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Extreme Heat Events: Lessons from Seattle's Record-Breaking Summers

Triple digit temperatures are affecting areas of the U.S. that historically never experienced them, including the City of Seattle, where home and facility air conditioning is rare or is not designed for extreme temperatures. "[Heat domes](#)" (when the atmosphere traps hot ocean air like a cap) struck the city in the summer of 2021, leading to several days of temperatures nearly 30 degrees Fahrenheit above the average highs for that period. The Washington Department of Health reported 136 heat-related deaths across the state from June 26 through July 6, 2021 ([Heat Wave 2021](#)) and [a recent study](#) found a total of 159 excess injury deaths when that time period was extended to July 16. At least 10 died and 540 were treated in emergency departments across the state during a 2022 heat wave ([Ryan, 2022](#)).

To add to the challenge, the U.S. was in the midst of the COVID-19 pandemic. ASPR TRACIE's Senior Editor Dr. John Hick met with the following health care stakeholders (listed alphabetically) who shared how lessons learned during the heat dome event in 2021 informed the 2022 response and how robust regional and local collaboration and communications during the pandemic facilitated connections during the heat wave in the summer of 2022:

- Susan Koppelman (director of preparedness and response at the Northwest Healthcare Response Network [NWHRN] who also serves as incident commander for the Network's responses);
- Onora Lien (executive director of the NWHRN); and
- Dr. Steve Mitchell (emergency physician and medical director at Harborview Medical Center who stood up the Washington Medical Coordination Center)

■ John Hick (JH)

What kind of heat preparedness planning did you engage in before these heat dome events occurred?

■ Steve Mitchell (SM)

From the hospital perspective, we had not done much planning. We would reinforce public health messages, and during conference calls, we would

The [Washington Medical Coordination Center](#) (WMCC) is a statewide product of ongoing collaboration between the regional [Disaster Medical Coordination Centers](#) (DMCCs) and the [Northwest Healthcare Response Network](#). It is operated 24/7 out of Harborview Medical Center and was established to triage and place COVID-19 and related patients requiring acute hospital care in an equitable manner across Washington.

The WMCC currently works across the state to load balance day-to-day operations. When local, short duration surge events occur, the DMCC distributes patients at the county level (there are mini DMCCs set up across the region).

review basic plans including steps for cooling people and strategies for retrieving ice. We did not anticipate an event of this scale.

■ Onora Lien (OL)

From a health care coalition (HCC) perspective because extreme heat isn't as common in the northwest, this type of event was more like a consideration more than a specific focus. Prior to the 2021 heat dome, we were more engaged in supporting and amplifying public health in their messaging to vulnerable populations. Some hospitals, long-term care (LTC) facilities and other health care organizations may have focused more on facility temperature control, planned for emergency department surges for heat-related illness, and mitigating the effects of extreme heat on equipment and patients, but as a region this level of impact across our whole health care system was not a primary focus.

■ Susan Koppelman (SK)

Before the heat dome events, we could not have fully understood the range of impacts of this type of event. Extreme heat wasn't considered a separate hazard that was prioritized by coalition members. Across our coalition, climate change was considered as a hazard amplifier or "force multiplier," but across the region as a whole, extreme heat wasn't considered an independent or even top threat to health care relative to other hazards and threats.

■ JH

Do you work with the University of Washington's (UW) various climate and health centers to help inform your planning and extreme heat preparedness?

■ SK

Yes, and it is an amazing relationship that benefits us, as well as our city and county emergency managers and public health. More recently, our team had the opportunity to attend sessions through the university that helped us learn about planning parameters around extreme heat. We were able to borrow and adapt some of their strategies in our [Extreme Heat Tip Sheet](#) and other communications we developed to support health care before and during events. They are also supporting our after-action report efforts regarding the 2021 extreme heat response.

■ OL

We work with multiple programs and teams and leverage different information from the various groups at UW (e.g., the Climate Impacts Group, the Center for Health and the Global Environment, and the Collaborative for Extreme events resilience. We are currently working on our after-action study of the 2021 event with a team under the umbrella of the Collaborative for Extreme Events Resilience and Center for Health and Global Environment. They conducted facilitated discussions and data collection with our coalition members and partners (ranging from very rural to very urban) across each of our regional districts throughout western WA.

■ JH

Onora, what other organizations have been helpful as you recraft your preparedness for extreme heat events?

