

Preparing Minnesota for Extreme Heat Events

Minnesotans are more equipped to deal with snowstorms and the extreme cold than extreme heat. Extreme heat notification and response plans are critical to preparing Minnesotans for extreme heat events. Notification systems and plans reflect local conditions and draw upon available local expertise and resources. As a result, local notification and response plans vary. This chapter discusses the key steps in responding to an extreme heat event and how to develop a heat response plan. The chapter also summarizes a range of strategies that can be included in the response plan and used to prevent morbidity and mortality from extreme heat events.

Key Steps for Planning for and Responding to an Extreme Heat Event

The key steps for planning for and responding to an extreme heat event have been summarized in Figure 1 on page 3-3. Below is a detailed description of each step.

Step 1: Create a heat response plan

The first step in preparing to respond to an extreme heat event is to develop a heat response plan. A heat response plan is essential for describing and coordinating activities to prevent heat-related morbidity and mortality. The next section, “Developing a heat response plan,” describes the minimum elements of an effective response plan. The response plan should define the lead agency responsible for the plan, criteria for activating the plan, and the roles of agencies and organizations involved with the plan. The plan also should contain a communications plan, identify high-risk and vulnerable persons, describe strategies to prevent heat-related illnesses and deaths, and establish an evaluation process.

Step 2: Predict extreme heat event and transfer information to lead agency

For successful notification of an upcoming heat event, it is critical for the lead agency of the response plan (see the next section for a description of the lead agency) to develop partnerships with the NWS to ensure early weather forecasts capable of predicting extreme heat conditions a few days in advance of an extreme heat event. In Minnesota, the NWS provides weather forecasts and determines the issuance of heat advisories, watches or warnings. Definitions and processes used by the NWS to determine extreme heat events are described in the section, “Defining extreme heat events.” All Minnesota jurisdictions involved in planning and implementing heat response plans should develop relationships with their local NWS station to ensure daily monitoring of weather conditions and early detection and transfer of information regarding the characteristics of the upcoming event to the lead agency of the response plan.

