity is weak overall, with IDPs facing a double disadvantage of low resources and high exposure. While some regions like Middle Shabelle show stronger resilience due to better warning systems and awareness, others such as Mudug remain critically under-resourced.

5.1.6 Community prepared and Support Systems

Community Preparedness Levels

Community perceptions revealed widespread fragility in preparedness for extreme heat events. Nearly half of respondents (49.7%) perceived their communities as poorly prepared

and an additional 35.5% as not prepared at all. Only 1.5% of households described their communities as well or very well prepared (**Figure 5.9**). This limited preparedness aligns with weak institutional and collective coping structures.

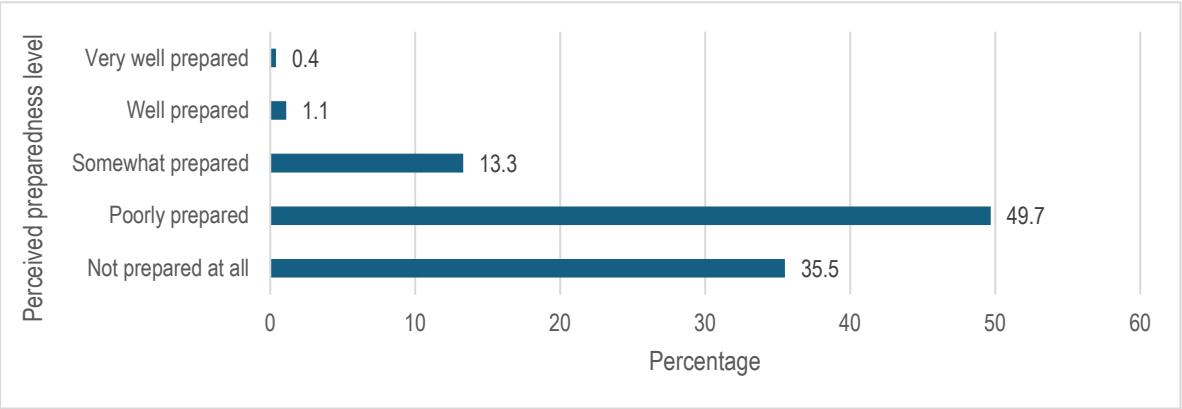

Figure 5.8: Perceived community heat preparedness assessment

Analysis of preparedness-outcome relationships demonstrates that community self-assessed preparedness is strongly associated with improved health outcomes (**Table 5.7**). Populations rating themselves as not prepared (scores 1–2) reported the heaviest burden, with an average of 3.3 heat symptoms, 50.1% seeking healthcare and 68.2% experiencing moderate to severe disruptions in daily functioning. In contrast, somewhat prepared communities (score 3) showed better outcomes, with fewer symptoms (mean = 2.5), reduced healthcare-seeking (36.5%) and lower levels of functional impairment (52.4%). The most favorable outcomes were reported among well-prepared groups (scores 4–5), where mean symptoms dropped to 1.9, healthcare-seeking fell to 28.6% and activity disruption decreased to 42.9%.

Moving from low to high preparedness reduced symptoms by 1.45 on average, lowered healthcare utilization by 21.5 percentage points and cut functional impairment by 25.3 percentage points.

Table 5.7: Preparedness level and health outcomes

Preparedness Rating	n	Mean Heat Symptoms	Healthcare Seeking	Functional Impact*
Not prepared (1-2)	403	3.31	50.1%	68.2%
Somewhat prepared (3)	63	2.54	36.5%	52.4%
Well prepared (4-5)	7	1.86	28.6%	42.9%
Difference	-	-1.45	-21.5%	-25.3%

**Percentage reporting moderate to severe impact on daily activities*

FGDs confirmed this sense of weakness. Participants stressed that there were no community-level plans, coordination mechanisms or leadership structures to address heat. Most said coping remains individual, such as fetching water earlier in the morning, resting in shade or reducing activity. As one participant in Baidoa noted: *"Everyone just does what they can. There is no collective plan or help from the community when the heat comes."*

Community preparedness for extreme heat is extremely limited, with nearly all households perceiving little to no collective readiness. While preparedness levels are strongly associated with better health outcomes (Table 5.7 demonstrates a clear dose-response relationship), the near-absence of formal mechanisms for community coordination means that households must rely primarily on individual coping strategies. However, this does not mean that all community support is entirely absent—rather, what limited support exists operates informally and reaches only a minority, as detailed below.

Community Support Systems

The apparent paradox between widespread lack of preparedness and some community support is explained by the nature of existing assistance: ad hoc, externally driven and reaching only a small fraction of households. Access to organized community support during heat events is minimal. Only 22.8% of households reported receiving any community support during extreme heat events, leaving 77.2% without collective assistance mechanisms. This limited coverage indicates weak social safety nets precisely when vulnerability peaks.

Among the limited support measures, the most frequently reported were health information provision (40.7%) and water distribution (29.6%), followed by check-ins on vulnerable individuals (33.3%) and first aid or medical support (28.7%). Only 16.7% of supported households had access to shared cooling centers or cool spaces (**Table 5.8**). This highlights a critical infrastructure gap in collective heat-response mechanisms.

Table 5.8: Community Support Availability and Types

Support Type	Recipients (n)	% of Those Receiving Support	% of Total Sample	Support Category
Any community support	108	100.0%	22.8%	Overall coverage
Health information	44	40.7%	9.3%	Knowledge support
Check-ins on vulnerable	36	33.3%	7.6%	Social support
Water distribution	32	29.6%	6.8%	Material support
First aid/medical support	31	28.7%	6.5%	Health support
Cooling centers/spaces	18	16.7%	3.8%	Infrastructure support
Other support	3	2.8%	0.6%	Miscellaneous

The disconnect between preparedness and support reveals a critical gap: while some households receive assistance (22.8%), this support operates without systematic planning or sustainable structures. Support is typically provided by external actors—NGOs, religious organizations or humanitarian agencies—during acute heat events, rather than through community-led preparedness systems. This explains why 85.2% of households accurately perceive their communities as unprepared even while a minority receive some form of assistance. The support that exists is reactive, inconsistent and dependent on external resources, rather than proactive, predictable and community owned.

Community support systems to buffer households against extreme heat are extremely weak. Where support exists, it is piecemeal and dependent on outside actors rather than sustained

local structures. The absence of cooling centers and organized social safety nets leaves households highly exposed during periods of extreme heat.

5.2 Early Warning and Information Systems

Access to timely and credible information about upcoming hot weather is critical for enabling household and community preparedness. Yet early warning systems for heat remain largely absent in Somalia, leaving most households reactive rather than prepared.

5.2.1 Warning System Coverage

Access to Heat Warnings and Information

Only 12.6% of respondents reported receiving regular heat warnings, 35.8% had occasional access, and over half (51.6%) reported never receiving any warnings (see **Figure 5.9**). This limited information flow constrains preparedness and disproportionately affects vulnerable populations.

Regional discrepancies in warning access were striking ($\chi^2 = 120.25$, $p < 0.001$). In Middle Shabelle, 80.0% of households reported receiving warnings regularly or occasionally, the highest coverage across the four regions. Bay also showed relatively strong access (54.6%). In sharp contrast, 82.1% of households in Banadir reported never receiving any warnings, while Mudug had the second-highest level of exclusion (60.4%) (**Figure 5.9**). These findings confirm structural discrepancies in information flow, with the regions that face the highest heat risk burdens often lacking adequate warning systems.

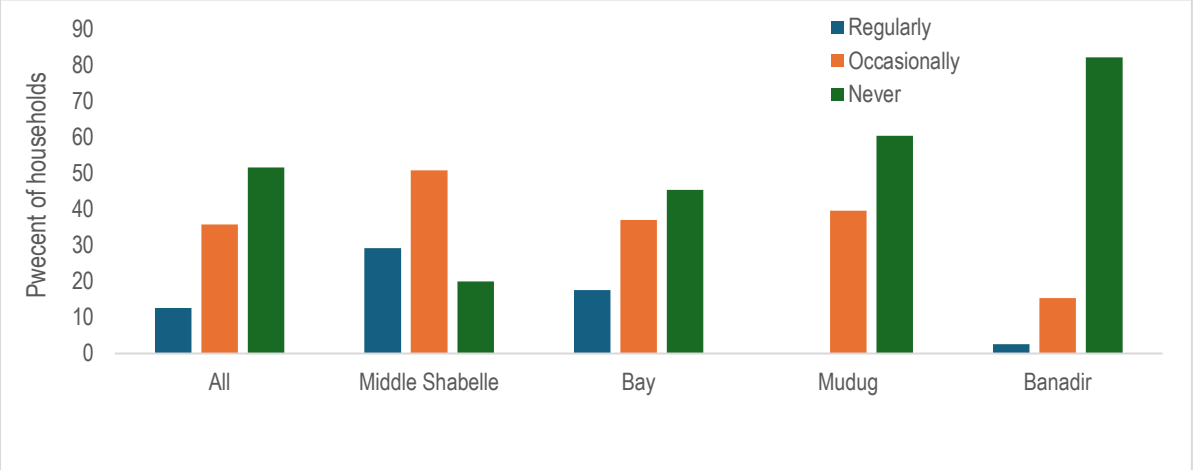

Figure 5.9: Warning system coverage by region

Difference in Warning Access

Analysis of warning access across settlement types revealed significant discrepancies. Host community households were more likely to receive warnings (52.5%) compared to IDP settlements (43.4%), though this difference was not statistically significant ($\chi^2 = 3.72$, $p = 0.156$). However, the pattern suggests that IDPs—who face higher heat exposure, as documented in Chapter 3—are slightly less likely to receive the information needed to protect themselves.

FGDs in Baidoa IDP camps described the absence of a formal warning system. Participants explained that *they receive very little advance warning about heat, though **they occasionally receive general heat-health information** (such as advice on hydration and shade-seeking) from health workers during vaccination campaigns or health education days*.

However, this information typically arrives during or after heat has already started, rather than as an advance warning, forcing households to respond reactively by seeking shade, reducing activity or collecting water earlier in the day.

The absence of a clear distribution of warnings means that those most at risk continue to face disproportionate exposure without adequate protection. This misalignment between vulnerability and access reveals a fundamental weakness in the current system: risk communication strategies remain vulnerability-blind, failing to align with disaster risk reduction principles that call for prioritizing the most at-risk populations.

5.2.2 Sources and Channels for Heat Warnings and Information

Among households that reported receiving heat warnings and/or information, radio was the dominant channel (80.1% of those with warnings, equivalent to 38.8% of the total sample), followed by community announcements (17.7%) and healthcare workers (12.4%) (see **Table 5.9**). More modern channels were less common: mobile phones (15.9%), television (10.2%), and social media (4.0%). Smaller proportions relied on word of mouth (9.7%) and religious leaders (4.9%).

Table 5.9: Information sources for heat warnings

Information Source	Users (n)	% of Those Receiving Warnings	% of Total Sample
Radio	181	80.1%	38.8%
Community announcements	40	17.7%	8.6%
Mobile phone (SMS/apps)	36	15.9%	7.7%
Healthcare workers	28	12.4%	6.0%
Television	23	10.2%	4.9%
Word of mouth	22	9.7%	4.7%
Religious leaders	11	4.9%	2.4%
Social media	9	4.0%	1.9%

FGDs provided additional context: *health workers and community leaders were described as the main sources of useful, easy-to-understand messages, usually in Somali language*. Typical advice included *drinking more water, resting in shade, wearing light clothing and reducing physical activity*. Participants valued this advice but consistently noted that *messages are too infrequent, often arriving late or only during the hot season*.

Several respondents highlighted the role of radio but stressed its limitations, explaining that *many people still lack information because messages from the government and health centers are too limited*. One woman emphasized that *mothers and elders in particular need more regular communication*.

Facility assessments mirrored these gaps at the institutional level. Among the 17 assessed health facilities, only 17.6% (three facilities) monitored indoor temperatures, and just 5.9% (one facility) received heat alerts or had heat action plans. While 70.6% of facilities (12 of 17) met WHO HMIS quality standards (≥70% recording rate) for general health data, only 41.2% (seven of 17) had adequate data quality for CVD seasonal analysis. Furthermore, the vast

majority (88.2%, 15 of 17 facilities) did not record heat illnesses separately in their health information systems. Facility managers explained that they usually recognize extreme heat only once patients begin arriving with dehydration, fainting or fevers. Key informant interviews with federal Ministry of Environment officials and the NCD policy advisor at the federal Ministry of Health confirmed that response to heat events is predominantly reactive, with interventions typically occurring only after heat impacts become evident. These findings confirm that gaps at household level are replicated at facility level, leaving both communities and clinics reactive rather than prepared.