Related Resources

Washington Heat Dome Resources

[2021 Heat Wave is Now the Deadliest Weather-Related Event in Washington History](#)

[Excess Injury Mortality in Washington State During the 2021 Heat Wave](#)

[Heat Wave 2021](#)

[Hospitals Brace for Surge as Seattle Area Feels the Heat](#)

[Washington Heat Wave Kills 10. Emergency Rooms Treat 540 Heat Victims \(2022 event\)](#)

University of Washington's

[Center for Health and the Global Environment](#)

[Climate Impacts Group](#)

[Collaborative on Extreme Event Resilience](#)

Extreme Heat Planning Resources

[Extreme Heat Tip Sheet](#)

[HEAT.gov \(National Integrated Heat Health Information System\)](#)

[How Health Care Organizations Are Preparing for Climate Shocks and Protecting Vulnerable Patients](#)

[NWS HeatRisk Prototype](#)

ASPR TRACIE Resources

[Natural Disasters Topic Collection](#)

- [Lessons Learned: Extreme Heat](#)
- [Plans, Tools, and Templates: Extreme Heat](#)

■ OL

In addition to the university, and from a coalition perspective, in terms of updating our coalition HVA, one of our top priorities is engaging across the continuum of health care. Working with the university is important, but so is working with our state, local, and tribal public health and emergency management agencies and ensuring their perspectives on extreme heat and vulnerable populations are incorporated. The National Weather Service is also a critical partner; many of our health care partners listened in on their readiness calls during the heat waves. However, as we engage more of health care from the continuum of care—and from both rural and urban areas—it improves our HVA planning and overall regional, then jurisdictional and district preparedness (geographic sub regions within our coalition).

■ JH

This response was layered on top of your COVID-19 response. You already had a robust structure and communicated regularly with DMCC and others; how did that help to coordinate the entities that needed to be involved as the forecast became worrisome?

■ SK

One good thing that came out of COVID was our increased connectiveness with others in the field. The WMCC also positively impacted our ability to connect during the various events we experienced, including civil unrest and extreme heat. During the heat dome event, working with DMCC, WMCC, and our LTC associations partnered with the Network to make the response a success.

The first heat dome event in 2021 occurred during the pandemic, so when the forecast indicated the threat of extreme weather and we shifted to more immediate planning we integrated our incident command meetings and our regular partner meetings; we were meeting at least once a week with our entire stakeholder coalition groups, including the Washington Medical Coordination Center, and in some cases it was daily. This helped us not clog the airwaves or duplicate effort. We were also able to make assignments, carve out our respective spaces, and develop healthcare-specific resources on this new risk we were facing. In 2022 we applied what we learned about using this approach to coordination and planning, and also developed the heat tip sheet which has received positive feedback. We subsequently applied this process to the development of other tip sheets.

■ OL

Over the summer in 2021, I would say we were between ankle and knee-deep in COVID. We were not quite at the same level of COVID surge we had been in previously and health care was trying to get back to other focuses and resuming delayed care. We had tried to deactivate and scale back some of our response. However, the 2021 heat dome was a real pivot point for us. The forecast for heat prompted us to engage at a coalition level differently and more deeply in western Washington since it was a more local regional event and not coordinated statewide as some aspects of COVID had been. It prompted us to start holding daily calls with our hospital systems to anticipate levels of readiness and share capacity information more specifically than we had been at the start of COVID. Concurrent events—the pandemic, civil unrest in the spring, and the upcoming 4th of July—gave us the opportunity to engage more on a regional level. It was an opportunity for us to elevate concerns and issues we saw during the first year of COVID that were impacting hospital capacity but do so with a focus on the impacts to another immediate threat in front of us. We met with hospital and other health care facilities regularly and were able to amplify with state and local leaders the concern around the “long length of stay” and difficult-to-discharge patients in the event of a heat wave which we thought might lead to patient surge and affect fire and emergency medical services (EMS) if there was a mass casualty incident. We also brought dialysis partners together to develop after-hours and outpatient solutions for eligible patients so they could be discharged and make room. We had to advocate differently to create hospital capacity in the hospital, and this gave us a different voice that we were able to then build upon throughout the rest of COVID response and for other events and surges as well.

■ JH

Let’s set the scene for the 2021 heat dome incidents; please explain the scope, number of days, and impact of the event on your community.

■ SM

The temperature at the end of June in Seattle is usually in the high 70s and low 80s. In 2021, we had a three-day period where temps were over 100 (F) and challenges increased exponentially and peaked on the third day; our medical systems were stressed, and we hit a threshold where things became unmanageable. The historic baseline for EMS responses to heat-related illness calls for a like period is 2 in all of King County. In a three-day period that June, we had more heat-related events than in the prior three years combined. County EMS normally receives 600 calls per day; on June 28, we received 1,133, setting an all-time record. We also had seven drownings, double the average for that time period.

