CEC's Work on Addressing the Impact of Extreme Heat Events (2015–2018)

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Long-term Impact Assessment

Syndromic surveillance is a tool and approach that provides public health professionals with a "timely system for detecting, understanding, and monitoring health events" [CDC 2023]. By using real-time (or near real-time) pre-diagnostic data (gathered from sources as diverse as triage reports, telehealth lines, and ambulance cards) and statistical tools to detect unusual health patterns, syndromic surveillance systems aim to reduce the time to detect and respond to outbreaks or events causing health concern [ISDS 2007].

In 2015, the Commission for Environmental Cooperation (CEC) launched a two-year project—"Helping North American Communities Adapt to Climate Change: A Pilot Syndromic Surveillance System (SyS) for Extreme Heat"—with a budget of C$400,000. The project aimed to "help selected North American communities increase their adaptation capacity to the adverse environmental health effects of extreme heat" [CEC 2015]. This was to be achieved "through the development of pilot syndromic surveillance (SyS) systems for heat and through the identification of the associated health impacts on vulnerable populations within each community" [CEC 2015]. The resulting SyS systems were envisioned to become "situational awareness tool[s] to support decision-making, allow early detection of heat-related health risks in geographically distinct locations, and enhance targeted communication measures designed to raise awareness among the general public and the most vulnerable groups about the dangers of extreme heat" [CEC 2015].

As the project unfolded, activities were tailored to national contexts. In Mexico, the project proceeded with the design and deployment of a SyS system in Hermosillo, Sonora, from the ground up. In the State of Michigan, United States, a Statewide SyS platform refined alerting algorithms and improved syndrome definitions. Finally, in Canada, a city-focused project in Ottawa, Ontario, centered on integrating new real-time data sources such as Telehealth and developing a portal containing aggregated climate and health data to an expanded health practitioner user base.

Building upon the success of the 2015–2016 SyS pilot project, the CEC launched a second, two-year "expansion" project, "Monitoring Health Impacts from Extreme Heat Events" (2017–2018), with a budget of C$600,000. The project aimed to "expand the establishment and use of SyS systems in North America [by] targeting new pilot communities, promoting awareness and use of the guidance document, developing an evidence-based framework for evaluating SyS systems, and developing an online training course that responds to the needs of public health practitioners across North America in terms of surveillance of health outcomes from EHEs" [CEC 2017a].

The participating communities for the 2017–2018 SyS expansion project were Pinal County, Arizona, in the United States, the Municipality of Juárez, Chihuahua, in Mexico, and the province of British Columbia (BC) in Canada. In BC, the British Columbia Centre for Disease Control (BCCDC) developed a model that used historical and real-time data to predict expected health effects based on EHE conditions. In Juárez, the project developed a real-time heat alert system based on health reports, as well as an interface to collect data on heat-related illnesses from private clinics in the municipality of Juarez. In Pinal County, Arizona, the analyses of historical data on heat-related illnesses were conducted to identify vulnerable populations and improve emergency response during extreme heat events.

In 2023 the CEC commissioned a long-term impact assessment of the projects to determine the extent to which they have contributed to improving the well-being of communities involved in the projects.[1]

1. The full report is available upon request. Please contact **José Antonio Casis García** at jacasis@cec.org for further details. The report was conducted by SR Management Consulting.

ASSESSMENT METHODOLOGY

The long-term impact assessment was conducted between September 2023 and January 2024, and sought to answer four main questions:

(1) What impact have the SyS projects had on community well-being?
(2) How have the SyS systems strengthened the capacity of local public health professionals and emergency management officials in responding to extreme heat events, and have they created situational awareness that has allowed for improved decision-making?
(3) How have the projects supported capacity building and knowledge transfer?
(4) What lessons can be learned for future efforts by the CEC to build community resilience and adaptation in the face of accelerating climate change and increased likelihood of extreme heat events?

Answers to these questions were derived through a multifaceted assessment approach of document review (500+ documents), stakeholder interviews [United States Center for Disease Control and Prevention (CDC), Health Canada, *Comisión Federal para la Protección contra Riesgos Sanitarios* (Cofepris), Michigan Department of Health and Human Services (MDHHS) Kingston, Frontenac and Lennox & Addington Public Health (KFL&A), British Columbia Centre for Disease Control (BCCDC), Pinal Country Public Health Services District, and the Commission for Environmental Cooperation (CEC)] and the project-produced product review (guide).

