Mexico

Heat early warning system: Current status and recommendations

August 2026

Introduction and objectives

This case study examines the current state of the heat early warning system in Mexico, including how heat risk is understood and monitored, and how warnings are issued, communicated, and acted upon across institutions. It forms part of a series of case studies conducted across eight countries of the Zurich Climate Resilience Alliance, which applies a common analytical framework to assess heat early warning systems across key pillars and identify good practices, gaps, and enabling conditions for people-centred, impact-based early warning for extreme heat.

Key messages

- **Heat risk knowledge in Mexico is growing but unevenly translated into early warning and decision-making.** Since 2005, the health sector has systematically monitored heat illness and mortality and research has mapped municipal and neighbourhood vulnerability, yet these insights are not consistently translated into operational triggers, spatial prioritization, or targeted advisories.
- **The National Meteorological Service (SMN)'s heatwave methodology was revised in 2025 which has improved regional monitoring, but temperature-based thresholds are still limited in capturing Mexico's spatial and climatic diversity**. Heatwaves are now identified using percentile-based regional thresholds (≥3 consecutive days above the 95th percentile). However, warnings remain largely based on maximum temperature, with limited integration of humidity, night-time heat, cumulative exposure, or health data. Mexico's highly diverse geography and strong intra-urban contrasts, for example in Mexico City, mean that coarse station coverage and model resolution sometimes limit the local representativeness and usefulness of warnings.
- **Heat warnings reach the public through many channels, yet messages are still mostly generic, only weakly target vulnerable groups, and have limited feedback mechanisms.** Civil protection, health agencies, mass media, and municipal systems disseminate advisories (with some advances in visual formats and Indigenous-language products), but differentiation for vulnerable groups such as outdoor workers, homeless people, migrants, and caregivers remains limited, and first-mile reach is uneven. Feedback mechanisms and accessibility measures exist but remain uneven and informal.
- **Preparedness and response rely mainly on seasonal health promotion and reactive measures during heatwaves.** Mexico lacks a national Heat Action Plan or formal heat-specific protocols, thus actions triggered by warnings are inconsistent and not embedded within a coordinated, multi-sectoral response system.
- **Institutional responsibilities for heat warnings are spread across multiple agencies, with no single legally mandated lead institution or dedicated national framework for heat.** Coordination exists but remains informal, budgets are ad hoc, and long-term sustainability and accountability mechanisms are weak.

Methodology

This case-study is based on a combination of semi-structured interviews and a targeted review of peer-reviewed literature and grey documentation related to extreme heat and the heat early warning system in Mexico. Five interviews were conducted between October and November 2025 with stakeholders across academia, meteorology, civil protection, and humanitarian response (see list of organizations below). Evidence was synthesized using the four pillars of early warning systems (risk knowledge; monitoring and forecasting; warning dissemination and communication; and preparedness and response) alongside enabling components such as governance, inclusivity, and a multi-hazard perspective.

Interviews were conducted with:

- Mexican Red Cross
- National Meteorological Service (SMN)
- Secretariat for Integral Risk Management and Civil Protection (SGIRPC)
- Veracruzana University
- National Autonomous University of Mexico (UNAM)

List of acronyms used

CENAPRED - National Centre for Disaster Prevention

CONAGUA - National Water Commission

IFRC - The International Federation of Red Cross and Red Crescent Societies

IWMI - International Water Management Institute

ENSO - El Niño-Southern Oscillation

EWS - Early Warning System

GESI - Gender Equality and Social Inclusion

GFS - Global Forecast System

NOAA - National Oceanic and Atmospheric Administration

PAHO - Pan American Health Organization

PILARES - Points of Innovation, Liberty, Art, Education, and Knowledge

SGIRPC - Secretariat for Integral Risk Management and Civil Protection

SMN - National Meteorological Service

STPS - Ministry of Labour and Social Welfare

UHI - Urban heat island

UMPC - Municipal Civil Protection Unit

UNAM - National Autonomous University of Mexico

WBGT - Wet Bulb Globe Temperature

WRF - Weather Research and Forecasting

Early Warning Systems

Early Warning Systems (EWS) are one of the best-proven and effective measures for saving lives and minimizing losses and harm caused by disasters. They help those at risk of floods, heatwaves, wildfires and other climate hazards to take risk-informed, timely, meaningful, and impactful early action to keep themselves and their assets safe. The Alliance works across all eight components of EWS so that they deliver essential services for the most vulnerable women, men, and children, supporting communities to be resilient to climate hazards, enabling them to thrive.

Disaster risk knowledge

Hazard knowledge and trends

Extreme heat is increasingly recognized in Mexico as a significant and growing hazard, and a substantial body of evidence around heat risks exists for the country. Climate and hazard studies have analysed the atmospheric drivers of heatwaves, urban heat island (UHI) dynamics, and the role of climate change (Aquino-Martínez et al., 2025; Kalashnikov et al., 2025). For example, a recent analysis of the spring 2024 heatwaves showed that a persistent high-pressure system kept hot conditions in place for several weeks (Cavazos, 2024). Attribution studies showed that the heatwaves in 2023 and 2024 were made more likely and hotter due to climate change (Lopez et al., 2025; Pinto et al., 2024). Urban studies in the Mexico Basin show that region-wide heatwaves interact with urban form and atmospheric circulation to intensify the urban heat island, particularly under high-pressure conditions, prolonging hot conditions in cities (Aquino-Martínez et al., 2025).

Mortality and epidemiological evidence

A large share of the scientific evidence around heat-related impacts focuses on health impacts and vulnerability, including epidemiological analyses of heat-related mortality and morbidity, studies on cardiovascular and mental health outcomes, and spatial vulnerability assessments at municipal and neighbourhood scales (Hurtado-Díaz et al., 2019; Vargas and Magaña, 2020; Schwarz et al., 2025). There is also evidence that heat significantly affects animals and plants, with consequences for ecosystems alongside human health (Paz, 2024).