5.2.3 Trust Patterns and Information Credibility

Trust patterns revealed a clear hierarchy of credible information sources (Table 4.45). Healthcare workers emerged as the most trusted source (62.8%), followed by community leaders (38.9%) and religious leaders (32.1%). Government officials were trusted by just over one-fifth of respondents (22.2%), while international organizations (21.6%) and media outlets (25.6%) ranked similarly. By contrast, traditional healers (7.6%) and family members (16.7%) had low credibility as sources of heat-health advice.

Table 5.10: Trusted Sources for Heat-Health Information (Up to 3 Selections)

Information Source	Trust Frequency	Trust Percentage	Trust Ranking
Healthcare workers	297	62.8%	1
Community leaders	184	38.9%	2
Religious leaders	152	32.1%	3
Media (radio, TV)	121	25.6%	4
Government officials	105	22.2%	5
International organizations	102	21.6%	6
Family members	79	16.7%	7
Traditional healers	36	7.6%	8

These trust patterns suggest a community-anchored communication strategy would be most effective, prioritizing healthcare workers for technical messaging, community leaders for mobilization and religious leaders for reinforcing protective behaviors. The relatively low government trust indicates that state-led warnings may require validation through trusted community intermediaries.

FGDs confirmed these rankings. Participants consistently described health workers as the most trusted source of technical information: *"When the health worker tells us something about our health, we listen because they have training."* Community leaders play a role in mobilizing people and disseminating messages, while religious leaders reinforce advice through cultural authority and Friday sermons. In contrast, government officials were described as largely absent from direct communication, and several respondents noted they had never heard government messages on heat in their areas.

5.2.4 Information Needs and Gaps

When asked what additional information would be most useful, households demonstrated clear priorities (**Figure 4.10**). Early warnings for hot weather were the most frequently requested (71.0%), followed by health protection measures (52.2%). The prioritization of information needs indicates both demand for timely warnings and a gap in actionable, health-protective advice.

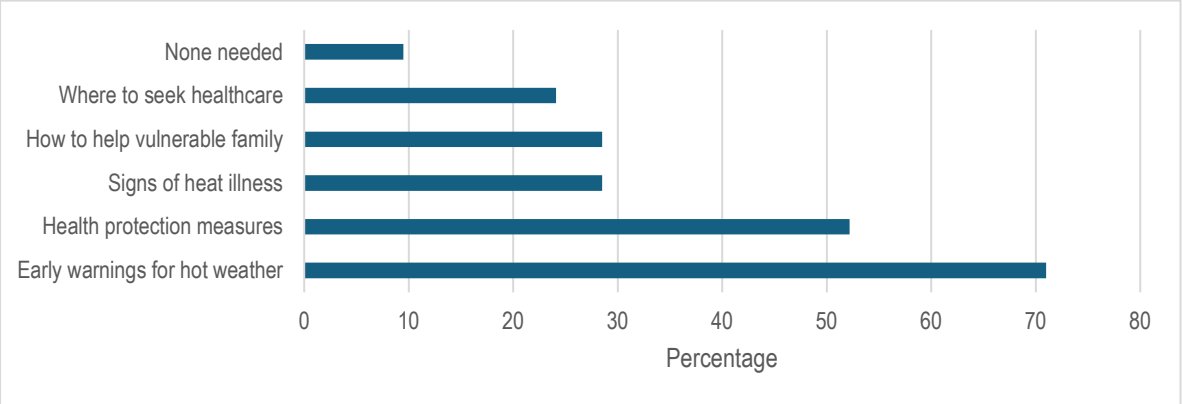

Figure 5.10: Community information needs assessment

This prioritization indicates both demand for timely warnings and a gap in actionable, health-protective advice. The high demand for early warnings (71.0%) validates investment in warning systems, while the strong interest in health protection measures (52.2%) and recognition of heat-illness signs (44.7%) points to critical knowledge gaps that could be addressed through structured health education.

FGDs provided detail on how information gaps play out in practice. Participants described uncertainty about when heat becomes dangerous, what symptoms require medical attention and how to protect vulnerable family members. One woman explained: *"We know it is hot, but we don't know when the heat is so bad that we need to go to the clinic. We wait until someone faints, but maybe we should have gone earlier."*

Others emphasized the need for specific, actionable guidance rather than general advice. *"They tell us to drink water and rest, but we need to know: how much water? When exactly should we rest? What do we do if someone becomes confused or very weak?"* This desire for concrete guidance reflects both the limitations of current messaging and households' recognition that they lack the technical knowledge to translate general advice into effective protection.

Key informant interviews with federal Ministry of Environment officials and Ministry of Health representatives further validated these findings. Officials confirmed that "Somalia currently has very limited early warning systems for extreme heat" and that "meteorological services monitor temperature trends, but there are no formal heat-alert protocols." They acknowledged that "early warning messages for heat in Somalia are very limited and rarely tailored," with "little adaptation for specific audiences," such as health workers or vulnerable groups. Officials also noted that "partnerships with meteorological services for heat-health early warning are minimal" with "no formal agreements or structured data-sharing protocols."

The systematic absence of heat early warning and information systems leaves households and health facilities reactive rather than prepared. Over half of households receive no alerts, and coverage is lowest in the regions facing the highest risks. Messaging is infrequent and

reactive, while trusted intermediaries such as health workers and community leaders remain underutilized. The result is an information system that is not only fragmented but also vulnerability-blind, leaving some populations unprotected. Without systematic investment in early-warning infrastructure, culturally adapted messaging and distribution focused on reaching everyone through trusted channels, Somalia's most vulnerable populations will continue to face heat risks without the information needed to protect their health.

5.3 Health System Capacities and Facility Readiness

The health system represents the formal institutional response to heat-related health impacts. While Chapter 4 examined how households seek and access care, this section assesses whether the health system has the capacity to respond effectively. The analysis focuses on facility-level preparedness, staff training, clinical protocols, infrastructure and institutional readiness to manage heat-health emergencies.

5.3.1 Facility-Level Heat Preparedness

The facility assessment revealed critical gaps in preparedness to address heat-related health risks. None of the 17 assessed facilities had standard operating procedures (SOPs) for managing heat illness or CVD during extreme heat events, underscoring a systemic gap in preparedness (**Table 5.11**).

Table 5.11: Facility heat preparedness indicators

Preparedness Indicator	Facilities with Capacity	Percentage	Gap Analysis
Heat action plan	1/17	5.9%	Critical absence
Receives heat warnings	1/17	5.9%	No early warning integration
Heat-illness SOPs	2/17	11.8%	No standardized protocols
CVD emergency protocols	3/17	17.6%	Limited CVD capacity
Staff trained in heat illness	5/17	29.4%	Severe training gap
Staff trained in CVD	4/17	23.5%	Limited CVD capacity
Public education on heat	4/17	23.5%	Minimal prevention efforts
Indoor temperature monitoring	3/17	17.6%	No environmental monitoring

On a composite heat stress service readiness scale (0–5), facilities averaged only 1.29, indicating that most facilities possess fewer than one-third of the core capacities needed for managing heat illness during heat stress. Only one facility (5.9%) had a heat action plan, and only one received regular heat warnings, demonstrating virtually no integration between meteorological services and health facilities.

These preparedness gaps are compounded by pharmaceutical supply constraints during hot weather periods. Household reports reveal systematic medication unavailability: among households with members using CVD medications (n=33), only 27.3% reported medications were always available during hot weather, while 72.7% experienced intermittent or frequent unavailability (**Table 5.12).** When expanded to all CVD/diabetes households (20.0% of the sample, n=95), 73% reported medication access problems during heat periods.

Table 5.12: CVD medication availability during hot weather (household reports)

Availability Pattern	Percentage (n=33)	Access Implication
Always available	27.3%	Reliable access
Sometimes unavailable	69.7%	Intermittent access
Often unavailable	3.0%	Poor access

Facility managers acknowledged that pharmaceutical supply chains are disrupted during peak heat periods through multiple mechanisms. Unreliable electricity compromises cold chain integrity: managers reported that vaccines and temperature-sensitive medications require improved cold storage systems during extreme heat, with most facilities lacking backup power infrastructure that one facility (Bay Regional Hospital) maintained through solar systems. Transport delays prevent timely restocking: managers emphasized the need for reliable transport networks, particularly to remote areas, noting that supply chain management systems are insufficient to track stock levels during peak demand periods (Madina Referral Hospital, Kulmis HF). These infrastructure failures coincide with demand surges from heat-exacerbated symptoms, creating acute medication shortages when cardiovascular patients face highest risk.

Focus group discussions illustrated how this supply failure affects patients. A woman in Galkayo explained: *"My husband has high blood pressure and takes medicine every day. But during the very hot months, the clinic runs out of his medicine. Sometimes for two weeks, he has no medicine at all. He feels very weak and dizzy, and I am afraid his heart will fail."* Others described rationing pills, skipping doses or stopping treatment entirely during periods when cardiovascular strain is highest.

This pharmaceutical supply gap represents a critical system failure where the convergence of infrastructure constraints (unreliable power, inadequate storage), supply chain disruptions (transport delays during heat) and inadequate forecasting (failure to anticipate increased demand) leaves CVD patients without essential medications precisely when they need them most.

5.3.2 Staff Capacity and Training

Staff capacity to identify and treat heat-related illnesses was severely limited. While 29.4% (five of 17) of facilities had some staff members trained in heat-illness management, the majority of staff at most facilities had never received formal training. When asked about staff ability to identify heat illness, **64.7%** of facilities reported "some" staff could identify cases, while **5.9%** reported "none" could (**Table 5.13**).

Table 5.13: Staff Clinical Capacity

Clinical Capacity	All Staff	Some Staff	Few Staff	No Staff
Identify heat illness	5.9%	64.7%	23.5%	5.9%
Treat heat illness	17.6%	47.1%	29.4%	5.9%
Identify CVD emergencies	11.8%	35.3%	35.3%	17.6%
Manage CVD emergencies	0%	35.3%	29.4%	35.3%

Treatment capacity showed similar patterns: while 17.6% of facilities reported all staff members could treat heat illness, nearly a third (**35.3%**) reported only "few" or "none" could provide appropriate treatment. For CVD emergencies, the gaps were even larger: **35.3%** of facilities had no staff members capable of managing cardiovascular emergencies, while none had all staff trained.

Health facility supervisors during interviews acknowledged these training gaps. One explained: *"We recognize heat as a contributing factor to many conditions, but we lack specific protocols for heat-illness management. Most staff treat symptoms—prescribing analgesics for headaches, antibiotics for presumed infections—without addressing underlying heat exposure."*

5.3.3 Clinical Protocols and Treatment Capacity

The absence of standardized clinical protocols represents a fundamental weakness. Only 11.8% (two of 17) of facilities had SOPs for heat-illness management, and just **17.6% (three of 17)** had protocols for CVD emergencies. None had specific protocols for managing CVD during extreme heat events—a critical gap given the documented heat-CVD interactions in **Chapter 4**.

This absence of protocols manifests in inconsistent treatment approaches. Facility staff members reported relying on general emergency guidelines rather than heat-specific interventions. The limited availability of cooling interventions (reported by only 4.4% of patients in **Chapter 4**) reflects this systemic gap: facilities lack not only the equipment (cooling packs, refrigerated fluids) but also the clinical guidance on when and how to use active cooling strategies.

Facility managers emphasized that the absence of cooling interventions reflects both knowledge gaps and resource constraints. As facilities lack cooling equipment, refrigerated IV fluids and even reliable electricity for fans, staff cannot implement evidence-based heat-illness management, even when they recognize the condition.

5.3.4 Facility Infrastructure and Environmental Conditions

Infrastructure assessments revealed significant environmental vulnerabilities. Only 47.1% (8 of 17) of facilities had adequate shaded waiting areas for patients, while cooling system functionality averaged just 42.2% across facilities (**Table 5.14**).