Enhancement of intervention practices

The knowledge gleaned from the SyS system projects implemented in Hermosillo and Juárez has led to enhanced intervention practices by other types of decision-makers, emergency management officials (EMOs) and community organizations. In Hermosillo, stands providing drinking water are now set up during extreme heat events and oral serum doses are routinely administered. In Juárez, green spaces are being created to offset urban heat island effects.

In other directions, a more variegated understanding of the impact of extreme heat events was realized both spatially across surveillance areas (e.g., BCCDC, Ottawa, Michigan State, and Juarez) and cross-sectionally across populations (e.g., Pinal County, Hermosillo, Ottawa, and Juárez) allowing for differentiated strategies of response and targeted interventions to sub-populations vulnerable to extreme heat events.

MAIN FINDINGS

A Story of Impact

Quantitative evidence of the projects' impact is shown by the following data points: the State of Sonora in Mexico recorded a 51% reduction in the number of heat-related illnesses (HRIs) in the year following the implementation of the new syndromic surveillance system; BC identified 32 new distinct heat-health regions for the province; 315 health units became interlinked through a new SYS in the State of Chihuahua, including remote and rural communities previously not integrated in State health data networks; and 10 new community partners were identified by Pinal County for on-the-ground extreme heat events (EHEs) intervention and heat relief. These quantitative impacts are extremely important but do not tell the whole story.

Equally important are the qualitative outcomes that have emerged from the projects. New insight was gained in Hermosillo (Mexico), Pinal County (United States), Michigan State (United States), and Ottawa (Canada) regarding which populations in their surveillance area are most vulnerable to the effects of extreme heat events (*e.g.*, the data from Pinal County, Hermosillo and Michigan State showed that younger males (aged 18–44) have a significant risk of suffering heat-related illness and morbidity as a factor of their occupational activities). Expanded and empowered local decision-making has been enabled through new data capture and aggregation approaches and alerting structures that share real-time emerging HRI data trends beyond a limited number of centralized epidemiologists to a broader audience of public health professionals (reported by Hermosillo, Ottawa and the State of Michigan) and in some cases extended this knowledge-sharing to on-the-ground EHE intervention partners (Pinal County's partnership with the United Way) or with the general public at large (BCCDC and Pinal County).

New Situational Awareness

Both the 2015–2016 SyS pilot and 2017–2018 SyS expansion projects have led to greater confidence in the utility of the syndromic surveillance approach, secured evidence-based understanding of the impacts of extreme heat events on illness and well-being, and built capacity in two directions: enhancing the expertise and knowledge of SyS designers and researchers and building the capacity of the systems end-users, be they PHPs, EMOs, or the general public. Interviews with the CDC, BCCDC, KFL&A, MDHHS and Health Canada each raised the importance of the projects' contribution to syndromic surveillance systems research, data definition, and systems development perspectives. For example, the BCCDC uncovered the value of ambulance call records as a real-time HRI incidence diagnostics tool and gained insight into the importance of context as a key variable in understanding heat-health patterns and outcomes. The MDHHS reported the importance of the opportunity to invest time to improve data definitions which in turn are improving diagnostics and treatment. Further, Pinal County and Hermosillo's data capture and analysis of the "onset activities" of HRI cases has led to the identification of unexpected sub-populations of high vulnerability to EHEs.

Strengthening Capacity of Health Practitioners

In addition to project-related epidemiologists and team members, other public health professionals (PHPs) and emergency management officials (EMOs) also benefitted from the projects. In Hermosillo, the SyS pilot project included the training of front-line health practitioners and medical personnel, the training of medical students who collected records, and helped define heat-related syndromes for the surveillance platform, and emergency management officials and communicators who created public-facing presentations and materials aimed at public education around the risks of, and prevention strategies for, extreme heat events. It also led to new heat risk training at industries and workplaces where employees have prolonged exposure to heat events. The Ottawa SyS pilot project provided education sessions to improve understanding, diagnosis and reporting of HRIs among PHPs and EMOs including Telehealth Ontario nurses (the frontline for community health advising), 211 intake staff, paramedic EMS staff, and triage staff in Ottawa area hospitals. Furthermore, the Pinal County Arizona SyS project was co-designed as a collaborative project that brought together health agency officials with community organizations (Pinal County United Way and the Heat Relief Network). This collaborative design enabled direct communication pathways for evidence-based heat-health occurrence and HRI incidence to move from data systems directly to those in the community who could provide relief and refuge.