Mexico's health surveillance system has collected heat-related illness and mortality data since 2005 and maintains standardized procedures for epidemiological surveillance during heat seasons; however, these figures are likely underestimated, as heat is often recorded as a contributing rather than primary cause of illness or death, and cases may be underreported due to limited access to healthcare or gaps in diagnosis and reporting (Gobierno de México, 2020; Secretaría de Salud, 2025; Hartinger et al., 2025). Official government reports indicate a significant increase, with 331 deaths in 2024 alone, due to extreme temperatures (Dirección General de Epidemiología, Secretaría de Salud, 2024). However, heat-related deaths are often misclassified in mortality records, leading to systematic undercounting. Research suggests that existing methodologies may not fully capture the true extent of heat-related mortality (Bressler et al., 2026). As a result, reported figures are likely well below actual rates, further compounded by inconsistencies in how data are monitored and shared across levels of government, with varying degrees of detail and disaggregation. The national surveillance system for extreme temperatures focuses on identifying and reporting heat-related illnesses and deaths according to clinical criteria. However, its standard procedure manual does not mandate reporting by age group or sex within its core case definitions.

Highly vulnerable groups identified across studies in Mexico include older adults, people with chronic conditions, pregnant women, children, and outdoor workers (Hurtado-Díaz et al., 2019; Schwarz et al., 2025; Lucatello et al., 2025). For example, a study in Mexicali showed disproportionate impacts among working-age men (30-55 years old) engaged in outdoor labour (Cueto & García, 2024); while a recent Wet Bulb Globe Temperature (WBGT)-based analysis showed that 75 per cent of heat-related deaths occur amongst even younger adults (18-35 years old), with future projections pointing to a shift in temperature-related mortality toward younger populations (Wilson et al., 2024). This change may indicate the fact that younger adults are more often employed in outdoor or manual labour such as agriculture and construction, where they face extended heat exposure with limited protection. It emphasizes how labour conditions and socioeconomic factors can increase vulnerability (Bressler et al., 2025). Studies also highlight heightened heat risk among people experiencing homelessness, people on the move (tourists, visitors, and migrants) with low adaptive capacity, and individuals with mental health or substance-use disorders, as well as gender-differentiated mental health impacts during heatwaves (Cueto & García, 2024; Hong and Vazquez, 2025; Pinchoff et al., 2023).

Socio-spatial vulnerability and urban heat exposure

Spatial analyses further demonstrate how structural and socioeconomic factors strongly shape vulnerability. Municipality-level studies show higher heat-related mortality in areas with greater marginalization, overcrowded housing, lower education levels, and older populations (Schwarz et al., 2025). Other urban studies, for example in the Mexico City Metropolitan Area, associate elevated heat vulnerability with overcrowding, limited access to potable water and healthcare, low vegetation cover, and lack of active cooling, with peripheral and informally developed areas facing higher exposure and lower adaptive capacity (Vargas and Magaña, 2020; Miquelajauregui et al., 2024). Also, the National Centre for Disaster Prevention (CENAPRED) has developed methodologies for municipal-level heat risk mapping (National Civil Protection System & National Centre for Disaster Prevention, 2016). Interviews reinforce these factors, adding that mobility patterns and conventional gender roles also shape vulnerability; for example, women may be disproportionately exposed as they move during the hottest hours to pick up children from school. The Mexican Red Cross reported recurrent dehydration cases among outdoor workers and noted that, during the 2024 heat season, most recorded heat-related deaths involved people living on the streets.

Case study: community-led resilience in Iztapalapa, Mexico City

In Mexico City, community education centres (PILARES) have been used as entry points to engage residents for heat-health literacy. Driven by the need to address high levels of overcrowding and limited cooling infrastructure, these community workshops focus on recognizing early warning signs of heat stress, particularly among children. These sessions emphasized the role of caregivers in identifying early warning signs, such as facial redness or dehydration, in children who may not be able to communicate discomfort. These activities were part of broader collaborations involving municipal planning units, the health sector, and risk management authorities, and were later replicated during large public events in the Zócalo.

Knowledge gaps

Despite the growing body of heat risk knowledge, important gaps remain in its operational use for early warning. Health evidence is not yet translated into warning thresholds, impact-based triggers, or spatial prioritization and processes for different vulnerable groups. Interviewees also emphasized a lack of research on social perception and interpretation of heat, limiting understanding of how heat is understood and acted upon by different population groups.

Observations, monitoring, analysis and forecasting

The monitoring and forecasting of extreme heat are led by the National Meteorological Service (SMN), under the National Water Commission (CONAGUA), which serves as the national authority responsible for meteorological observations, weather prediction, and the issuance of forecasts and advisories for extreme temperatures. Meteorological monitoring capacities have expanded in recent years, with temperature as the variable with the widest observational coverage, measured by approximately 1,189 meteorological stations (189 being automatic stations and the rest conventional stations) across the country, whereas other variables (e.g. humidity, wind, radiation) are measured by far fewer stations (around 200 nationwide) (National Civil Protection System & National Centre for Disaster Prevention, 2016). Although many stations exist, research indicates that their density is relatively low given the country's size (Gutiérrez et al., 2022). Stations are geographically distributed across Mexico, with higher concentrations in the central region and populated regions, with some remote areas remaining less well-monitored (CONAGUA, 2026). From these observations, seasonal outlooks and daily forecasts are produced, which include the detection and monitoring of extreme heat. Meteorological data produced by the SMN is made publicly available online for users with different types of dashboards (Servicio Meteorológico Nacional, 2025), however, the data is not quality controlled or homogenized.