The third day of the event resembled a mass casualty incident, where we witnessed an exponential rise in calls and admissions in a concentrated time period, primarily of patients who suffered cardiac arrest and were from more vulnerable populations (e.g., they lived alone, from more marginalized populations). The average age of these patients was 64, but many were older. We managed more cardiac arrests over the phone with EMS than we ever had. In the DMCC, we realized that not all emergency departments were impacted the same way; those that served the highest numbers of vulnerable patients became overwhelmed far faster. They were in crisis and running out of staff and ventilators and had seen what used to be a career's worth of patients with heatstroke and related life-threatening conditions in a matter of hours. We cooled patients by placing them in ice in body bags and using cooling catheters.

■ JH

Did hospitals activate disaster plans?

■ OL

Many hospitals did activate plans at some level. There were a wide range of local facility impacts; some had to do horizontal evacuation of particular wings because cooling wasn't sufficient; many had to cancel non surgeries for a combination of reasons, including surge capacity. COVID also compounded some challenges because facilities had to address cooling strategies for facilities while also dealing with necessary infection control (this was also a challenge in LTC facilities who were accustomed to using fans and could not due to risk of spreading disease). With many remote staff (especially those in incident command structures), some hospital systems also had to prepare for potential incident command impacts for staff who might be affected by power disruptions due to rolling outages or potential brown outs.

Home health providers also had to develop plans with patients and families for safe home care in the heat, check in on patients, and work with families on redundant plans for keeping loved ones cool if they experienced power outages or if their residence got too hot.

■ SM

Everything was manageable until the afternoon of the third day. We all came together to determine who was overwhelmed. At Harborview, we activated our disaster plan as did other hospitals. We took an active management of distribution of ALS units in King County (which we normally do not do). We did this to distribute patients to less impacted facilities; we had never done this before. This was all run through our DMCC structure at Harborview until things slowed down later that night.

■ JH

Did you experience any utility challenges?

■ SM

Harborview did not, but some hospitals in our system and region did experience utility challenges. The NWHRN did a great job tracking those impacts, which were relatively brief. Some nursing rooms and operating rooms lost power. CT scanners and other types of facility-based equipment overheated and stopped working for reasonably short periods of time. Some operating room parameters were exceeded due to the inability to cool the rooms; the systems simply could not keep up with the demand.

■ OL

Many of our health care facilities simply were not set up to accommodate that level of heat out here. For example, during the 2021 heat dome, one of our hospital's air conditioning systems was not sufficient in their inpatient behavioral health

unit so they evacuated those patients to other areas and facilities. There were intermittent utility interruptions across the region, due to power interruptions as a result of the extreme heat, overuse of air conditioning, and related causes.

■ JH

How did this affect long-term care facilities?

■ SK

As Onora said, our infrastructure is not built to tolerate this type of heat; LTC facilities are no exception. Not every facility in the region has air conditioning, and if it does, it is more likely to be set up to cool common spaces, not necessarily patient rooms. Many of our larger counties increased their coordination with LTC associations who were also pre-planning and participating in our calls. Most facilities that had air conditioning in a common space had to weigh concerns about bringing residents into that space to keep them cool due to COVID and the need for maintaining infection control practices. Staff were also very tired due to having to manage yet another disaster on top of the COVID-19 pandemic, so this was an added effort. Facilities took different steps to support their staff (e.g., allowing them to stay at the hospital in air-conditioned areas).

Our team at the Network focused mainly on preparedness and logistics with LTC, but honestly we had to do a lot of “ground truthing” as well. For example, if emergency manager X heard that LTC facility Y was closing their doors, we did the work to determine the accuracy of that rumor. Overall, LTC did amazingly well. There was only one facility that came close to having to close their doors due to not being able to cool the air and the patients. There were no fans for purchase in many areas, no one could fix your air conditioning if it went down, and parts were hard to find. We helped put them in touch with other LTC providers who were able to give them suggestions and keep them from having to evacuate their residents. We truly were problem solving and ground truthing on the fly.

■ JH

Are you targeting your communications to specific populations now?

■ OL

LTC, home health and dialysis organizations continue to be a priority as well as working our federally qualified health centers (FQHCs). Many of the FQHCs also work closely with local public health and are coordinated with their messaging as well to reach target vulnerable populations. We also continue to work closely with EMS and the acute care hospitals.