Step 3: Assess risk and determine activation of response plan

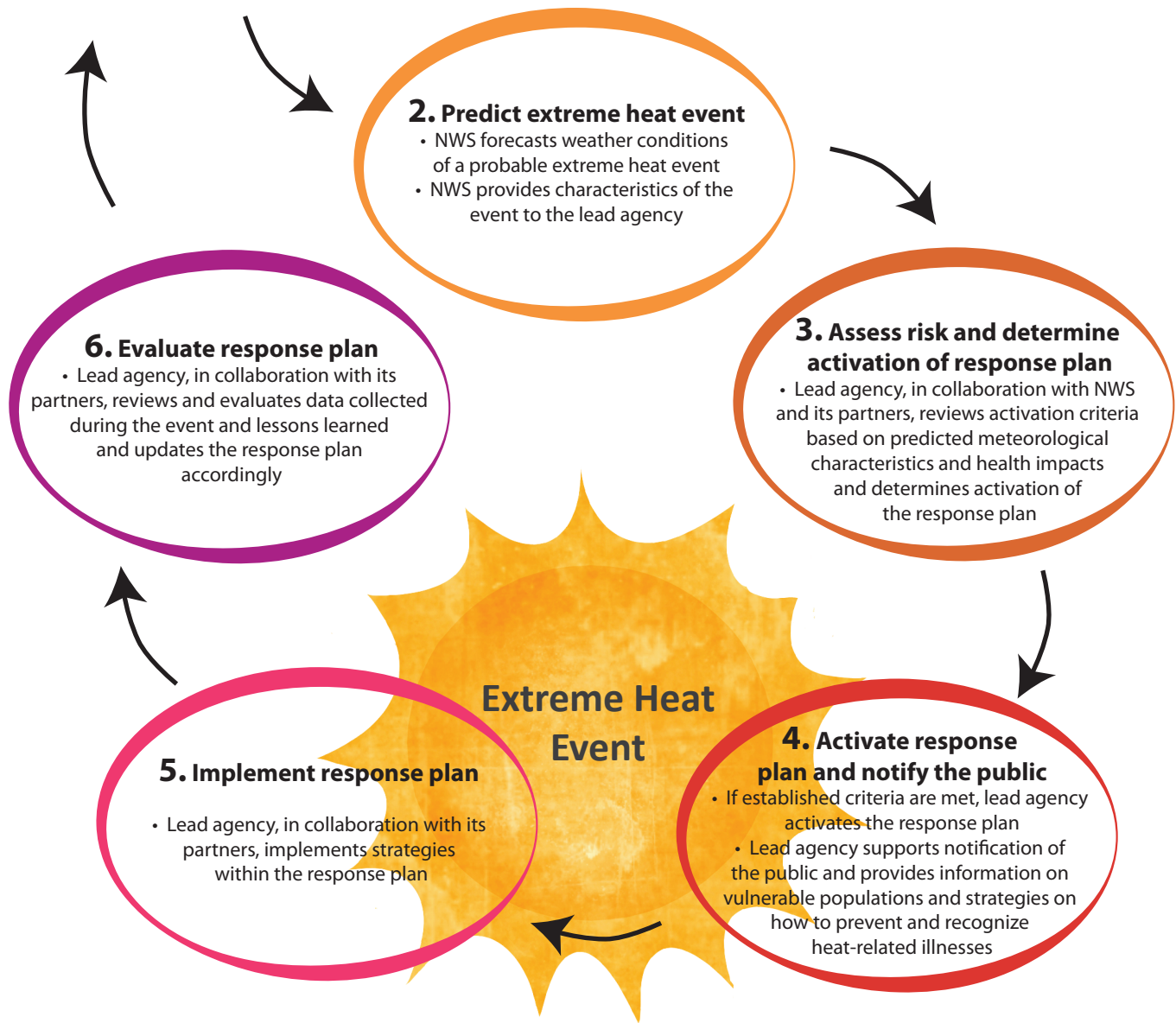
Once the lead agency is informed of a possible extreme heat event, the agency, in collaboration with its partners, needs to determine if the characteristics are indicative of an extreme heat event that could trigger activation of the heat response plan. Generally, the lead agency reviews the NWS forecast data and health-impact information to determine whether location-specific criteria for an extreme heat event are satisfied, and then, if the conditions are met, the agency activates the plan. Activation of the heat response plan should happen before the extreme heat event occurs to ensure that preventive measures and strategies are implemented at the most opportune time for preventing illnesses and deaths from extreme heat.

Figure 1: Key Steps for Responding to an Extreme Heat Event*

1. A heat response plan should be developed before an extreme heat event. Below are the critical elements of a successful response plan.

Response Plan Elements:

- Identification of a lead agency responsible for the response plan
- Defined criteria for activating and deactivating the plan
- Defined roles and activities of agencies and organization involved with the plan
- A communications plan for communicating heat-related information to partners and the public before and during an extreme heat event
- Identification of vulnerable persons
- Strategies for preventing morbidity and mortality from extreme heat
- Evaluation of the response plan



* Although this diagram presents key steps in responding to an extreme heat event as discrete steps, actual details and timing of each step will vary locally. For example, determining the activation of the response plan may happen simultaneously with notifying the public of an impending extreme heat event. The response plan should reflect local conditions and resources and should clearly articulate each step in responding to an extreme heat event, along with the agencies and organizations that are responsible for implementing each step of the process.

Step 4: Activate response plan and notify the public

Assuming the impending heat event meets location-specific criteria for an extreme heat event, the lead agency activates the response plan. Immediately after a decision has been made to activate the extreme heat response plan, the public needs to be informed of the timing, severity and duration of the forecasted extreme heat event. Effective public notification of an upcoming extreme heat event helps eliminate the risk of the heat event taking a population by surprise. Notifying the public of anticipated conditions, strategies to stay cool and hydrated, and places to go to cool off will enable residents to prepare themselves and will enable the organizations involved in the response to concentrate on known high-risk individuals and locations. Advance public notification about the cooling centers (if used as a strategy) will increase the likelihood that at-risk individuals can take advantage of these services. All messages regarding an upcoming extreme heat event should be coordinated with media outlets to ensure the public receives consistent and accurate information. The communications strategy should be described in detail within the heat response plan.