SMN uses multiple models to monitor and predict extreme heat across timescales. For short- and medium-range temperature forecasts, SMN uses the National Oceanic and Atmospheric Administration (NOAA) Global Forecast System (GFS) model (approximately 25–28 km) to publish outputs up to 15 days ahead, which forms the basis for forecasts, heat advisories, and municipal-level temperature maps. Higher-resolution regional models (Weather Research and Forecasting (WRF); 7 km driven by 0.25 degree GFS data) are used to refine local assessments yet are available on shorter timescales (Servicio Meteorológico Nacional, n.d.). These higher-resolution outputs are also widely used in academic and applied studies of urban heat islands and heat risk, particularly in Mexico City and northern states (Aquino-Martínez et al., 2025; Miquelajauregui et al., 2024).

In addition, SMN produces sub-seasonal and seasonal temperature outlooks, anticipating monthly and three-month temperature anomalies (Servicio Meteorológico Nacional, 2025). At the city level, forecasting capacities are complemented by local initiatives. Interviewees highlighted that in Mexico City, the Secretariat of Integrated Risk Management and Civil Protection (SGIRPC) operates an early warning system that integrates local station data with national forecasts. Heat alerts are then issued when large-scale anticyclonic systems and atmospheric blocking are expected to generate persistent high-temperature events, enabling more targeted local monitoring.

Heatwaves definitions

In recent years, SMN has strengthened its methodological approach for identifying heatwaves. Whereas earlier advisories relied largely on expert judgement when forecast temperatures appeared unusually high, heatwaves are now detected using a statistical framework grounded in long historical temperature series. At the national level, SMN defines heatwaves as periods of at least three consecutive days during which maximum daytime temperatures exceed the 95th percentile for a given region (Northern Arid Region, Pacific Coast and Western Mexico, Central Region; Highlands & Valley of Mexico, Southeast and Yucatan Peninsula) in combination with the presence of mid-level anticyclonic circulation favouring persistent hot conditions (Servicio Meteorológico Nacional, n.d.). SMN now routinely monitors the 90th, 95th, and 99th percentiles of maximum temperature across regions (Servicio Meteorológico Nacional, 2026). These percentiles were calculated for the warm season (April–September) from 1950 to 2022, using historical data from the SMN. Since 2025, heatwaves have been identified and communicated by region, allowing meteorologists to track their spatial progression across the country and improving the spatial relevance of warnings. Interviewees described the monitoring and forecasting system as technically robust, with heatwave conditions detectable up to 96 hours in advance and forecasts updated daily. In practice, alerts are typically issued within a 72-hour window to ensure forecast confidence.

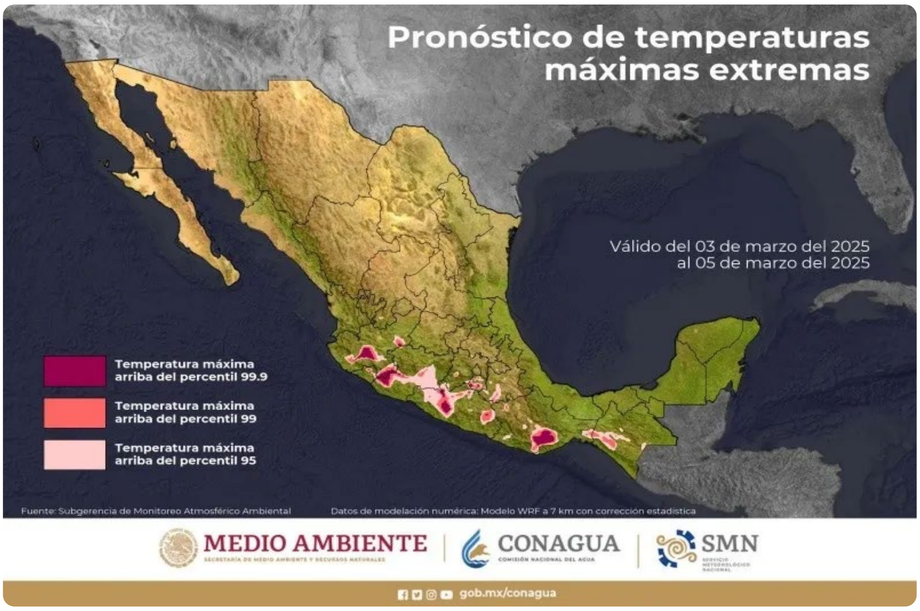

Figure 1. 95th, 99th, and 99.9th percentile of maximum temperature forecasted, valid from 3-5 March, 2025. Source: Servicio Meteorológico Nacional, 2025 (https://www.informador.mx/mexico/SMN-Estados-con-las-temperaturas-maximas-extremas-del-3-al-5-de-marzo--MAPA-20250303-0079.html)

At the national level, Mexico thus detects heatwaves using percentile-based thresholds set by the SMN, who oversees monitoring conditions, creates forecasts, and issues technical guidance to state authorities. Preparedness and response measures are activated at sub-national levels, where civil protection agencies may adopt locally tailored criteria. For instance, Mexico City has its own early warning system and depends on absolute temperature thresholds to trigger alerts and response actions. Usually, public alerts are disseminated by state and municipal Civil Protection agencies, which rely on SMN forecasts but are responsible for issuing warnings and carrying out preparedness and response efforts.

Academic and local pilot initiatives have explored alternative and complementary heat metrics that go beyond maximum temperature alone. In Veracruz, a university-led pilot applied percentile-based thresholds across multiple historical station records and tested the Excess Heat Factor, which integrates maximum and minimum temperature and acclimatization effects to identify heatwaves. Such indices remain employed in research settings only and are not yet implemented operationally within the national early warning system.