Table 5.14: Facility infrastructure for heat resilience

Infrastructure Component	Adequacy
Shaded waiting areas: adequate	41.2% (7/17)
Shaded waiting areas: limited	47.1% (8/17)
Shaded waiting areas: none	11.8% (2/17)
Mean cooling system functionality	42.2%
Facilities with functional AC (central)	29.4% (5/17)
Facilities with functional AC (split/window)	76.5% (13/17)
Facilities with functional electric fans	82.4% (14/17)
Natural ventilation adequate	47.1% (8/17)

Power supply reliability posed additional challenges. While 76.5% (13 of 17) facilities had backup power systems (either generator or solar), only 70.6% (12 of 17) reported that cooling systems functioned during power outages. Facility managers stressed that frequent power outages leave wards suffocating during peak heat, undermining both patient and staff safety.

Vegetation and shading around facilities showed mixed results: 52.9% had moderate vegetation, while 17.6% had none. Heat-resilient design features were limited: only 29.4% (5 of 17) had cross-ventilation, and 23.5% (4 of 17) had overhanging roofs for additional shading.

5.3.5 Regional Discrepancies in Health System Capacity

Regional variations in facility preparedness were pronounced (**Table 5.15**). Middle Shabelle facilities demonstrated the strongest capacity, with a mean CVD readiness score of 3.0 (out of 5) and relatively better infrastructure. In contrast, Mudug facilities showed the lowest readiness across all indicators, with a mean CVD readiness score of just 0.33.

Table 5.15: Regional Health System Capacity Comparison

Region	CVD Readiness (0-5)	Cooling System Functionality	HMIS Quality (%)	Facilities with Heat Training
Banadir	1.56	24.6%	44.9%	2/8 (25.0%)
Bay	1.00	91.7%	91.7%	1/3 (33.3%)
Middle Shabelle	3.00	40.7%	97.3%	2/3 (66.7%)
Mudug	0.33	33.3%	94.7%	0/3 (0%)
Overall	1.29	40.8%	71.2%	5/17 (29.4%)

Bay facilities, despite serving areas with high CVD prevalence documented in **Chapter 4**, had no CVD screening capacity (none of three facilities) and minimal heat-illness preparedness. Mudug facilities had the lowest capacity across most indicators, with no staff

members trained in heat-illness management and minimal CVD services despite the region's high cardiovascular disease burden (31.9% of households).

Facility managers across all regions emphasized that extreme heat affects not only patient care but also staff performance. Several noted that healthcare workers themselves suffer from heat exhaustion during peak periods, compromising service quality and forcing temporary service reductions.

5.3.6 Health Information Systems and Surveillance

Data systems for monitoring heat-health patterns were extremely weak. While 70.6% (12 of 17) of facilities met WHO HMIS quality standards (≥70% recording rate) for general health data, only 41.2% (seven of 17) had adequate data quality for CVD seasonal analysis, with 64.5% of CVD consultation records missing even among these facilities. Furthermore, 88.2% (15 of 17) did not record heat illnesses separately in their health information systems. Without distinct coding for heat-related conditions, facilities cannot track trends, identify high-risk periods or plan resource allocation.

Similarly, only 11.8% (two of 17) of facilities maintained 24-month data on CVD admissions, and 23.5% (four of 17) tracked dehydration cases. This limited data availability prevents correlation analysis between temperature patterns and health outcomes—a critical gap for evidence-based heat-health planning.

Key informant interviews with federal Ministry of Health officials confirmed these data system weaknesses. One NCD policy advisor explained: *"There are no formal reporting mechanisms or standardized data-sharing protocols. Information is mostly communicated informally through phone calls, emails and occasional meetings. This weak system delays early warnings and limits the ability of local authorities and health facilities to respond effectively."*

5.3.7 System-Level Capacity Gaps and Priorities

The analysis reveals four interconnected system-level capacity gaps:

- **Protocol and guidance gaps:** The near-universal absence of heat-specific SOPs (88.2% of facilities) and CVD emergency protocols during heat (100% of facilities) leaves staff without standardized approaches to diagnosis and treatment. This gap translates directly into the inconsistent and often inadequate treatment patterns documented in **Chapter 4.**
- **Training and knowledge gaps:** With only 27.4% of facilities having any staff members trained in heat illness, and 23.5% trained in CVD management, the health workforce lacks the technical capacity to recognize and respond to heat-health emergencies. This training deficit compounds protocol gaps, leaving even motivated staff unable to provide evidence-based care.
- **Infrastructure and equipment gaps:** Limited cooling system functionality (40.8%), lack of adequate shaded areas (52.9%) and unreliable power supply create environmental conditions where facilities themselves become heat hazards. Combined with absent cooling equipment for patient treatment, these infrastructure deficits prevent implementation of heat-illness protocols even where knowledge exists.
- **Information system gaps:** The failure to record heat illnesses separately (88.2% of facilities) prevents the health system from learning, adapting and improving

responses. Without surveillance data, facilities cannot identify at-risk periods, allocate resources proactively or evaluate intervention effectiveness.

Health system strengthening must address all four gaps simultaneously. Priority interventions identified through facility assessments and key informant interviews include: (1) development and dissemination of context-specific heat illness and CVD treatment protocols; (2) comprehensive pre-service and in-service training for health workers on heat-health management; (3) integration of heat warnings with health facility operations and resource planning; (4) infrastructure improvements including reliable power, cooling systems and shaded patient areas; and (5) establishment of heat-illness coding in HMIS to enable surveillance and data-driven planning.

5.3.8 Community Validation of System Preparedness

Community assessments of health-system preparedness validated the facility-level gaps documented in preceding sections. When asked to rate health services' preparedness for heat-related illness, only 7.0% of respondents rated services as "very prepared" or "prepared," while 60.1% rated them as "not prepared" and an additional 32.9% rated them as "poorly prepared." This represents near-universal community recognition that the formal health system lacks the capacity to respond effectively to heat-health emergencies.

These perceptions reflect direct experience rather than abstract assessment. Focus groups confirmed these ratings through concrete examples. Participants described arriving at facilities during heat emergencies to find them hot, overcrowded and lacking basic supplies. One man in Mudug explained: *"The clinic itself was so hot that patients were sitting outside under trees. The nurses were sweating and tired. There was no cold water, no ice, nothing to cool people down. They can give medicines, but they cannot make it cool."*

A woman in Baidoa added: *"When I took my mother to the health center during a very hot day, we waited three hours. The waiting area had no shade, no fan. Inside was even hotter. My mother became worse while waiting. The nurse tried to help, but she said they have no equipment for heat problems, only normal medicines."*

These community assessments triangulate and validate the facility assessment findings: limited infrastructure (42.2% cooling functionality), minimal training (27.8% with heat-illness training), absent protocols (11.1% with heat SOPs) and inadequate equipment. The alignment between objective facility assessments and subjective community perceptions confirms that health-system unpreparedness is both measurable and experienced, leaving populations without effective institutional protection during extreme heat events.

5.4 Institutional and Policy Capacity

Institutions and policies form the enabling environment for effective heat-health response. While communities manage immediate exposure and health facilities provide frontline care, national and regional institutions establish the frameworks, allocate resources and coordinate multi-sectoral action needed for systematic preparedness. This section examines policy frameworks, early warning systems at the institutional level, service delivery capacities, resource mobilization and implementation gaps, drawing primarily on key informant interviews with federal Ministry of Environment officials and the NCD policy advisor at the federal Ministry of Health.

5.4.1 Policy Frameworks and Institutional Coordination

Somalia's major policy frameworks acknowledge heat-health linkages but consistently fail to treat heat as a distinct hazard requiring specific interventions. The draft National Adaptation Plan (2020/22) identifies health as environmentally sensitive yet subsume heat under the broad label of "extreme weather events" without dedicated guidance or resource allocation.

A federal Ministry of Environment official explained: *"Somalia has weak policies on heat-related health impacts…None provide clear guidance on managing extreme heat or protecting vulnerable groups."* The NCD policy advisor at the federal Ministry of Health confirmed this gap: *"Somalia has no standalone heat-health policy. Issues are partly covered under … disaster-risk management and public health preparedness plans, but they lack specific heat-health measures."*

The Health Sector Strategic Plan (HSSP III, 2022–2026) emphasizes preparedness and health security but remains generic in practice. As one MoH Galmudug State official explained: *"There are no specific national or regional policies or guidelines in Somalia—or in Galkayo—that focus only on heat and health. While some general emergency guidelines exist, they do not clearly talk about extreme heat or how to manage heat-related health risks."*

This policy vacuum leaves facilities without guidance on clinical management, staff preparedness or systematic recording of heat illness in HMIS systems, directly contributing to the facility-level gaps documented in **Section 5.3**.

Emergency Preparedness Plans

Somalia has no dedicated emergency preparedness plans for extreme heat or heatwaves. National and regional frameworks cover weather shocks in general without heat-specific measures. Local authorities lack structured plans and depend on ad hoc responses. Officials confirmed: *"There are no clear temperature triggers to activate actions. When heat impacts occur, interventions like water trucking or health awareness are usually reactive."*

Institutional Coordination

Coordination between health, environment, and disaster management sectors in Somalia is weak and largely fragmented. While inter-ministerial committees and ad hoc working groups exist, mainly led by SoDMA and the Ministry of Environment, they rarely focus on heat-related health impacts. Federal officials noted: *"Joint planning processes with the Ministry of Health are limited and mostly occur during emergencies. Information sharing and early warning integration are still poor, which makes coordinated response slow."*

At regional and local levels, policy implementation on heat and health is very limited. There are no clear guidelines or frameworks to translate national policies into local action. Resource allocation is weak, with little funding or technical capacity at district level to address heat-related risks. The main challenges include lack of financial resources, weak institutional capacity and poor coordination between local authorities and national ministries.

5.4.2 Early Warning Systems and Information Management at Policy Level

While **Section 5.2** documented household and community access to heat warnings, institutional capacity to generate, coordinate and disseminate those warnings is equally weak. Federal officials confirmed that *"Somalia currently has very limited early warning*

systems for extreme heat. Meteorological services monitor temperature trends, but there are no formal heat-alert protocols."

An MoH Southwest State official stated: *"There are no early warning systems or technology-based alerts for extreme heat."* MoH Galmudug officials reported that *"early warning systems for heat events are not in use"* and that *"there are no SMS alerts or mobile applications to inform the public."*

Information Sharing and Data Integration

Heat and health information in Somalia is shared poorly between national, regional and local levels. There are no formal reporting mechanisms or standardized data-sharing protocols. A federal official emphasized: *"Partnerships with meteorological services for heat-health early warning are minimal, and there are no structured data-sharing protocols."* Information is mostly communicated informally through phone calls, emails and occasional meetings, delaying early warnings and limiting response capacity.

Meteorological data includes temperature and rainfall from a limited number of stations, while health data mainly comes from EWARN reporting. Data quality and coverage are poor, with gaps in rural and IDP areas. Frequency of reporting is irregular, and analytical capacity to link weather and health trends is limited. As a result, data use for heat-health planning is minimal.

Message Development and Targeting

Early warning messages for heat in Somalia are very limited and rarely tailored. When issued, they are mostly general alerts broadcast via radio, social media or SMS. There is little adaptation for specific audiences: health workers receive minimal technical guidance, and messages for vulnerable groups like IDPs, the elderly or children are often not culturally or linguistically adapted.

Officials confirmed that *"partnerships with meteorological services for heat-health early warning in Somalia are minimal with no formal agreements or structured data-sharing protocols between health and meteorological sectors."*

5.4.3 Service Delivery Capacities and Resource Mobilization

Health-system capacities to address heat-related risks remain extremely limited, reflecting both institutional blind spots and chronic resource scarcity. While the HSSP III emphasizes preparedness and surveillance, it contains no heat-specific standards. Facility supervisors confirmed that staff members *"use general health guidance when treating heat-related cases."*

Capacity Constraints

Federal and state officials identified multiple capacity constraints:

- **Human resources:** Staff shortages limit even basic service delivery, making preparation for heat events nearly impossible. Training in heat-related illness is rare; cardiovascular disease management in the context of heat is *"almost non-existent."*
- **Infrastructure:** Many facilities lack shaded waiting areas, reliable power, or access to water. Officials noted that *"resource constraints, such as limited medicines, water and fans, reduce the effectiveness of care."*

- **Financing:** The most systematic bottleneck. A federal official explained: *“Resource allocation is still limited due to competing health priorities. However, we dedicate a small budget for awareness campaigns, train staff in early detection of heat-related illnesses and work with partners to secure equipment such as water tanks and mobile clinics in high-risk areas.”*

Funding is largely emergency-oriented, leaving prevention and preparedness neglected. Facilities rely on reallocation of general or outbreak funds, while donor support remains ad hoc and short-term. One official admitted that resource allocation is *"mostly ad hoc, responding to crises rather than risk or vulnerability assessments."* Most resources go toward response (emergency water trucking, medical treatment), while prevention and preparedness receive less funding.