Step 5: Implement response plan

The fifth step in responding to an extreme heat event is to implement the strategies in the response plan. The strategies should reflect the demographics and vulnerabilities of the community. See the next two sections for detailed descriptions of several strategies that can be inserted into the response plan. The response plan should clearly delineate which participating agencies and organizations are responsible for implementing each strategy.

Step 6: Evaluate response plan

Each step of responding to an extreme heat event should be reviewed and evaluated after an extreme heat event. Evaluation is critical for improving the plan and making it more effective for preventing heat-related illnesses and deaths in the future.

Developing a heat response plan

Heat response plans have been shown to be effective in reducing heat-related mortality.⁷² Heat response plans describe in detail the roles and actions of government agencies and nongovernmental organizations for preventing morbidity and mortality from an extreme heat event. Each city or county in Minnesota should have a heat response plan. The level of detail and the number of strategies in the plan will vary based on available resources, geographic location, agencies and organizations involved in planning and responding, and the types and distribution of vulnerable populations. For a draft heat response plan that can be modified and adapted to a local jurisdiction, see Appendix D.

All Response Plans Should Contain the following Elements:⁷³

Lead agency: A lead agency for implementing the extreme heat response plan should be identified. Typically, a health department or emergency management is the lead agency in charge of responding to extreme heat events, but this can vary at the local level. The lead agency will activate the plan and help coordinate the efforts of organizations involved in the response.

Criteria for activating and deactivating the plan: Criteria for activating and deactivating an extreme heat response plan vary and should be based on location-specific factors that affect the relationship between weather and mortality. These factors may include air temperatures, dew point temperatures, wind, daytime highs and overnight lows, and how long the hot weather is expected to last. Some public health departments have their own thresholds and calculations that include health-related criteria for extreme heat events. Others use the NWS criteria for activation. See the box below for how the City of Minneapolis determines activation of their heat response plan.

Minneapolis Department of Health and Family Support Activation of Heat Response Plan

The Minneapolis Department of Health and Family Support reviews information from the Synoptic Health Watch-Warning Network to assess the health risks for an upcoming heat event. The integrated heat health watch/warning system uses meteorological forecast data as inputs into a health impact model. The program identifies when forecast conditions may result in excess mortality and estimates the potential number of heat-attributable deaths. This information is used by Minneapolis to determine activation of the heat response plan and the type and scope of response activities that will be implemented.

Roles and activities of agencies and organization involved with the plan: Implementation of a heat response plan requires close collaboration between government agencies (e.g., local public health department, city/county emergency management, NWS, tribal health departments) and non-governmental organizations, especially organizations that serve the community and vulnerable populations (e.g., the American Red Cross, Meals on Wheels, Salvation Army). Engaging local organizations that work with vulnerable populations in planning and implementing the response plan will make it easier to identify appropriate strategies for the vulnerable populations in the community. Additionally, these organizations are most likely to perform successful outreach and strategies targeted to specific populations. The plan must clearly articulate the roles and responsibilities of all the organizations involved in the plan.

Communications plan: The communications plan needs to articulate communication strategies both between partners involved in the response plan and with the public. There should be frequent communication between the NWS, the lead agency in charge of the response plan and other collaborating agencies and organizations. Additionally, the plan should identify communication strategies for communicating heat-related information before and during an extreme heat event. For example, the lead response agency, in coordination with other partner organizations, should coordinate extreme heat education/awareness campaigns in their communities in the spring before a heat event to help prepare and educate residents of the dangers of extreme heat.

In addition to messages to the public, information should be provided to organizations/companies that have at-risk populations (e.g., young children, outdoor workers, elderly) and may include the following: schools, daycares, landscape/construction businesses, sports teams/camps, and senior living facilities. Messages should include information on what to do (e.g., how to prevent illnesses from extreme heat) (see Appendix E for a tip sheet), symptoms of heat-related illnesses (see Table 2 on page 2-3), characteristics of persons more vulnerable to extreme heat (see Table 3 on page 2-5), and where to go for more information. Messages may be transmitted through a variety of media outlets, including television, radio,

internet, and distribution of fliers and posters. Messages should be tailored, translated and sensitive to the demographics and population of the area. For example, translations of tip sheets for individuals could be translated into the top five languages spoken in Minnesota, in addition to English, which are Spanish, Hmong, Somali, German and Vietnamese.⁷⁴ The communications plan should be developed before the heat event and updated after the event using lessons learned from implementing the plan.