Gaps and challenges

Several structural and operational constraints limit the effectiveness of heat forecasting for early warning in Mexico. Firstly, the country's highly diverse geography, ranging from arid northern regions to humid coastal zones and high-altitude basins, means that heat behaves very differently across short distances. Interviewees emphasized that even regional thresholds may fail to reflect local conditions, particularly in large or topographically complex municipalities where a single station or city-level average may be unrepresentative:

'If the municipality is 100 km or 120 km in size, the maximum temperature at the capital will not be representative of the entire municipality [...]. Half of the territory is on the coast, and the other half is in the high mountains.'

This challenge is evident in areas such as Veracruz, where lower-lying zones consistently experience higher temperatures than higher-altitude surroundings. Beyond the geographical diversity of states, interviewees also noted a challenge with administrative jurisdiction. This is the case particularly in Sonora, Chihuahua, Coahuila, and Oaxaca, which are large, climatically diverse states. For example, a single state-level alert from these states may cover coastal lowlands (hot, humid), high-altitude cities (cooler), and desert zones (extreme daytime heat, large diurnal range). As a result, alerts are over-generalized. Some populations receive warnings that are not relevant, and possible public trust in alerts erodes. Meanwhile, others might be left facing underestimated risk, leading to vulnerable communities not acting when they should. Coarse model resolution further limits the ability to capture intra-urban variability. This spatial heterogeneity complicates threshold setting and reduces the local relevance of forecasts and current warnings. Additionally, operational heat metrics remain temperature-based and are not systematically grounded in health evidence. While health surveillance data and research are available, they are not yet used to develop health-relevant thresholds. Although the recent introduction of regional temperature thresholds has improved contextual relevance, the incorporation of humidity or cumulative exposure remains limited.

Capacity and resource constraints further shape system performance. SMN's climate services teams cover multiple hazards (storms, cold spells, heatwaves, rain, volcanoes, drought, wildfires, tropical cyclones, and earthquakes) with limited dedicated staff and budgets, constraining efforts to advance heat-specific services, expanding observational networks, automated local alerting, or the integration of additional indicators. While existing systems can detect heatwaves up to 96 hours in advance, researchers from UNAM and representatives from Mexican Red Cross argue that current lead times, often limited to 48-72 hours to maintain forecast confidence, are insufficient for effective anticipatory action. Furthermore, experts emphasize that the electricity and agricultural sectors are highly dependent on these forecasts for operational planning, yet they currently face critical gaps in specific, proactive response plans to address issues like power grid overloads and socioeconomic impacts.

Finally, interviews highlight significant challenges in translating technical heat forecasts into user-oriented services, and fail to address socially constructed vulnerabilities that determine how different groups experience and respond to heat. An example of this translation gap is the Mexico City subway, which can reach temperatures of 40°C during extreme heat events. While basic measures like drinking fountains or sprinklers may be installed at entrances, there is a lack of specific, actionable information for the millions of daily commuters. Furthermore, warnings and plans do not adequately account for the gendered exposure of women, who often commute during peak heat hours to pick up children, or the occupational constraints of outdoor workers who cannot easily follow generic 'stay indoors' advice. Moreover, while monitoring and prediction products are widely available, their conversion into actionable information remains limited, leaving users to engage largely passively with few opportunities for interaction or feedback.

Warning dissemination and communication

Channels and institutional mechanisms

Heat warnings in Mexico are disseminated through a multi-actor communication system involving meteorological authorities, civil protection agencies, health institutions, and mass media. SMN produces technical forecasts, advisories, and map-based products for extreme temperatures, which are transmitted to national, state, and municipal civil protection authorities. Civil protection entities are ultimately responsible for delivering alerts to the population and issuing bulletins to the public, while health authorities complement warnings with preventive guidance and weekly surveillance updates (Secretaría de Salud, 2025; Servicio Meteorológico Nacional, 2025).

At the national level, heat information is shared through official government websites, electronic bulletins, and digital platforms, and is amplified via radio and television. SMN disseminates heat-related information through daily and 96-hour forecasts, advisories on its website, and social media channels (e.g. YouTube, Facebook, X), as well as the ConaguaClima app[1]. A dedicated national government portal hosts alerts for multiple hazards, including high-temperature events[2]. Interviewees confirmed that traditional mass media remain a central dissemination channel, particularly for reaching broad audiences:

> *'Mass media outlets like radio and television issue daily alerts about rising temperatures and the potential for heat waves'*

Also, CENAPRED produces dissemination materials such as infographics for several hazards, including heatwaves. Although Mexico introduced a national cell-broadcast emergency alert capability in 2023, requiring mobile phones to support emergency alerts (Mexico Certifying Body S.C., 2026), this technology has not yet been applied to heat warnings. This system was piloted in 2025 for earthquakes only (the hazard for which the system has been most widely developed and robust at this point). Although the architecture in 2023 was initially developed with scaling to other hazards in mind, it has not yet been tested or expanded for operational use beyond earthquakes, and the timeline for this process remains unclear.

At the municipal level, dissemination relies primarily on the Municipal Civil Protection Unit (UMPC), which adapts national and state-level alerts to local contexts and redistributes them through locally relevant channels. In some cases, such as the northern city of Mexicali, municipal authorities issue tailored alerts that specify expected temperatures, the period of relevance, Heat Index values (an index that combines temperature and humidity), and some recommended actions (Gobierno de Mexicali, n.d.). For Mexico City, civil protection authorities further use social media and messaging (e.g., WhatsApp) to rapidly disseminate alerts, which are then redistributed through the mayor's offices and local official networks.