Resource Prioritization

The federal ministry has no formal system to prioritize resources for heat-health interventions. One official noted: *“We prioritize based on vulnerability assessments that identify hotspots such as IDP camps and drought-affected regions. Areas with higher exposure and limited coping capacity receive more attention, guided by both data analysis and partner consultations.”* However, this remains informal rather than systematically integrated into national planning and budgeting cycles.

5.4.4 Community Engagement and Capacity Building

Community engagement in heat preparedness in Somalia is very limited. There are few consultation mechanisms or participatory planning processes at national or regional levels. Feedback from communities is rarely collected or integrated into planning. Most awareness and response efforts rely on general radio messages or social media, with minimal involvement of local leaders or vulnerable groups in decision-making.

Officials acknowledged: *“There are no formal channels for community representatives or civil society to contribute to planning. Traditional authorities are occasionally consulted, but their input is limited and not systematically included in policy development. As a result, community voices are rarely reflected in heat preparedness or response strategies.”*

The ministry’s engagement with local governments and community structures on heat-health issues is minimal, limited to *“ad hoc technical advice and occasional awareness messages.”* Support includes promoting awareness campaigns through radio, social media, schools, mosques and IDP camps, focusing on safe hydration, early recognition of heat stress and preventive measures. Community health workers also conduct outreach sessions and encourage small adaptation measures such as tree planting and improving ventilation in shelters.

Vulnerable Population Targeting

Vulnerable populations—children, the elderly, pregnant women, people with chronic diseases and IDPs—are rarely specifically included in heat preparedness and response planning. Awareness messages and interventions are mostly general, with no tailored programs or resources to address their specific needs during extreme heat events. One official noted: *“We prioritize these groups by tailoring health messages, ensuring access to shaded water points and working with NGOs to distribute hygiene kits and cooling supplies.”* However, implementation remains limited and depends heavily on external partner support.

Traditional leaders and elders are described as *"central in mobilizing communities. They help spread accurate information, encourage participation in awareness campaigns and ensure that vulnerable families are identified and supported."* However, their involvement is not systematically institutionalized in planning processes.

Capacity-Building Programs

Capacity-building programs for government staff on heat-health issues are very limited. There are few formal training programs or technical assistance initiatives. Most learning occurs informally during emergencies, leaving staff with limited skills to plan, prepare or respond effectively to extreme heat events.

Current training is *"provided mainly through workshops with partner organizations like WHO and NGOs. These focus on early detection of heat-related illness [and] community education."* A cascade model is used where central-level staff are trained first, then mentor regional and district officers, with resource manuals and guidelines shared to ensure standard messaging.

For communities and local organizations, capacity building is similarly limited. Officials noted: *"We train community health promoters, women's groups and local NGOs on recognizing heat symptoms, safe water use and protective practices. Local organizations are also supported with materials to run awareness campaigns and to respond during peak heat seasons."*

However, these efforts remain sporadic and dependent on external funding, lacking the systematization needed for sustained impact.

5.4.5 Implementation Gaps and Future Capacity Needs

A sharp disconnect persists between policy aspirations and implementation realities. Federal officials acknowledged barriers including limited funding, weak technical capacity, poor coordination and insecurity that diverts resources and restricts access to vulnerable communities.

Key Barriers to Implementation

Officials identified several interconnected barriers:

- **Financial constraints:** *"The main barriers are inadequate funding, shortage of skilled staff and limited inter-ministerial coordination."*
- **Institutional challenges:** *"Institutional challenges include overlapping mandates between ministries, weak coordination frameworks, and limited accountability. Roles are not always clear, which slows decision-making and reduces effectiveness in addressing heat impacts."*
- **Technical gaps:** *"Technical challenges include lack of reliable weather-health data, insufficient expertise in… modeling and poor infrastructure such as cooling centers or water supply systems."*
- **Conflict and insecurity:** *"Conflict and insecurity make it difficult to deliver services in certain areas, as health staff cannot access communities safely. Resources are often diverted to emergency care instead of preventive programs, and local institutions are disrupted, weakening coordination."*

- **Social and cultural factors:** *"Some cultural practices, like heavy clothing or reluctance to change work schedules, increase vulnerability to heat. Mistrust of government initiatives also affects uptake. Addressing these requires culturally sensitive communication and involvement of local leaders."*

Future Capacity Requirements

Looking ahead, federal officials warned that *"future heat extremes will increase the demand on our ministry to provide timely early warnings, coordinate with health and local authorities, and support vulnerable communities,"* stretching already thin capacities. One official emphasized: *"Future heat extremes will expand our mandate…. Policies will need to prioritize preparedness, early warning systems and stronger integration of environmental health."*

Priority capacity needs identified by officials include:

1. establishing clear policies and dedicated funding streams for heat health;
2. strengthening early warning and surveillance systems with formal meteorological-health partnerships;
3. building health worker and local authority capacity through structured training programs;
4. developing culturally adapted awareness campaigns for communities;
5. clarifying mandates and coordination mechanisms across ministries;
6. investing in infrastructure (cooling centers, water systems) and technology for early warnings; and
7. strengthening health information systems for better decision-making.

Strategic Priorities

Officials emphasized that *"a national strategy should include risk assessments, early-warning systems, capacity building, public awareness, resource allocation and strong coordination across government, NGOs and communities."* Policy changes should include *"dedicated heat-health strategies, clear roles and responsibilities across sectors, and allocated funding for preparedness and response."*

Necessary strategic investments include expanding meteorological and health-monitoring infrastructure, improving early warning technologies, strengthening data systems, training health workers and establishing community-based programs. Innovations such as *"mobile apps for heat alerts, solar-powered cooling systems and community-based water harvesting"* were identified as potentially transformative, along with digital reporting tools for health workers.

Officials acknowledged familiarity with WHO guidance, noting: *"Yes, we are familiar with WHO's guidance, which provides useful frameworks for preparedness, awareness and response. We often use these materials in training and planning."* However, they emphasized that *"international guidance is helpful, but it requires adaptation to Somalia's local realities, including pastoralist lifestyles, IDP settings and cultural factors. Simpler, low-cost approaches are often more suitable."*

The systematic absence of heat-specific policies, weak coordination, limited resources and fragmented implementation leave Somalia's institutional framework unable to support effective heat-health response. Without comprehensive, multi-level investments in policies, financing, human resources, infrastructure and coordination platforms, the health system will remain reactive and ill-equipped to protect populations from intensifying heat risks.

📌 **Key Messages: Capacity of Health and Health-Relevant Systems**

- **Thin household capacity:** Most families rely on simple, low-cost behaviors like drinking more water or seeking shade; those with the highest exposure (IDPs, high-HESI shelters) report the fewest coping options.
- **Warnings sparse and uneven:** Only one in eight households receive regular heat alerts, while over half receive none. Coverage is lowest in Banadir and Mudug, with IDPs slightly less reached.
- **Trusted but underused channels:** Radio dominates, but the most trusted messengers are health workers, community leaders and religious leaders—yet they are rarely engaged in systematic heat communication.
- **Facilities unprepared for surges:** Fewer than one in 10 facilities have heat protocols. Only a quarter of staff members are trained in heat or CVD care. Cooling equipment and shaded waiting areas function in less than half of facilities.
- **Medicines unreliable in heat:** Nearly three-quarters of CVD/diabetes households report treatment interruptions during hot periods due to supply chain disruptions, cold chain failures and demand spikes.
- **Policy and coordination gaps:** No national heat-health policy and no formal meteorology–health linkage; financing remains reactive rather than preventive.
- **Community priorities clear:** Households emphasize infrastructure—better housing, water storage and reliable electricity—over education or insurance, pointing to structural barriers beyond individual behavior.

Overall interpretation: Capacity gaps exist at every level—households, facilities and institutions—and these gaps map directly onto vulnerability. Without heat-specific policy, protocols, infrastructure and early-warning delivery that reach everyone, the system will remain reactive despite predictable seasonal risks.

Chapter 6: Future Heat-Health Risks and the Imperative for Action

Risk is not static—it evolves as long-term weather patterns shift, populations grow and social systems adapt or fail to do so. This chapter examines future heat-health trajectories in Somalia by integrating heat projections (**Chapter 2**), household perceptions of heat, community expectations of future coping capacity, institutional assessments of emerging challenges and current vulnerabilities that will intensify without intervention. The evidence points to a critical conclusion: current adaptation strategies are already insufficient, and without systematic investment in preparedness, vulnerability will deepen as temperatures continue to rise.

6.1 Projected Temperature Increases and Health Implications

6.1.1 Methodological Note on Future Projections

This chapter projects future heat-health risks using expert judgment and evidence-based extrapolation. As detailed in **Section 2.1**, systematic barriers in Somalia's information infrastructure prevented the quantitative heat-health correlation analysis outlined in the project inception report. The inception report's phased methodological design anticipated this scenario, specifying that where minimum data quality criteria were not met (24-month overlapping datasets, ≥70% health data completeness, <50km facility-weather station distance), the assessment would proceed with Phase 3 qualitative methodology. This approach follows WHO guidance (**TOR Section IV, Footnote 2**) recognizing expert judgment as a valid alternative where modeling is not feasible.

Future risk projections therefore integrate: (1) established heat projections from authoritative sources (**Chapter 2**), (2) federal ministry officials' assessments, (3) community heat perceptions (75.1% recognize temperature increases), (4) documented heat-health relationships from current data and (5) evidence-based extrapolation of vulnerabilities. While Somalia-specific heat-health models remain unavailable, this triangulated approach provides robust projections grounded in lived experience, institutional expertise and global environmental science.

6.1.2 Heat Projections and Direct Health Consequences

Somalia's heat trajectory, detailed in **Chapter 2**, projects substantial intensification of heat risks over the next three decades. Under moderate-emission pathways (SSP2-4.5), national temperatures are expected to rise by 1.5 to 2.0°C by the 2040s, translating to 20–90 additional very hot days (≥35°C) annually across study districts (IPCC, 2023; Weathering Risk/PIK, 2022). Under high-emission scenarios (SSP5-8.5), increases of 2.5 to 3.5°C could create year-round extreme heat conditions in interior regions, with wet-bulb temperatures in coastal areas approaching physiological survival thresholds.

These heat projections translate directly into increased health burden. The convergence of projected temperature increases with current health vulnerabilities creates predictable crisis trajectories:

Cardiovascular disease burden: With 20% of households already affected by CVD (**Chapter 3**), and 41.3% of CVD patients reporting symptoms worsening during heat

(**Chapter 4**), each additional degree of temperature increase will drive more acute cardiovascular events. The projected 20–90 additional very hot days annually means more frequent and prolonged periods when CVD patients experience chest pain, breathing difficulties and cardiovascular strain—precisely the conditions that precipitate strokes, heart attacks and acute heart failure.

Health system overwhelm: Current facility capacity—with only 22.2% having CVD emergency protocols, 27.8% with heat-illness training, and 11.1% with heat-specific SOPs (**Chapter 5**)—is wholly inadequate for current demand. Projected temperature increases will surge patient loads beyond breaking points. Facilities already report being overwhelmed during heat events; sustained year-round extreme heat will eliminate recovery periods, forcing health systems into permanent crisis mode.

Medication supply collapse: The 72.7% of CVD households already experiencing medication unavailability during heat will face more frequent and prolonged stockouts as heat events intensify. Supply chain disruptions (transport delays, cold storage failures) that currently occur episodically will become chronic, leaving patients without life-sustaining medications during precisely the periods when cardiovascular strain is highest.