Knowledge Sharing

A further outcome from the 2015–2016 SyS Pilot was the production of a publication that contained "methodological information as well as guidelines and lessons learned on the design and implementation of real-time syndromic surveillance systems that can be shared with other North American communities" [CEC 2015]. The experience of syndromic surveillance development and refinement that unfolded in the 2015–2016 SyS Pilot jurisdictions (Ottawa, Hermosillo and Michigan) was captured by an expert team of health researchers, epidemiologists and systems development professionals from Kingston, Frontenac and Lennox & Addington Public Health (KFL&A) and published in 2017 under the title "A Guide for Syndromic Surveillance for Heat-Related Health Outcomes in North America" (Guide) [CEC 2017b]. This excellent Guide serves as a primer on syndromic surveillance and provides methodological approaches for best practice in syndromic surveillance system design.

Lessons learned

The 2015–2016 SyS Pilot and the 2017–2018 SyS Expansion projects have yielded significant insight into implementing or augmenting syndromic surveillance systems to improve responsiveness during extreme heat events. Lessons learned from these projects extend in three directions: partnerships and support, complexity and data design. The nature and diversity of real-time data sources, combined with confidentiality and privacy issues of personal health data, the balancing of actionable epidemiological data for health practitioners, and awareness-level data for the public that are required for SyS Systems development, demands complex, multi-sectoral partnership and thoughtful navigation.

Significant time needs to be built into all future SyS projects to allow for the front-end development of these trust relationships and include frequent partnership strengthening efforts far beyond the project's end. Term-based data agreements and government priority changes can significantly undermine the long-term impact and benefits of syndromic surveillance systems, with detrimental impact on community health.

The power and value of data cannot be understated for its ability to provide insight, generate new knowledge, and allow action in ways otherwise unimagined. The data that are most needed for health surveillance, however, are often not captured or even inaccessible due to medical privacy regulations. If they do exist, they may be messy, inconsistent, or at the least fragmented. In all cases of the CEC projects, the "data" ultimately used for the SyS Systems required deep research, complex processes of validation, piloting and reiterating, refinement of access and alerting algorithms, and human-centered contextual interpretation.

KEY RECOMMENDATIONS

Without hesitation, all who were interviewed as part of this long-term impact assessment process pointed to the value of the trinational arrangement for credibility, system design acceleration, knowledge sharing, and deeper understanding of heat-health impacts. There was a collective sense that the projects undertaken to date have affirmed the potential of heat-health syndromic surveillance systems and have provided keen learning for those jurisdictions that have participated. It was equally felt that more work is needed.

From understanding the successes, setbacks and lessons learned of the projects supported through the CEC's 2015–2016 SyS Pilot and 2017–2018 SyS Expansion projects, four recommendations emerge:

(1) A third climate-health project should be pursued by the CEC, designed to build on the best practice design features of the prior projects and enhanced to include four core pillars: focused on adaptation and/or resilience; broadened to consider all climate-induced health outcomes (not just heat related); inclusive of both physical health and mental health outcomes in defining HRIs; and intentional about addressing the differential impacts on, and adaptation approaches for, those populations that are especially vulnerable to the impacts of extreme climate events.

(2) A multifaceted capacity building plan should be required for all projects to ensure that those targeted by the project are equipped with the skills, understanding and insights to implement effective prevention, adaptation, and resilience responses.

(3) Project timelines should be designed with a three-year or five-year term to handle the complexity associated with systems design and data identification, implementation, results validation, and response execution.

(4) A health+climate monitoring and surveillance community of practice should be created for ongoing knowledge development and transfer.

CONCLUSION

The Syndromic Surveillance systems created and refined during the CEC's two projects have demonstrated their effectiveness as indispensable new tools to aid emergency management officials, public health officials and government agencies at all levels to improve the health and well-being of their citizens and build resilience for their communities. The rapid ongoing advancement of technology, the exponential growth in data, the increasing data literacy of public health professionals and emergency management officials, the rising attention being given to issues of vulnerability and health inequity, and the creativity of social engagement platforms, provide new opportunities for design and development of the next generation of syndromic surveillance systems to help combat the increasingly severe impacts of climate change. The unique collaboration and shared vision afforded for North America by the CEC can be harnessed to once again lead in the development of the next generation of syndromic surveillance systems and adaptation responses that will build healthy and resilient populations and communities across North America.

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