Audience targeting and accessibility

The Mexican Red Cross has highlighted the need for clearer, more visual, and locally contextualized communication formats, which include the impact of heatwaves on certain populations (Las ondas de calor en México: impactos y cómo reducir los riesgos, 2025). Many vulnerable populations face structural barriers that limit their ability to act on generic heat advice. Outdoor workers, informal labourers, migrants, and caregivers may still be unable to reduce their exposure despite receiving

[1] YouTube (https://www.youtube.com/@smnmexico2), Facebook (www.facebook.com/conaguamx) and X (@conagua_mx and @conagua_clima), the ConaguaClima app (https://www.gob.mx/smn/videos/app-conagua-clima).
[2] https://preparados.gob.mx/apps/alertamientos/alertamientos.php

warnings, highlighting the need for context-specific protective measures and social protection-linked response mechanisms. Recent years have seen some efforts to improve accessibility. In addition to written bulletins, the SMN has developed video-based communication formats, including versions translated into Indigenous languages for specific regions, such as Mayan dialects in the Yucatán Peninsula. Visual formats, infographics, and colour-coded alerts are increasingly used at the city level to link temperature ranges with specific times of day and response actions, aiming to make heat warnings more understandable and actionable for non-specialist audiences.

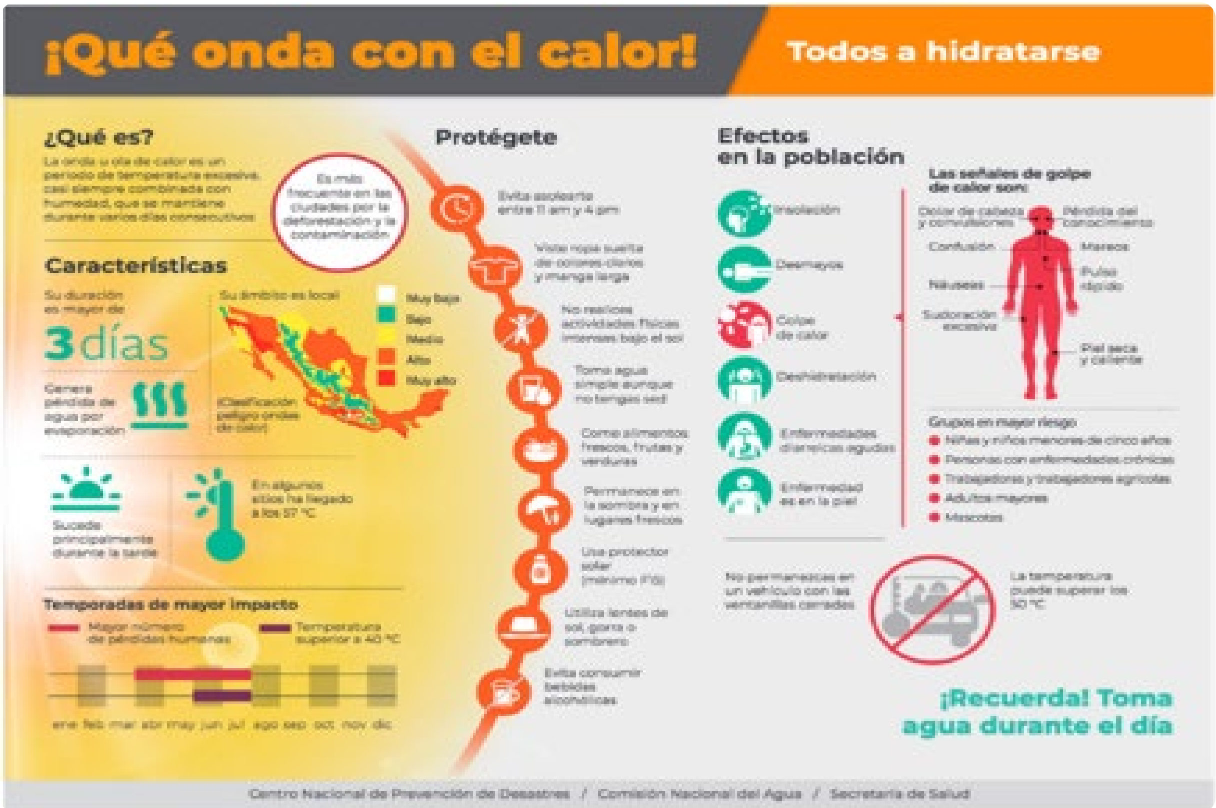

Figure 2. Infographic explaining what a heatwave is and its characteristics and effects on human health, along with protective actions. Source: CENAPRED, 2025 (https://www.gob.mx/cms/uploads/attachment/file/903561/TEMPORADA_DE_CALOR__2024_FINAL__2_.pdf)

Interviews noted that communities lack basic habits such as regularly checking weather forecasts, reflecting a broader gap in heat literacy and demand for warning information. In addition, interviewees expressed uncertainty about how consistently national heat warnings reach remote, rural, or marginalized communities, particularly outside major urban centres.

Also, both literature and interviews highlight that audience targeting remains limited. Heat warnings are generally framed as generic advice for the entire population, with limited differentiation for high-risk groups such as older adults, outdoor workers, migrants, people with disabilities, pregnant women or residents of informal settlements. Even where high-risk groups are mentioned, this is typically embedded within general guidance rather than delivered through targeted or group-specific messaging. Interviewees further noted limited involvement of at-risk communities in the design of warning formats, contributing to accessibility gaps at the final stage of heat warning delivery.

Effectiveness of communication

Interview evidence suggests that the effectiveness of heat warnings is constrained less by information availability than by perception, trust, and use. In regions facing chronic extreme heat, such as Mexicali, long-term exposure has shaped perceptions of 'adaptation', leading communities to rely on personal judgment rather than formal warnings. Alert fatigue, generic messaging, and the perception of heat as 'common sense' further undermine compliance with preventative guidance. Compared to hazards such as earthquakes or floods, heat warnings often receive less attention and urgency from the population, partly due to the absence of immediate, visible impacts and the gradual onset of heat-related harm. Interviewees also noted that misinformation on social media can dilute official messages, reinforcing the need for clear, accessible, and trusted communication.