Compounding environmental stress-health interactions: Heat will not act alone. As temperatures rise, agricultural productivity declines, worsening malnutrition and weakening immune systems. Water scarcity intensifies, forcing reliance on unsafe sources and elevating diarrheal disease risk. These feedback loops create cascading failures where each weather hazard and environmental stress impact amplifies others, overwhelming household and institutional coping mechanisms.

6.2 Community Perceptions of Heat and Future Expectations

6.2.1 Recognition of Temperature Increases

Community perceptions validate scientific projections. Three-quarters of respondents (75.1%) recognized that local temperatures have become hotter over the past five to 10 years, with 33.9% reporting conditions as “much hotter now” and 41.3% as “somewhat hotter now” (**Figure 6.1**). Only 13.0% perceived no change, while 11.9% believed conditions had cooled.

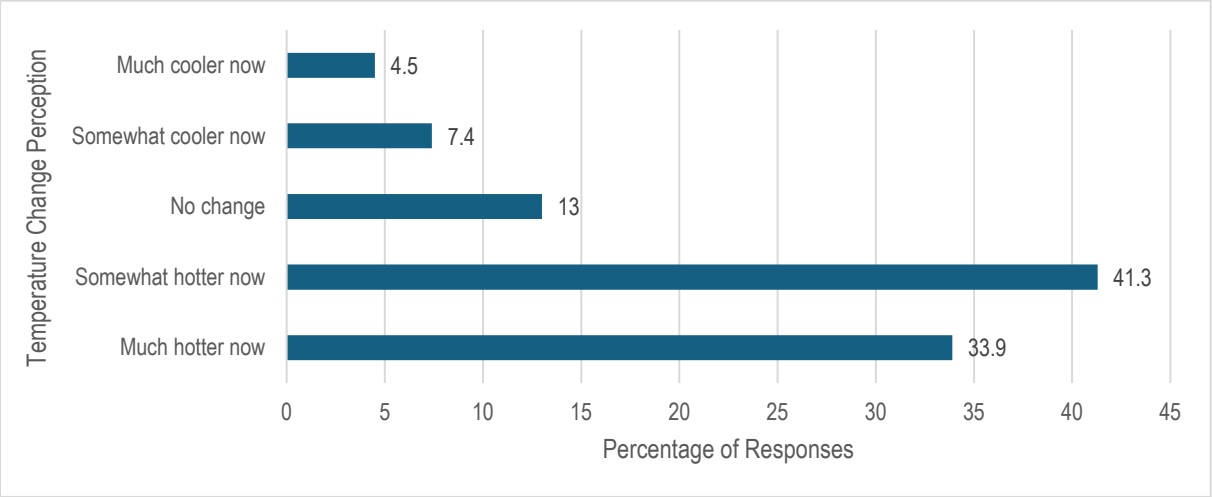

Figure 6.1: Temperature change perceptions (Past 5–10 Years)

Community discussions revealed understanding not just of increased intensity but of changing heat patterns. Participants in Bay region noted that temperatures now reach levels previously unknown in their lifetimes. Participants in Middle Shabelle observed that traditional cooling periods between seasons have shortened or disappeared entirely. Several focus groups independently mentioned that nighttime temperatures no longer provide the relief they once did, making recovery from daytime heat exposure increasingly difficult.

6.2.2 Temporal and Seasonal Shifts

Beyond intensity, households reported strong recognition of temporal changes. More than half (57.2%) said hot periods now last longer, 57.3% observed that the hot season begins earlier, and 18.1% indicated that it ends later (**Figure 6.2**). In total, 91.6% of households identified at least one form of seasonal shift, demonstrating broad recognition of altered heat rhythms.

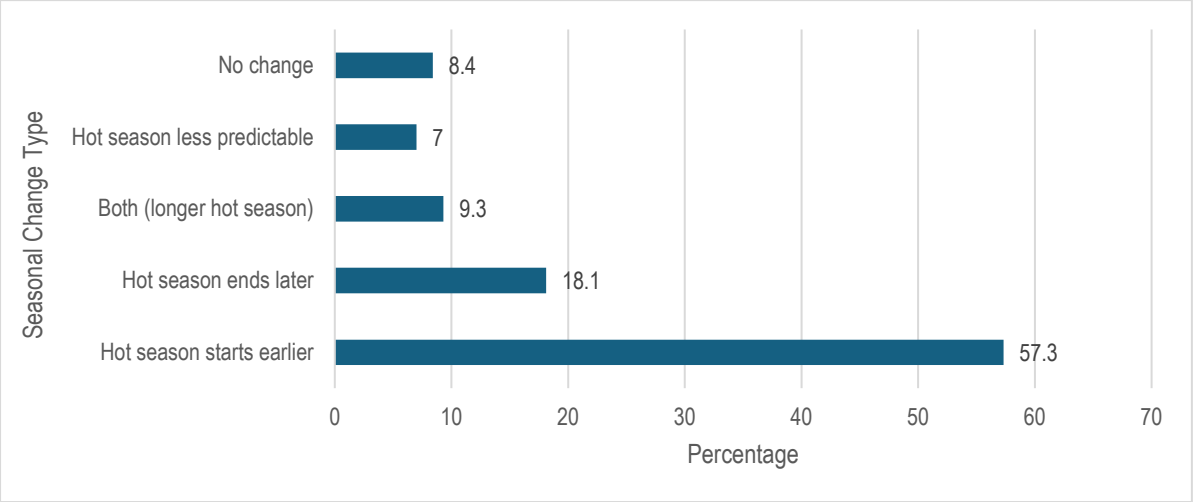

Figure 6.2: Seasonal change perceptions

6.2.3 Extreme Heat Event Frequency

Nearly all respondents (98.6%) experienced at least one extreme heat event in the past year, with 53.9% facing three or more (**Figure 6.3**). For many, events were recent and persistent: 79.2% had experienced extreme heat within the past three months, and 69.5% reported their most recent event lasted more than a week, including 44.3% who endured episodes exceeding two weeks.

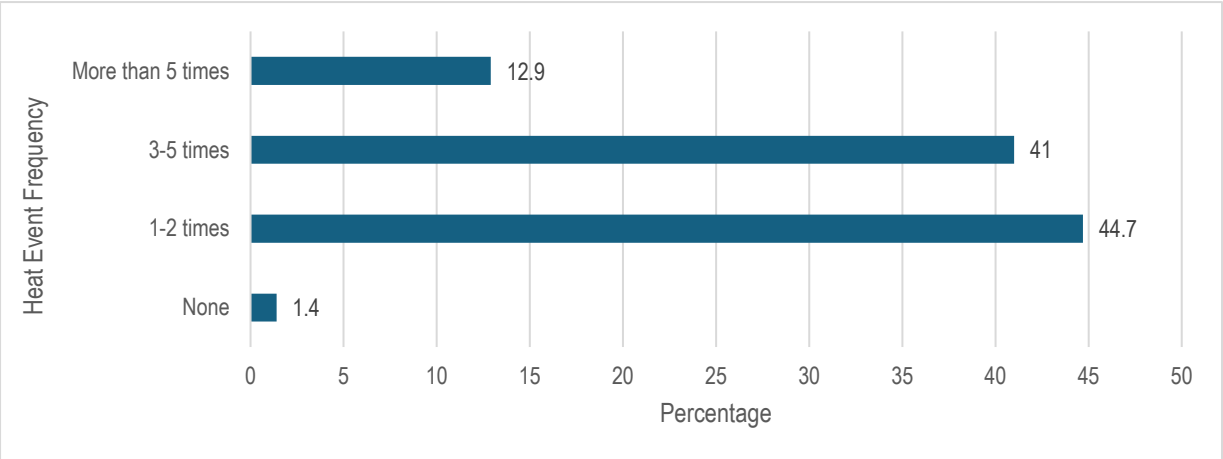

Figure 6.3: Extreme heat event frequency (past year)

Threshold awareness was relatively strong. A majority (58.1%) identified 35–40°C as the danger range for health impacts, while 23.9% placed the threshold at 40–45°C. Only 6.1% recognized risks below 35°C, suggesting underestimation of moderate heat vulnerability. Still, 92.2% could specify a threshold, showing strong quantitative awareness of the heat–health link.

6.2.4 Regional Variation in Heat Perception

Regional differences in perception were striking (**Table 6.1**). Middle Shabelle had the highest recognition of temperature increase (96.6%), followed by Mudug (85.2%). In contrast, Bay (58%) and Banadir (59.3%) showed lower recognition ($\chi^2 = 151.1$, $p < 0.001$).

Table 6.1: Heat perception index by region

Region	Mean Index Score	Standard Deviation	n	Heat Awareness Ranking
Middle Shabelle	2.59	0.75	120	Highest awareness
Mudug	2.19	0.92	116	High awareness
Bay	1.65	1.00	119	Moderate awareness
Banadir	1.55	1.18	119	Lower awareness
Overall	1.99	1.06	474	Good overall awareness

These differences reflect livelihood systems and environmental connections. Middle Shabelle's farmers and Mudug's pastoralists closely monitor environmental conditions for agricultural and livestock management decisions. Urban Banadir shows greater disconnection from natural cues, while Bay's mixed perceptions likely reflect both localized variability and disruption of traditional knowledge systems due to displacement.

6.2.5 Existing Knowledge and Eroding Predictive Capacity

Communities rely on existing knowledge systems that once guided adaptation. Focus groups described using wind direction and intensity, livestock and bird behaviors, and seasonal plant cycles to anticipate hot periods. However, across all regions, participants expressed concern that such cues are increasingly unreliable, creating anxiety and uncertainty.

> *"We know it will be too hot when the animals refuse to leave the shade and the wind changes direction. These signs helped us before, but now they do not always come at the right time." — Participant, Mudug*

> *"In the past, we could tell from the trees when to prepare for the hot days. Now the plants flower at strange times, and we are no longer sure." — Participant Middle Shabelle*

This erosion of predictive capacity illustrates how heat undermines not only physical health resilience but also cultural knowledge systems that have sustained communities for generations.

Communities clearly recognize rising temperatures and changing seasonal patterns through lived experience. Near-universal exposure to extreme heat events (98.6%) and strong awareness of temporal shifts (91.6%) demonstrate that heat is not an abstract future threat

but a present reality. However, the erosion of existing predictive systems leaves communities increasingly uncertain about when heat will strike and how severe it will be, undermining preparation.

6.3 The Awareness-Concern Gap: Why Recognition Doesn't Translate to Preparedness

6.3.1 Fragmented Future Concern

Looking forward, perceptions revealed divided concern. Among those able to assess future risks (n=436), only 42.4% expressed high concern about rising temperatures over the next decade. More troubling, 27.3% reported no concern at all (**Figure 6.5**).

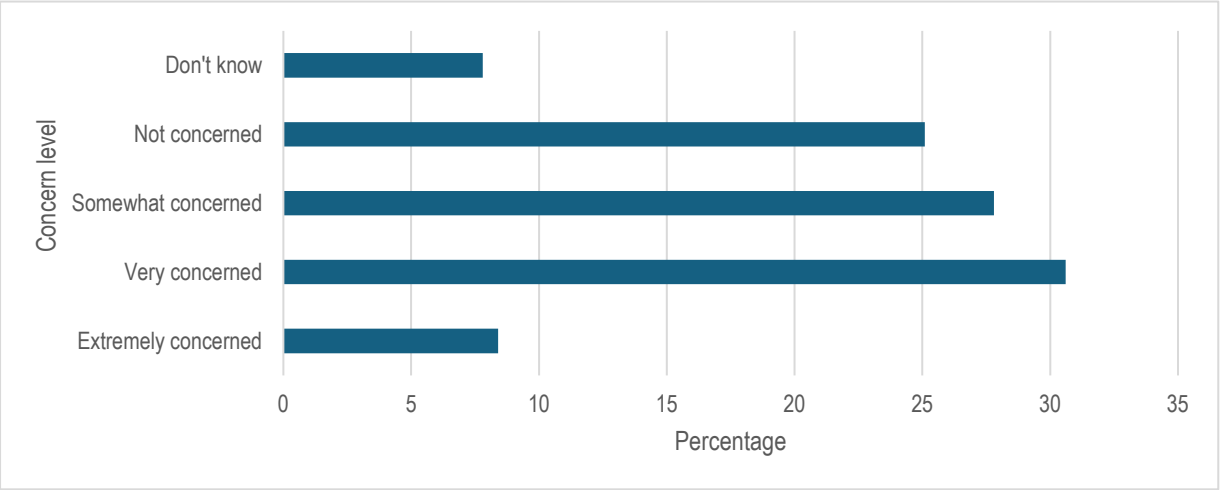

Figure 6.4: Community concerns about temperature increases over the next 10 years

This indifference was most common among highly vulnerable households—those with multiple risk factors, limited adaptive capacity, and greatest exposure. Facility staff confirmed that unless concern translates into preparedness actions, both households and clinics remain reactive, responding only once patients begin arriving with heat-related illness.