■ SM

Other vulnerable populations we are trying to communicate with are those who live in small, non-air-conditioned public housing units that are under older building codes. A lot of these residents are older and may be taking medications that put them at higher risk.

■ JH

Did public health set up cooling centers?

■ SK

Most of the public health agencies in the affected area set up cooling centers. Because Washington is such a strong home rule state, public health engages in a variety of ways in ESF #8. There were times we worked directly with them, and other times we would inform them or, for example, make formal requests to them to activate their emergency management if needed for logistics support.

■ OL

Cooling centers were generally set up around the region but who led them varied county to county and city to city; whether it was emergency management or public health depended on local plans. This was a very important issue. Our hospitals



and health care facilities really valued getting information on the availability, locations, and hours of cooling centers. This was helpful for those in the emergency departments, for discharge planners, outpatient providers, home care, LTC, and EMS. One of the challenges was that some jurisdictions didn't have the resources to set up as many centers as they might have needed and there were learnings about improvements needed in order to get the messaging out about their availability. In some communities cooling centers were set up, but very few people used them. There was also a challenge in some areas that weren't able to keep cooling centers open at night. During this extreme heat event, we didn't see much cooling in the evening, and so there was still a high risk for heat impacts in the evenings and overnight, when we otherwise would have expected cooler temperatures.

■ JH

What other lessons did you learn in real time?

■ SK

We had a day in the very beginning where hospitals were starting to go on ambulance divert and EMS was frustrated because there were rumors circulating about hospital status, challenging our ability to get them to the right areas. We addressed these rumors, and at the same time, DMCCs were hosting meetings with EMS and their hospitals to encourage them to stay off divert. We tapped Harborview's DMCC to coach others on how to stay off divert and how DMCCs could coordinate patient placement.

■ JH

Your area experienced another heat dome in 2022; how did that response go compared to the 2021 event, and what is next as far as planning goes? Are you acquiring additional resources, such as chillers and bladeless fans to help prepare for another event?

■ SM

We are trying to have a more active role with advanced lifesaving EMS agencies in King County; our goal is to communicate earlier and activate shelters earlier when we see high heat in the forecast. We are also working on having each dispatch agency notify us in real time when they see an uptick in heat-related illnesses. We also now have a much lower threshold for managing EMS destinations when we see one hospital being overly impacted.

■ OL

What we learned in 2021 is that extreme heat can have significant and cascading impacts on emergency departments, staff, and operations across the rest of the health care facility. As referenced in the article [How Health Care Organizations Are Preparing for Climate Shocks and Protecting Vulnerable Patients](#), leaders are paying attention differently, and are more willing to consider investing in resources like chillers and mitigating impacts on infrastructure. Our teams are also treating anticipated heat waves as a critical event and reviewing their levels of preparedness sooner. As Steve said, teams are meeting more frequently and earlier to share information. At a regional level, what's been demonstrated is that the level of coordination needed for success relies on the fact that our coalition exists and that we can do what we do—convening partners, maintaining situational awareness around capacity and impacts across the health care system bringing people together to understand thresholds, connecting public health departments with each other and partners to amplify and share information, and bringing associations into the discussion to help support their members. This level of coordination and communication has helped improve our responses. Partners now appreciate that in an extreme heat event, there are clinical impacts, infrastructure impacts, and information sharing needs, and no single institution can manage them on their own. We have to do it together and it takes a dedicated effort to ensure that level of coordination happens. We didn't understand all of these factors as needs to deal with heat prior to 2021. In 2022, at all levels, a much more proactive stance was taken, and I think that is going to continue.

Editor's note

Seattle was fortunate in a way that the extreme heat did not last longer and imaging, laboratory, and other equipment only temporarily overheated. They also were able to obtain adequate quantities of ice, which can be extremely difficult after a disaster, let alone during a heat wave. Further, Seattle's power outages were limited in scope and duration. Had power been lost to health care facilities (including long-term care) it is unlikely in their area that facility generators would have been designed to sufficiently power the air conditioning units. Many facilities may have needed to evacuate, compounding strain on remaining facilities. Loss of power to homes compromises electricity-dependent medical equipment and dramatically increases the potential for heat-related illness and death. Extremes of temperature such as this often generate cascading failures of utilities in the community that challenge health care operational capabilities and can greatly increase the number of victims in the community. Health care facilities and coalitions need to be prepared for a range of system failures during disasters and be as self-sufficient as possible.