Preparedness and response capabilities

Link to action and operational response

Preparedness and response to extreme heat in Mexico are largely organized through seasonal prevention and public health promotion, rather than through a dedicated national Heat Action Plan. Unlike hazards such as hurricanes or earthquakes, heat preparedness is not governed by a unified framework. Instead, responsibilities are distributed across multiple institutions, including the Ministry of Health, civil protection authorities, the meteorological service, municipal governments, and humanitarian organizations.

The Ministry of Health frames extreme heat through the concept of the 'temporada de calor' ('heat season'), operationally between weeks 12 and 42 (i.e. the third week in March until October), during which enhanced prevention, health promotion, and epidemiological surveillance are activated (Secretaría de Salud, 2025). Preparedness is also supported by CENAPRED and CONAGUA, which translate heat risk into practical household and community measures, including ventilation, shading, hydration, and identification of cooling spaces, and additionally, acknowledging cascading risks such as power outages, water scarcity, and wildfire occurrence during heatwaves (Centro Nacional de Prevención de Desastres, 2025). In this regard, extreme heat in urban Mexico increasingly represents a systemic risk affecting interconnected infrastructure systems, including electricity supply, water access, transportation networks, and healthcare services. These cascading impacts are not yet systematically integrated into heat preparedness planning or warning triggers.

Interviewees highlighted that local actors are beginning to invest in campaigns aimed at raising awareness among the community and educate people on heat risk, although these efforts remain prevalently project based. The health sector focuses on service readiness, including training health personnel, and amplifying communication through media and institutional networks (Secretaría de Salud, 2025). At the municipal level, authorities may issue local heat alerts, open hydration stations or shelters, distribute oral rehydration solutions, and conduct outreach to highly exposed groups such as people experiencing homelessness or outdoor workers (Gobierno de Mexicali, 2025). At the regional level, organizations such as the Pan American Health Organization (PAHO) support preparedness through capacity strengthening, advocacy for heat action planning, and the dissemination of ready-to-use communication materials, including infographics, videos, and educational resources aimed at raising awareness and supporting community education (Organización Panamericana de la Salud, 2021).

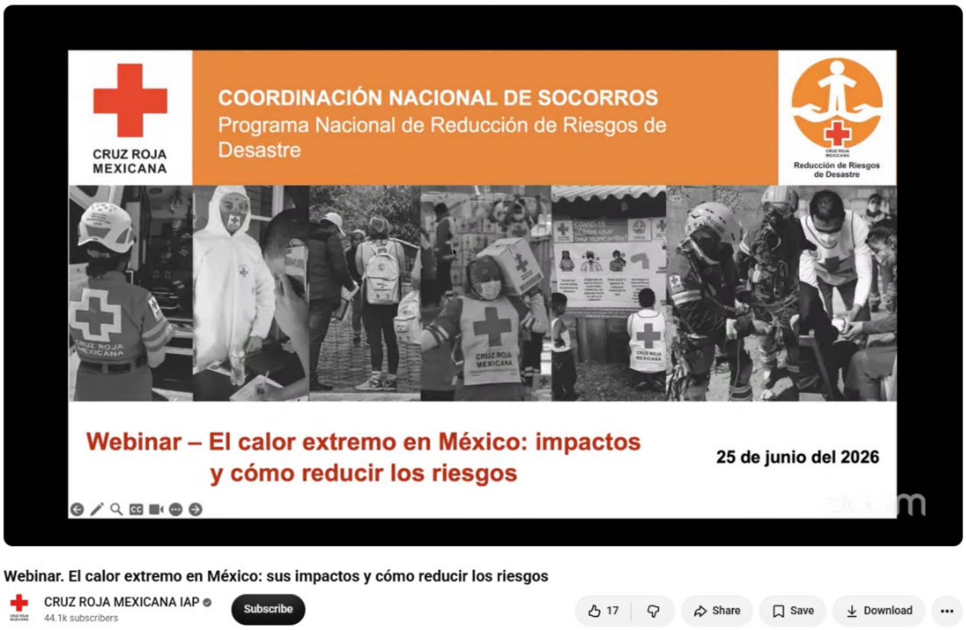

Figure 3. Webinar co-hosted by the Mexican Red Cross and Zurich Mexico on how to reduce the risk of extreme heat in Mexico. Source: https://www.youtube.com/watch?v=lzxhVZ2u1_s&t=1067s

The Mexican Red Cross has similarly contributed through public-facing initiatives, including national webinars framing heat as a 'silent killer' with unequal impacts and emphasizing the need for behavioural change alongside technical preparedness (Las ondas de calor en México: impactos y cómo reducir los riesgos, 2025). Furthermore, a recent project led by the National Institute for Public Health is working in six rural communities in southern Mexico, to co-develop, test, and evaluate a user-driven heat-health action plan, including an early warning and surveillance system, capacity building, prevention education and communication tools (Riojas Rodríguez, 2023).

While Mexico’s current approach to heat preparedness is predominantly seasonal and health-oriented, emerging initiatives reveal significant opportunities for enhancing the integration between heat early warning systems and anticipatory action. Measures such as those previously outlined already exemplify anticipatory practices; however, they remain disjointed and are not systematically activated by forecast-based risk information. Strengthening this connection would require moving from reactive seasonal preparedness to coordinated anticipatory action protocols that define pre-agreed responses, responsibilities, and threshold triggers associated with heat forecasts and impact indicators. Moreover, incorporating cascading risks into warning systems would further promote a more risk-informed and operationally actionable framework.

Interagency coordination

Despite these efforts, interviewees consistently indicate that the link between warnings and concrete action remains weak, as there are neither risk-reduction measures under law nor social protection regulations. Interviewees noted that, even when seasonal outlooks suggest heightened risk (e.g. during El Niño-Southern Oscillation (ENSO) El Niño or La Niña years), these signals are not translated into coordinated preparedness planning across sectors. Preparedness is described as reactive and short-term, rather than anticipatory and coordinated. There are currently limited formal mechanisms linking heat forecasts to predefined anticipatory actions, financing triggers, or mobilization protocols, reducing the ability of institutions to act before heat-health impacts escalate.