6.3.2 Forward-Looking Coping Expectations

Chapter 5 documented that when asked about household ability to cope with heat in the next 5–10 years, nearly two in five respondents (37.4%) anticipated being worse off. Only 41.6% believed they would cope better, while 20.9% expected no change. This prevailing pessimism suggests communities recognize that heat risks are accelerating more quickly than their resilience strategies.

Yet despite these expectations, forward planning remained rare. Only 2.3% of households had detailed adaptation plans, while 18.0% had basic plans. The majority were either still "thinking about it" (28.8%) or had made no plans at all (51.0%). This critical awareness–action gap demonstrates that recognition of future risks—even pessimistic expectations—does not automatically translate into preparedness behavior.

6.3.3 Why the Gap Exists

Focus group discussions revealed why households recognize future risks but fail to prepare.

- **Resource constraints:** Participants frequently noted they think about coping strategies but lack resources for concrete investments. One woman explained: *"We*

know the heat will be worse, but we cannot afford better housing or electricity. We just think about it and worry, but we cannot change anything."

- **Competing priorities:** Households facing immediate livelihood pressures prioritize survival over preparation. A man in Mudug noted: *"Yes, heat is getting worse, but we must focus on finding work today. We cannot plan for next year when we don't know if we will eat this week."*
- **Lack of institutional support:** Communities see no evidence that systems are preparing to help them. *"Why should we make plans when the government has no plans? When heat comes, we are alone."*
- **Fatalism and normalization:** Some households have normalized heat as inevitable hardship. *"Heat has always been part of life here. It is worse now, but what can we do? We endure it like we endured it before."*

The awareness-concern gap represents one of the most critical vulnerabilities for future heat-health risk. Communities know conditions are worsening and expect to cope less effectively, yet this knowledge does not mobilize preparation. This disconnect is most pronounced among the most vulnerable—precisely those who need to prepare most urgently. Without addressing structural barriers (resource constraints, competing priorities, lack of institutional support) that prevent awareness from translating into action, heat vulnerability will continue to deepen regardless of how well communities understand the problem.

6.4 Institutional Perspectives on Future Heat-Health Challenges

6.4.1 Anticipated Health System Pressures

Key informant interviews with federal Ministry of Environment officials and the Ministry of Health's NCD policy advisor revealed deep concern about the health system's capacity to manage future heat impacts. Officials warned that *"future heat extremes will increase the demand on our ministry to provide timely early warnings, coordinate with health and local authorities, and support vulnerable communities,"* stretching already thin capacities.

Ministry officials projected specific health system impacts:

> *"We expect more frequent heatwaves, increased dehydration and more cases of heatstroke. Malnutrition could worsen as heat stresses agriculture, and infectious diseases may spread due to weakened immune systems and water scarcity." — NCD Policy Advisor, Federal Ministry of Health*

> *"Heatstroke, dehydration and kidney-related conditions are expected to rise. Respiratory illnesses and malnutrition may also worsen, while heat could exacerbate chronic diseases like hypertension and diabetes." — Federal Ministry of Environment*

6.4.2 Most Affected Populations and Regions

Officials identified populations and regions likely to face the greatest future impacts:

Vulnerable Populations:

- Children, the elderly and pregnant women remain at highest risk.
- People with chronic illnesses (CVD, diabetes) face compounding physiological stress.

- IDPs in poorly sheltered camps with limited water access
- Outdoor workers with no option to modify work schedules

Geographic hotspots: Officials consistently identified central and southern regions, particularly IDP settlements in Mudug, Hiraan and Bay, as areas expected to suffer most due to high temperatures, limited water supply and poor infrastructure. These assessments align with current vulnerability patterns documented in **Chapters 3** and **4,** suggesting that existing discrepancies will intensify rather than equalize over time.

6.4.3 Health System Capacity Deficits

When asked about the health system's capacity to handle increased heat-related demand, officials acknowledged severe limitations:

> *"Extreme heat will strain health services through increased patient load, higher costs for cooling and water, and workforce fatigue. Infrastructure like clinics may also deteriorate faster under high temperatures." — Ministry Official*

Facility assessments (**Chapter 5**) confirmed these concerns: with only 27.8% of facilities having staff members trained in heat illness, 5.6% with heat action plans and 42.2% with cooling system functionality, the health system lacks the infrastructure, protocols and human resources to manage current heat impacts—let alone increased future demand.

6.4.4 Compound Environment-Health Interactions

Officials emphasized that heat will not act in isolation but will interact with other stressors:

> *"Heat worsens malnutrition by reducing food production, and it increases the risk of infectious diseases due to poor water quality. Conflict compounds these challenges by limiting access to healthcare and resources." — Federal Ministry of Health*

These compound interactions create feedback loops where heat stress reduces agricultural productivity, worsening malnutrition and weakening immune systems, which in turn increases susceptibility to both heat illness and infectious disease. Simultaneously, reduced water availability due to heat and drought increases reliance on unsafe water sources, elevating diarrheal disease risk precisely when heat stress is highest.

6.4.5 Policy and Capacity Implications

Officials stressed that future heat extremes will expand institutional mandates beyond current capacity:

> *"Policies will need to prioritize preparedness, early warning systems and stronger integration of environmental health." — NCD Policy Advisor*

However, they acknowledged that current institutional capacity is wholly inadequate for this expanded role. Key gaps include:

- no dedicated heat-health policies or funding streams;
- minimal coordination between meteorological and health services;
- inadequate technical capacity for heat-health modeling;
- limited human resources for expanded surveillance and response; and
- infrastructure deficits (cooling centers, water systems) in high-risk areas.

Institutional perspectives validate household concerns: the health system recognizes that future heat risks are intensifying but lacks the capacity, resources and coordination mechanisms to respond effectively. Without urgent investment in policies, infrastructure, human resources and inter-sectoral coordination, the gap between heat risk and institutional response will continue to widen.

6.5 Future Risk Stratification: Where Vulnerability Will Intensify

6.5.1 Geographic Risk Concentration

Combining current vulnerability patterns (**Chapters 3-4**), capacity assessments (**Chapter 5**) and forward-looking projections reveals clear geographic hotspots where heat-health risks will intensify most rapidly.

Highest Future Risk: Mudug Region

- Current CVD burden: 31.9% (highest)
- Health system capacity: Lowest across all indicators (mean CVD readiness 0.33/5)
- Heat-illness training: 0% of facilities
- Warning access: 60.4% never receive warnings
- Heat perception: High (2.19/3)
- **Projection:** Without intervention, Mudug faces a catastrophic convergence of rising heat, highest disease burden and weakest health system response. CVD patients will face increasing heat stress with no facility capacity to manage complications.

High Future Risk: Bay Region

- Current CVD burden: 25.2% (second highest)
- Health system capacity: No CVD screening despite high burden
- Heat perception: Moderate but mixed (1.65/3)
- Cooling functionality: Highest (91.7%) but undermined by absent protocols
- **Projection:** Infrastructure without protocols or training creates false security. Rising heat will overwhelm facilities unable to translate cooling capacity into effective care.

Moderate But Increasing Risk: Banadir

- Current CVD burden: Moderate (12.6%)
- Urban heat island effects likely to intensify
- Lowest heat perception (1.55/3) despite exposure
- Modest facility capacity (2/8 with screening)
- **Projection:** Urban disconnection from heat awareness, combined with heat island effects and moderate health system capacity, creates vulnerability that communities don't recognize and institutions can't address.

Lower Current Risk But Vulnerable Infrastructure: Middle Shabelle

- Lowest reported CVD burden (10.8%) but likely under-diagnosed
- Highest heat perception (2.59/3) and warning access (80%)

- Best facility preparedness (CVD readiness 3.0/5)
- **Projection:** Strong awareness and relatively better systems provide some resilience, but absolute capacity remains low and will be strained as heat intensifies.

Table 6.2: Regional future heat-health risk assessment

Risk Domain	Mudug	Bay	Middle Shabelle	Banadir
HEALTH VULNERABILITY				
CVD/diabetes burden	31.9%	25.2%	10.8%	12.6%
HEALTH SYSTEM CAPACITY				
CVD service readiness (0-5)	0.33	1.00	3.00	1.56
Heat-illness training	0%	33.3%	66.7%	22.2%
Heat-action plans	0/3	0/3	1/3	0/8
EARLY WARNING				
Never receive warnings	60.4%	45.4%	20.0%	82.1%
Heat perception (0-3)	2.19	1.65	2.59	1.55
COMPOSITE RISK	**CRITICAL**	**HIGH**	**MODERATE**	**HIGH**

Legend: Critical/Severe Risk | High Risk | Moderate Risk | Lower Risk (relative)

6.5.2 Population-Level Risk Amplification

IDPs: Compounding Vulnerability

IDP populations face triple vulnerability that will intensify with future heat:

1. **Physical exposure:** Poor shelter (73.8% in inadequate structures), limited vegetation (80.1% minimal/none), high settlement density
2. **Health vulnerability:** Similar CVD burden to hosts but worse access to care (mean adaptive capacity 2.42 vs. 3.50 for hosts)
3. **Ingrained exclusion:** Lower warning access (43.4% vs. 52.5% for hosts), minimal community support (22.8% access)

As temperatures rise, IDPs will face the most severe heat exposure with the least capacity to adapt, creating humanitarian emergencies within already fragile displacement settings.

CVD Patients: Silent Crisis

The convergence of rising heat and high CVD burden (20% of households) with minimal health system capacity creates a silent future crisis:

- 72.7% already experience medication unavailability during heat.
- Only 17.6% of facilities have CVD emergency protocols.

- Heat-CVD interaction is well-documented (41.3% symptom worsening) but unaddressed.
- **Projection:** Without intervention, preventable CVD deaths during heat events will increase sharply.

Children and Elderly: Demographic Certainty

While demographic projections are unavailable, Somalia's population is growing and vulnerable age groups (young children, elderly) will increase in absolute numbers. Combined with intensifying heat, this ensures:

- more children exposed to developmental risks from heat stress;
- more elderly with limited physiological heat tolerance; and
- increased burden on households caring for dependent family members.

6.5.3 The Adaptation Gap: Coping Capacity Falling Behind Risk

Current coping strategies (**Chapter 5.1**) are already insufficient:

- 47.9% use only one coping method.
- 10.8% have no coping strategies at all.
- Paradox: Highest exposure (HESI 6) = fewest strategies (mean 1.05).
- 37.4% expect to be worse off in 5–10 years.

Trajectory: As heat intensifies, the gap between exposure and coping capacity will widen.

Current State	Future Trajectory (No Intervention)
Heat events: 98.6% annual exposure	More frequent, longer duration, higher intensity events
Coping capacity: Mean 1.51 strategies	Strategies become less effective; no expansion of options
Health system: 1.29/5 readiness	Overwhelmed by increased demand; capacity degrades further
Warning access: 51.6% never receive	Gaps persist; vulnerable populations remain excluded
Adaptation planning: 51% no plans	Gap widens as risks accelerate faster than preparation

Future risk will concentrate in precisely the populations and places least able to respond: Mudug and Bay regions, IDP settlements, CVD patients and households with no current coping strategies. Without systematic intervention, rising temperatures will interact with existing vulnerabilities to create compounding crises that overwhelm both household and institutional capacity.

6.6 The Cost of Inaction: What Happens If We Do Nothing?

The evidence across **Chapters 3–5** and forward-looking assessments converge on a sobering conclusion: current trajectories are unsustainable. If no action is taken to

strengthen heat-health preparedness, Somalia faces escalating morbidity, mortality and socioeconomic disruption.