'There is no annual plan as such… it is on a day-to-day basis.'

Guidance to the public is predominantly framed around generic self-protection measures, often without specifying exposure limits or tailoring actions to different vulnerable groups.

Interviewees described several localized response initiatives that have emerged during severe heat events. In Mexico City, civil protection actors reported temporary operational measures during peak heat in the metro system to install fans with cold water sprinklers in underground tunnels. In Mexicali, a heat emergency that caused more than 40 heat-related deaths prompted a series of municipal response measures. The government and the military intervened through the DN-3 Plan, distributing water during peak temperatures. The municipal government also implemented a strategy that involves anticipatory monitoring of high temperatures and the activation of shelters and cooling centres providing shade, drinking water, bathing facilities and space for rest and basic assistance, and is used mostly by people experiencing homelessness.

Interviews indicate that response actions remain largely reactive, short-term, and predominantly health-centred, rather than embedded within a formal, multi-sectoral heat response system. A significant hurdle in the early warning ecosystem is the current absence of the Ministry of Labour and Social Welfare (STPS), which creates a critical governance gap. Without their active integration, there are no binding regulations mandating work stoppages during periods of extreme heat, leaving workers vulnerable and formalizing a disconnect between climate alerts and labour protections.

Community awareness, engagement, and response

‘SOS Hidrátate’ is a campaign launched by the municipality of Mexicali that mobilizes volunteers to distribute water across neighbourhoods. It is not only meant to reduce heat-related risks but also to engage the community and raise awareness.

Interviewees consistently emphasized that public understanding of heat risk in Mexico remains limited. The assumption of local acclimatization creates a barrier to the effectiveness of communication, with residents for example in Mexicali often dismissing alerts: *'Worry about yourselves who come from outside, we are already adapted'*.

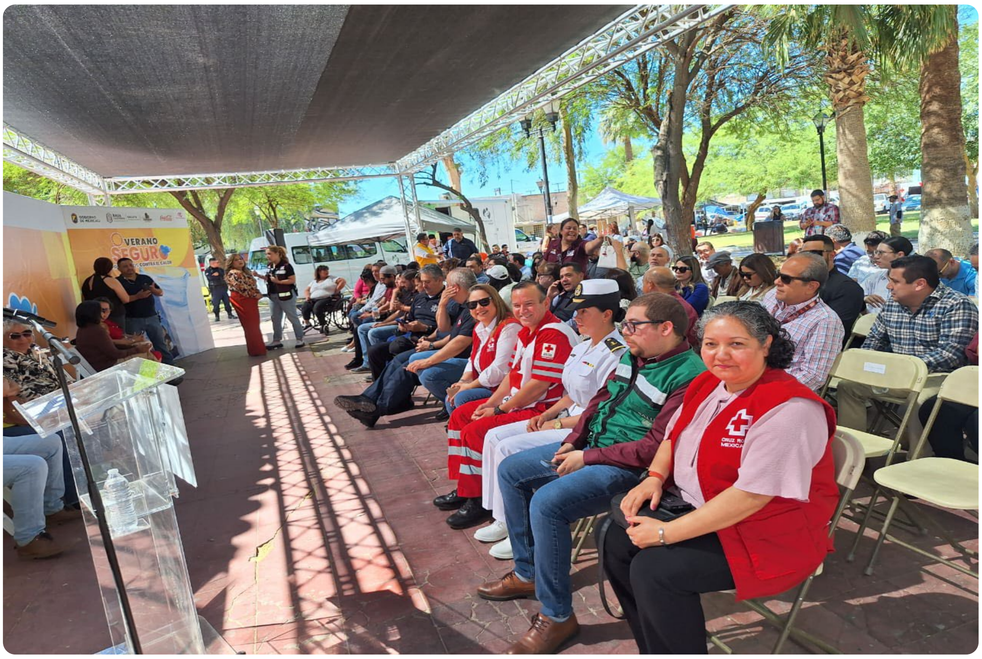

Figure 4. Launch of the 2025 ‘SOS Hidrátate’ in the municipality of Mexicali. Source: Mexican Red Cross.

Interviewees also pointed to coordination challenges that limit the effectiveness of education efforts. Health clinics often lack information on the spatial distribution of vulnerable groups, constraining tailored preparedness, while emergency services such as the Red Cross and emergency response units are not yet systematically involved in the design and delivery of heat risk education. Some early efforts to address these gaps are emerging, including public surveys to understand heat risk perception and more impact-oriented communication in Mexico City that explicitly explain 'what can happen to you if you expose yourself' and how long exposure can lead from dehydration to heat stroke. However, interviewees agreed that feedback mechanisms remain largely underdeveloped:

'We have not managed yet to have users that have been there for the long term, users we could have educated and who could also provide feedback… to then tailor the products to the actual needs.'

This limits the ability to tailor warnings and preparedness measures to user needs. Overall, strengthening preparedness will require not only clearer links between warnings and action, but also improved coordination across sectors and deeper engagement with communities to ensure that heat warnings translate into timely and effective protective behaviour.

The Mexican Red Cross is well-positioned to support people-centred heat early warning through its auxiliary role to public authorities, extensive volunteer network, and trusted access to vulnerable communities, particularly populations that may not engage with formal communication channels.

Multi-hazard approach

Heat risk in Mexico is increasingly recognized as interacting with other hazards and stressors, including drought, water scarcity, wildfires, energy demand, and public health pressures. Civil protection and disaster risk agencies acknowledge these cascading dynamics in guidance and communication materials, particularly during extreme heat seasons. However, heat warnings are not yet embedded within a fully integrated multi-hazard early warning framework comparable to those used for hurricanes or earthquakes. As a result, compound risks, such as simultaneous heat and water shortages or heat-driven strain on energy systems, are not systematically reflected in warning thresholds, preparedness planning, or response coordination.