6.6.1 Health Outcomes

- **Preventable mortality:** Without intervention, heat-related deaths will increase, concentrated among CVD patients, children, elderly and IDPs. The combination of rising temperatures, high disease burden (20% CVD prevalence), medication unavailability (72.7% during heat) and absent treatment protocols (88.2% of facilities without heat SOPs) ensures that deaths will occur from conditions that are both predictable and preventable.
- **Chronic disease exacerbation:** CVD patients already report symptoms worsening during heat (41.3%), yet facilities lack capacity to manage these complications (17.6% have CVD emergency protocols). As heat intensifies, unmanaged hypertension and cardiovascular strain will drive more acute events—strokes, heart attacks, kidney failure—overwhelming a health system already unable to cope with current demand.
- **Developmental impacts:** Children exposed to repeated, severe heat stress face long-term developmental consequences including impaired cognitive development, reduced educational attainment and increased lifetime disease risk. These impacts, largely invisible in current data, will manifest over decades, perpetuating cycles of vulnerability.

6.6.2 Health System Collapse

Facilities already report being overwhelmed during heat events (60.1% “not prepared” in community assessment). As heat intensifies:

- patient loads will surge beyond current capacity (47.9% already seek care);
- staff members will face increasing heat stress themselves, reducing productivity;
- infrastructure will degrade faster (40.8% cooling functionality already inadequate); and
- medicine stockouts will worsen (72.7% CVD medication unavailability).

The result: a reactive system forced into crisis mode with each heat event, unable to provide proactive care or build resilience.

6.6.3 Socioeconomic Disruption

- **Livelihood losses:** Heat already disrupts work (casual laborers reduce hours, farmers adjust schedules). Key informants noted that *“prolonged heat has damaged crops, dried up pasture and weakened livestock, pushing families to rely more heavily on aid.”* Intensifying heat will deepen these impacts, reducing household income precisely when medical expenses increase.
- **Deepening poverty:** The convergence of reduced income and increased healthcare costs (26.6% unable to pay, 25.3% rely on borrowing) will push more households into debt and poverty. The 51.9% who access emergency care only through borrowing or asset sales will exhaust these coping mechanisms, creating a new category of heat-impoverished households.

- **Erosion of social cohesion:** Communities already report reduced social gatherings during heat (*"people stay isolated in their homes"*). As heat events become more frequent and severe, social support networks—critical for collective resilience—will weaken further, leaving households more isolated and vulnerable.

6.6.4 Compound Environmental Risks

Heat does not act alone. Officials warned that *"heat worsens malnutrition by reducing food production, and it increases the risk of infectious diseases, due to poor water quality."* The feedback loops are clear:

- Heat → reduced agricultural productivity → malnutrition → weakened immunity → increased infectious disease
- Heat → increased water demand → reliance on unsafe sources → diarrheal disease → dehydration → heat vulnerability
- Heat → medication stockouts → unmanaged CVD → acute events → healthcare costs → impoverishment → reduced adaptive capacity

These interactions create cascading failures where each weather hazard and environmental stress-impact amplifies others, overwhelming both household and institutional coping mechanisms.

6.6.5 Irreversible Tipping Points

Some impacts, once triggered, may be irreversible:

- **Health system collapse:** If staff attrition (due to heat stress, low morale, better opportunities elsewhere) reaches critical levels, rebuilding capacity takes years.
- **Loss of knowledge:** Elders warned that traditional predictive systems are becoming unreliable. If this generation passes without transmitting knowledge to youth, centuries of adaptive wisdom will be lost
- **Permanent displacement:** If heat renders some areas uninhabitable (due to water scarcity, crop failure, unbearable temperatures), displacement becomes permanent, creating new IDP populations with compounding vulnerabilities.

6.6.6 The Window for Action

The evidence suggests a narrow window for effective action. Current trajectories show:

- communities recognize risks (75.1% know it's hotter) but aren't preparing (51% have no plans);
- institutions acknowledge future challenges but lack capacity to respond;
- health systems are already strained and will be overwhelmed by increased demand; and
- households expect to be worse off (37.4%) and have no illusion that current strategies will suffice.

This combination—high awareness, low preparation, weak systems and realistic pessimism—creates both urgency and opportunity. Communities know what's coming but need support to act. Institutions recognize the problem but need resources and capacity to respond. The window exists now, before tipping points are crossed and before heat-health impacts escalate from manageable challenge to humanitarian crisis.

The cost of inaction is clear: preventable deaths, collapsing health systems, deepening poverty and irreversible loss of adaptive capacity. The alternative—systematic investment in preparedness—remains feasible but requires immediate action. **Chapter 7** will outline specific pathways forward, but the imperative is established: act now, or accept escalating crisis as inevitable.

📌 **Key Messages: Future Heat-Health Risks and the Imperative for Action**

- **Projected intensification:** By the 2040s Somalia will face **+1.5–2.0°C temperature increases** under moderate scenarios and **+2.5–3.5°C under high emissions**, translating into **20–90 more very hot days/year**—with some regions facing **year-round extreme heat**. Coastal wet-bulb thresholds may approach **physiological survival limits**.
- **Predictable health crises:** Rising heat will sharply worsen **cardiovascular disease events**, disrupt medication supply chains and push health facilities—already with <30% trained staff or heat SOPs—into **permanent crisis mode**.
- **Community awareness, limited preparedness:** Three-quarters (75.1%) perceive rising heat and 91.6% recognize longer, earlier or later hot seasons. Yet **51% have no adaptation plans**, and only 2.3% report detailed strategies—reflecting the **awareness–concern gap**.
- **Eroding traditional cues:** Existing environmental knowledge (animal behavior, plant cycles, winds) is increasingly unreliable, leaving households **uncertain and anxious about when heat will strike**.
- **Uneven concern:** Only 42.4% express high concern for future heat, while 27.3% report **no concern at all**—paradoxically most common among the most vulnerable households.
- **Institutional alarm, but low readiness:** Ministries foresee surges in heatstroke, dehydration, renal stress and malnutrition, but **lack heat-health policies, protocols, funding or coordination**. Current readiness is **critically low** (5.6% of facilities with heat action plans).
- **Geographic hotspots:**
  - **Mudug:** Critical convergence of highest CVD burden, weakest facility readiness, poor warning access
  - **Bay:** High disease burden, poor screening, weak protocols despite cooling infrastructure
  - **Banadir:** Rising urban heat island risks amid low community heat awareness
  - **Middle Shabelle:** Strong awareness but limited absolute capacity, likely strained under intensifying heat
- **Populations at highest future risk:**
  - **IDPs:** Triple disadvantage—poorer shelters, weaker health access, minimal warning systems
  - **CVD patients:** A silent crisis—20% of households affected, but 72.7% report medicine unavailability during heat
  - **Children and elderly:** Growing demographic numbers guarantee rising health burdens
- **The adaptation gap:** Coping strategies are shallow (47.9% use only one, 10.8% none). Communities expect to be **worse off in 5–10 years** yet lack resources and institutional support to prepare.
- **Cost of inaction:** Without urgent investment, Somalia faces **preventable deaths, overwhelmed health systems, deepening poverty and irreversible tipping points**—from collapsing clinics to permanent displacement and loss of knowledge.

Overall interpretation: Somalia stands at a tipping point. Communities already feel worsening heat, institutions recognize looming crises and health systems are strained to breaking. Yet both households and government remain reactive, under-resourced and under-prepared. The **window for effective action is narrow**: urgent investment in preparedness is the only way to prevent escalating heat-health crises from becoming locked-in humanitarian emergencies.

Chapter 7: Conclusions and Recommendations

7.1 Synthesis of Key Findings

This assessment provides the first comprehensive evidence base on how extreme heat affects health, livelihoods and systems in Somalia. Across all data sources—household surveys, facility assessments, focus group discussions and routine DHIS data—a consistent picture emerges: **extreme heat is already a major and under-recognized public health challenge.**

a) **Exposure is widespread and rising.** Nearly all households report experiencing extreme heat events, often lasting more than a week, and 95% of individuals report heat-related symptoms. Seasonal analysis shows that health burdens concentrate in the hot months (January through June), creating predictable waves of illness that facilities are ill-prepared to manage.
b) **Vulnerability is uneven.** The most disadvantaged populations—including IDPs, women, children and the elderly—face the highest risks. Displacement carries a clear "penalty," with IDP households nearly twice as vulnerable as host communities due to poor shelter, unreliable water and lack of electricity. Regional differences further compound discrepancies: Middle Shabelle demonstrates relatively high adaptive capacity, while Mudug combines high symptom burden with the lowest facility readiness.
c) **Health impacts are profound.** Heat drives a broad spectrum of symptoms, from sweating and fatigue to confusion and respiratory distress, with one in six people unable to carry out daily activities during hot weather. Cardiovascular disease emerges as both a prevalent condition (affecting over one-third of households when hidden burdens are included) and a sensitive marker of heat stress, with symptoms worsening sharply in hot conditions. Sleep disruption, livelihood losses and reduced social functioning extend the impact beyond health into economic and social resilience.
d) **Adaptive capacity remains weak.** Communities demonstrate strong experiential awareness of rising heat, but this knowledge rarely translates into preparedness. Most households lack adaptation plans, and facilities lack protocols, infrastructure and trained staff. Predictive modeling confirms that structural deficits—particularly unreliable water and electricity—are stronger drivers of vulnerability than education or demographics, demonstrating the primacy of infrastructure in shaping resilience.
e) **The health system is unprepared.** Facility assessments reveal critical deficits: most lack cooling, shaded waiting areas, reliable electricity or water; none have heat action plans; and only a quarter provide training on heat illness. Routine surveillance fails to capture seasonal spikes in heat-sensitive conditions, masking the true scale of the burden.

Taken together, the findings show that Somalia's households and health systems are already strained by current levels of heat exposure, with vulnerabilities rooted in displacement, poverty and structural deficits. Without urgent adaptation, rising temperatures will further

overwhelm communities and the health sector, deepening health discrepancies and eroding resilience.

7.2 Implications for Health Systems

The findings demonstrate that Somalia's health system is already under severe strain from extreme heat and is ill-prepared for projected future increases. Several critical implications emerge:

a) **Systemic readiness gaps:** Most facilities lack the infrastructure to provide safe care during extreme heat. Inadequate cooling, unshaded waiting areas, unreliable electricity and limited water access compromise both patient safety and provider performance.
b) **Absence of protocols and training:** No facility had a heat action plan, and only a minority of staff members were trained to recognize or manage heat-related illness. This leaves frontline providers dependent on improvisation during heatwaves, undermining clinical effectiveness.
c) **Weak integration of chronic disease care:** The high prevalence of cardiovascular disease, combined with its sensitivity to heat, creates a significant but under-recognized burden. Limited screening, poor continuity of care and frequent medicine shortages expose CVD patients to heightened risks during hot periods.
d) **Surveillance and data blind spots:** Routine health information systems (DHIS) do not capture heat-related illness as a category, masking seasonal surges in demand and preventing policymakers from recognizing heat as a health priority.
e) **Access challenges:** IDPs and other high-vulnerability groups experience the greatest heat-health impacts, yet facilities serving these populations often have the weakest infrastructure and lowest readiness. This reinforces discrepancies and leaves the most vulnerable with the least protection.
f) **Dependence on emergency and donor-driven responses:** Resource allocation is reactive and ad hoc, with limited domestic financing for environmentally sensitive health risks. This undermines long-term resilience and sustainability of services.

Implication: Without deliberate investment in infrastructure, protocols, workforce training, surveillance and focused targeting, Somalia's health system will remain reactive, fragmented and unable to protect vulnerable populations from predictable and escalating heat-health risks.

7.3 Implications for Policy

The assessment shows that heat-related health risks remain largely invisible in Somalia's current policy landscape, with profound consequences for preparedness and response. Several key implications stand out:

a) **Heat not recognized as a distinct hazard:** National frameworks (National Adaptation Plan, Disaster Risk Management Policy and Health Sector Strategic Plan) subsume heat under "extreme weather," preventing the development of targeted guidelines or financing streams for heat health.
b) **Fragmented institutional mandates:** Responsibilities for health, environment and disaster management are spread across multiple ministries without a lead agency for

heat-health. This weak coordination dilutes accountability and ensures heat risks are consistently deprioritized.

c) **Resource allocation blind spots:** Budgets are reactive and emergency-driven, with little to no earmarked funding for prevention or preparedness. As a result, IDPs and high-risk regions remain underserved.
d) **Surveillance gaps limit policy visibility:** The absence of heat-related categories in the DHIS and weak integration of meteorological and health data mean that decision-makers lack the evidence base to prioritize heat in national planning.
e) **Risks embedded in current approaches:** Displacement and regional differences are not adequately reflected in policies, despite clear evidence that IDPs, women, children and the elderly bear the greatest burdens. This could widen existing health and social discrepancies.