Gender and social inequalities (GESI) addressed inclusively

The evidence base in Mexico clearly identifies socially differentiated heat vulnerability, shaped by age, health status, housing conditions, occupation, gender roles, and access to services. However, these insights are not yet systematically operationalized within heat warning design or response planning. Warning messages are generally framed for the general population, with limited tailoring to groups such as outdoor and informal workers, people experiencing homelessness, migrants, pregnant women and children, people with disabilities, or caregivers whose mobility patterns increase exposure. Gendered dimensions of exposure, such as women’s caregiving responsibilities during peak heat hours, are recognized in research and interviews but are not explicitly reflected in warning formats or preparedness measures. As a result, inclusivity remains largely implicit rather than actively designed into the system.

> *'The dangerous thing is that people who are exposed, because of their work and their activities, don't carry out these preventative measures... people who are on the street directing traffic, the police officers on the corner, people who do juggling acts at stoplights... street workers, app delivery drivers... those are the populations that need to be identified.'*

Local community involvement

Local community engagement emerges as a critical yet underdeveloped enabling factor. Community-level initiatives such as hydration points, cooling centres, neighbourhood outreach, and awareness workshops, demonstrate the potential of locally grounded action to reduce heat impacts, particularly in high-risk urban areas. Also, field surveys, social media questionnaires, and street-level temperature measurements were described by interviewees in the context of exploratory and research-oriented activities aimed at better understanding heat exposure and perceptions at the neighbourhood level. However, these community engagement and research efforts primarily led by academic researchers in collaboration with international organizations, with the Mexican Red Cross and local borough authorities, are often project-based, geographically limited, and not systematically linked to national or state-level warning systems. There is limited community involvement in the design of warning thresholds and formats, and no institutionalized mechanisms for users to provide feedback on the heat warning system. Interviews highlight low levels of heat literacy, limited habitual use of weather information, and perceptions of heat as a 'normal' or unavoidable condition in chronically hot regions, all of which undermine warning effectiveness. Trust in warnings is further weakened by alert fatigue and the absence of clear feedback mechanisms that allow communities to shape how warnings are issued and communicated.

Effective governance and institutions

Governance arrangements for heat early warning remain fragmented. Responsibilities are distributed across meteorological services, civil protection, health authorities, and municipal governments, but without a dedicated national Heat Action Plan or formal heat-specific protocols to align roles, responsibilities and actions. Resource and capacity constraints within SMN further limit the system's development. Interviews consistently described preparedness and response as reactive and event-driven, with limited advance planning even when seasonal or large-scale climate signals indicate elevated heat risk. While coordination mechanisms exist during emergencies, particularly through civil protection structures, heat is not yet treated as a strategic risk requiring sustained, cross-sectoral governance. These factors raise challenges for long-term sustainability and the translation of warnings into action.

Key recommendations

- **Strengthen the operational use of heat risk knowledge:** Mexico has a relatively strong and growing evidence base on heat as a hazard, health impacts, and vulnerable populations, but this information is not yet systematically integrated into warning thresholds, spatial prioritization, or anticipatory action. Improving the link between risk knowledge and early warning operations is a key priority.
- **Improve the relevance of heat monitoring and forecasting:** Despite recent progress in regionalizing temperature thresholds, spatial heterogeneity and predominantly temperature-based metrics continue to constrain the local relevance of heat warnings. To strengthen decision support, it is essential to expand the use of locally adapted thresholds and potentially integrate health-or sector-relevant indicators.
- **Shift from broad dissemination to targeted, impact-based communication, including strengthening community engagement:** While heat warnings are currently communicated through multiple channels, messages remain largely generic and insufficiently tailored to high-risk groups or specific exposure contexts. To ensure these warnings trigger protective behaviour, it is essential to strengthen audience targeting, accessibility, and first-mile delivery, particularly in rural and remote locations, for example by integrating a GESI-centred approach. This involves developing gender-responsive messaging, and utilizing inclusive platforms beyond digital media, such as community networks and radio, to reach the elderly and those without internet access. Communication must shift toward context-specific, impact-based alerts that address unique dangers, while ensuring that first-mile delivery is culturally tailored and builds social trust within marginalized communities. Establishing user-friendly GESI feedback mechanisms, such as non-digital reporting channels or community workshops, is essential to allow these groups to share their experiences and help refine the system, ensuring it remains responsive to the real-world challenges faced by the most marginalized populations.
- **Develop local and national Heat Action Plans, and strengthen** coordination **and governance:** In the absence of a national or local Heat Action Plans, preparedness and response to extreme heat remain fragmented and reactive. Clearer links between warnings and predefined, multi-sectoral actions are needed to minimize impacts from extreme heat. Responsibilities for heat early warning and plans are currently distributed across multiple institutions without a unifying framework to align risk knowledge, forecasting, communication and action. To improve system effectiveness and trust, there is a critical need for stronger coordination and clearer institutional leadership that actively integrates the participation and representation of diverse needs within communities.

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This case study complements our global report: Understanding the Global Landscape of Heat Early Warning Systems. You can view the full report here.

Front cover image: *Children cool off in a fountain at a park in Mexico City, Mexico*. Photo: Mercedes Matzm

About the Zurich Climate Resilience Alliance

The Zurich Climate Resilience Alliance is a collaboration between humanitarian, NGO, research and private sector partners, working to build resilience to climate hazards in rural and urban contexts.

Formerly the Zurich Flood Resilience Alliance, we have over a decade of experience in generating evidence of communities' current levels of climate resilience and identifying appropriate solutions.

Through long-term community programmes, new research and stakeholder influencing, we strive to deliver systemic change at scale and realize our vision of a world in which communities are more resilient to climate hazards, and able to thrive.

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