Implication: Unless heat is explicitly recognized within Somalia's environment and health policy frameworks, supported by clear institutional mandates, financing mechanisms and surveillance integration, it will remain systematically deprioritized. Addressing this gap is essential to shift from ad hoc crisis response toward structured adaptation planning.

7.4 Programmatic Recommendations

Building on the assessment findings, this section outlines priority programmatic actions to strengthen Somalia's preparedness and response to extreme heat. Recommendations are structured across community, health system and policy levels to ensure multi-layered and interventions.

1. Community and Household Level

- **Upgrade shelter and infrastructure:** Support IDPs and vulnerable households with durable roofing (heat-reflective or insulated materials), improved ventilation and shaded communal spaces, with priority for Mudug and Bay regions where 73.8% of IDPs live in inadequate structures.
- **Expand access to water and cooling:** Promote small-scale water storage, tree planting and low-cost cooling technologies at the household and community level. Establish community cooling centers in high-risk districts equipped with solar-powered fans, drinking water and trained volunteers.
- **Awareness and behavior change:** Develop culturally tailored risk communication through trusted channels (radio, health workers, religious and community leaders), linking experiential knowledge to future heat.
- **Empower vulnerable groups:** Integrate women, youth and community elders as partners in designing and implementing local adaptation strategies, including documenting traditional heat indicators, household cooling strategies and community heat watch systems.

2. Health System Level

- **Heat-health action protocols:** Develop and roll out standardized protocols for triage, treatment and referral of heat-related illnesses, including heat exhaustion, heat stroke and heat-exacerbated cardiovascular conditions. Each facility should

develop heat action plans with trigger thresholds, resource allocation and staff scheduling.

- **Early warning and information systems:** Establish a National Heat-Health Early Warning Committee integrating meteorological warnings with health facility preparedness and community awareness. Develop Somalia-specific heat alert thresholds and disseminate through SMS to facilities, radio broadcasts, mosque announcements and community networks.
- **Heat data infrastructure:** Install automated weather stations in target districts to enable accurate temperature monitoring and correlation with health outcomes. Somalia currently has no functioning national meteorological observation network.
- **Health information systems integration:** Modify HMIS to include specific diagnostic codes for heat exhaustion, heat stroke, heat-related dehydration and heat-exacerbated CVD to enable surveillance, trend analysis and evidence-based planning.
- **Facility infrastructure upgrades:** Prioritize shaded waiting areas, cross-ventilation, reliable electricity and water supply in health facility investments. Install shade structures, solar-powered fans, reflective roof coatings and solar air conditioning in critical areas.
- **Pharmaceutical supply chain resilience:** Strengthen cold-chain systems through solar-powered refrigeration, implement heat-adjusted demand forecasting, pre-position buffer stocks of essential CVD medications before peak heat seasons and explore multi-month medication dispensing during cool seasons.
- **Capacity building:** Train health workers in heat-illness recognition, management and counseling for high-risk groups (CVD patients, elderly, pregnant women, children) through cascade training model. Integrate heat-health modules into pre-service medical and nursing curricula.
- **Strengthen chronic disease care:** Expand CVD and diabetes screening, ensure consistent medication supply chains and integrate chronic disease management with seasonal heat preparedness. Priority for Mudug (31.9% CVD burden, zero screening) and Bay (25.2% burden, zero screening).

3. Policy and Institutional Level

- **National Heat-Health Action Plan:** Develop standalone policy framework that explicitly recognizes heat as a distinct health hazard, with clear objectives, institutional roles, resource allocation and integration with existing frameworks (HSSP, NAP, DRM policy).
- **Inter-sectoral coordination:** Formalize coordination mechanisms between health, environment and disaster management sectors through National Heat-Health Coordination Committee with regular meetings and mirror committees at state and district levels.
- **Financing mechanisms:** Integrate heat-health budget lines into Ministry of Health annual budgets, develop finance proposals (GCF, Adaptation Fund) and explore public-private partnerships for health facility infrastructure.

- **Regulatory frameworks:** Develop occupational health regulations for outdoor work during extreme heat, integrate heat-resilient design into building codes and establish protocols for school closures and public event restrictions during heat warnings.
- **Targeting vulnerable groups:** Ensure all policies, programs and resource allocation explicitly target vulnerable groups (IDPs, CVD patients, children, elderly) and high-risk regions (Mudug, Bay), allocating resources based on vulnerability indices.

4. Knowledge Generation and Monitoring

- **Sentinel surveillance:** Establish sentinel sites across the country to track longitudinal heat-health trends, correlate temperature with health outcomes, and evaluate intervention effectiveness through daily health utilization data and patient outcome monitoring.
- **Operational research:** Support evidence generation on heat-attributable CVD burden, cost-effective household cooling interventions, medication adherence during heat, optimal early-warning thresholds and heat-pregnancy interactions.
- **Monitoring and evaluation:** Establish framework tracking outcome indicators (heat-illness incidence, CVD emergencies, mortality, medication availability) and output indicators (facilities with plans, trained workers, cooling centers, community awareness) through regular reporting and evaluations.

Chapter 8: Suitability of WHO Assessment Tools for the Somali Context and Required Adaptations

This assessment reviewed the practical fit of WHO heat-health and resilience tools against Somali operating realities, using evidence from 17 facilities, household and qualitative findings on early warning access and DHIS facility analysis. Together, these data provide an empirical basis to judge tool suitability and specify adaptations.

8.1 WHO Health Facility Resilience to Extreme Weather Checklists— Partial Suitability

The core domains (infrastructure, supplies, workforce, protocols) are relevant and mapped cleanly to our facility assessment. However, several checklist expectations presuppose capabilities that were absent in all assessed sites: indoor temperature monitoring, heat action plans, integration with heat alerts and routine recording of heat illness. Given these systemic gaps, direct “as-is” scoring understates progress in low-resource settings and offers limited guidance on near-term improvements. Adaptation is needed to:

(i) re-weight toward no-power/low-power measures (passive shading/ventilation, water availability, patient flow during peak heat);
(ii) add items specific to displacement settings (temporary shelters, plastic sheeting roofing, unreliable electricity and water); and

(iii) include a minimal “essential heat-readiness package” (clinician checklist, triage prompts for heat symptoms, hydration points, shaded waiting, backup water) that facilities can meet, even without HVAC or automated sensors.

8.2 WHO Heat-Health Action Plan & Early Warning Guidance — Conceptually Sound, Implementation-Constrained

Guidance on thresholds, alerts, preparedness and communication is appropriate, but implementation assumes functioning meteorological services and data exchange. Our data infrastructure review found repeated inaccessibility of temperature series (referrals to SWALIM, non-functional extraction, no response to requests) and no routine heat alerts reaching facilities. Household data show only 12.6% receive warnings, with radio and health workers as primary channels, and trust concentrating in health/community leaders. Adaptation is required to operationalize a low-data EWS pathway:

(i) pragmatic triggers (simple forecast cues and locally observed hot-spell indicators agreed with weather services once available);
(ii) facility-level “manual” heat triggers (e.g., consecutive days of reported indoor heat and surge in heat-compatible symptoms prompting readiness actions); and
(iii) delivery via trusted channels (radio, health workers, community leaders) in Somali, scheduled before known hotter periods and again ahead of late-year peaks suggested by DHIS.

8.3 WHO Surveillance and Coding Guidance — Needs Expansion for Heat

While facilities largely meet minimum HMIS quality standards, our findings show 88.2% do not record heat illnesses separately and DHIS data do not capture heat-sensitive conditions well enough to reveal seasonal patterns. Suitability is limited by the absence of heat-related indicators and standardized case definitions in routine tools. Adaptation should add:

(i) simple heat-related diagnosis and exposure fields (heat exhaustion, heat stroke, dehydration during hot spell, outdoor work exposure);
(ii) a monthly checkbox for “heatwave period” to contextualize surges; and
(iii) prompts to record basic environmental context (e.g., “very hot indoors” as observed by staff). This will allow progressive improvement without requiring immediate heat-health data integration.

8.4 Risk Communication and Community Engagement Tools (MoH/WHO Messaging) — Suitable with Localization

Household/FGD data show reliance on radio and health workers, strong trust in health workers and community leaders and knowledge gaps on severe outcomes (e.g., cardiovascular risks). Tools are appropriate but must be localized to:

(i) Somali-language, low-literacy formats;
(ii) delivery via radio and health workers as default;

(iii) emphasis on practical steps (hydration, shade, activity pacing, seeking care for red-flag symptoms); and
(iv) timing that reflects both early hot months and the observed August-through-October consultation peaks.

8.5 Responsiveness to Men's and Women's Different Needs — Requires Explicit Integration

The tools do not systematically surface specific risks that our data document (women's domestic/reproductive burdens, men's outdoor occupational exposure, systematic IDP infrastructure deficits and lower adaptive capacity). Adaptation should embed specific prompts in all checklists and action plans: shaded spaces and queue protections for pregnant women and young children, hydration access near maternity/child-health areas, occupational guidance for outdoor workers and displacement-specific facility and community actions.

8.6 Practical Adaptation Package for Somalia (12-Month Pathway)

Based on the evidence, WHO tools can be made fully usable through a:

(i) **Somalia Facility Heat Readiness Addendum** to the WHO checklist (low-power measures, IDP-context items, essential package);
(ii) **Heat Surveillance Mini-Module** in HMIS/DHIS (basic heat diagnoses, exposure/context fields, "heatwave month" flag); and
(iii) **Low-Data Heat-Warning Playbook** aligning facility triggers with radio/health-worker messaging in Somali, targeted to high-risk months and groups.

Piloting these adaptations in a small set of facilities in Banadir and Mudug (where reporting is relatively strong) and one site each in Bay and Middle Shabelle would allow rapid learning and scale-up.

8.7 WHO Vulnerability and Adaptation Assessment (VCA) Guidance — Appropriate Framework, Implementation-Constrained

The WHO VCA guidance provided the overarching methodological framework for this assessment. The phased approach (plan → conduct → assess adaptation → implement) proved conceptually sound and allowed flexible adaptation when data constraints emerged, particularly the provision for expert judgment when quantitative modeling is not feasible (applied in **Chapter 6**). The emphasis on multi-stakeholder engagement and vulnerable populations aligned well with Somalia's context.

However, the guidance assumes foundational capacities absent in Somalia: functioning meteorological observation networks (Section 2.1 documented none exist), HMIS systems recording heat illnesses (88.2% of facilities do not) and functional coordination between environmental and health sectors (found to be fragmented and ad hoc). Adaptation is needed to:

i. explicitly validate qualitative-dominant evidence pathways for fragile, data-poor contexts rather than emphasizing quantitative approaches;

ii. provide simplified heat-health surveillance options (sentinel syndromic surveillance, paper-based case definitions) when HMIS integration is not immediately feasible;
iii. outline staged implementation (rapid situational assessment → targeted primary data collection → longitudinal surveillance) rather than comprehensive one-time VCA; and
iv. address conflict-affected settings explicitly, including insecurity limiting field access, displacement creating mobile populations, parallel governance structures and donor-dependent health systems.

Despite constraints, the VCA guidance provided essential structure preventing disconnected findings and ensuring systematic coverage across household, health system and institutional dimensions. Future VCAs in similar contexts will benefit if these adaptations are integrated.

Conclusion

WHO tools—including the overarching VCA guidance, facility checklists, heat-action plan frameworks and surveillance tools—provide appropriate conceptual foundations but require targeted adaptation to Somalia's data and systems constraints. The modifications above are directly derived from this assessment's evidence—lack of alerts and heat coding, no facility heat plans, limited monitoring capacity, reliance on radio and health workers, and pronounced IDP vulnerabilities. When these adaptations are integrated, the tools will enable realistic implementation. Piloting in select facilities across target districts will allow rapid learning and scale-up, contributing both to Somalia's preparedness and to global guidance on heat-health assessments in challenging operational environments.