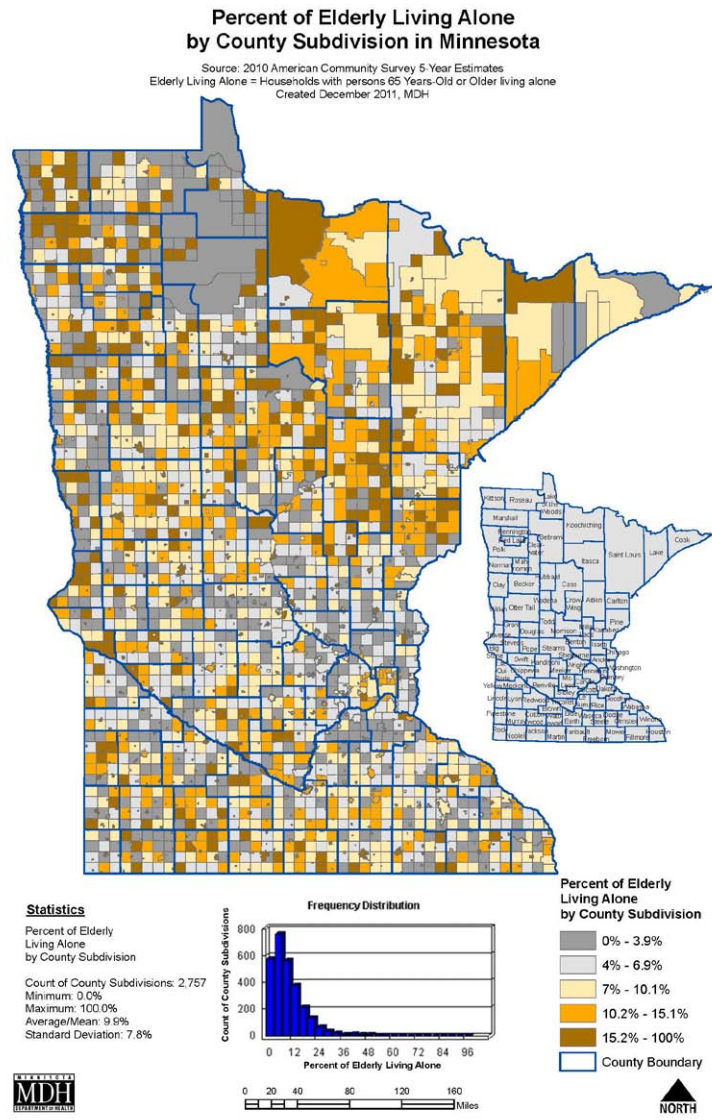
Identification of vulnerable persons: Quantifying and mapping vulnerable populations and other risk factors provide important information for planning and implementing appropriate strategies that reach the most vulnerable members of a community. The lead response agency or another entity should create data summaries and/or maps to identify the most vulnerable populations in their community and where the populations reside, so that appropriate preventative actions and strategies for these populations can be determined before an extreme heat event. See the section, “Characteristics that increase the risk of heat-related illnesses,” for more information on characteristics to map.

MDH created a suite of resources to aid local public health departments in locating their community’s vulnerable populations. The suite includes the following resources:

1. Statewide maps of five vulnerability characteristics:
 - a. Percent of population 65 years old and older
 - b. Percent of population less than 5 years old
 - c. Percent of population 65 years old and older living alone (see image on the right)
 - d. Percent of population living below the poverty level
 - e. Percent of population living below 200% of the poverty level.

These maps can be found online with an Excel spreadsheet that contains tabulated data at: <http://www.health.state.mn.us/divs/climatechange/extremeheat.html>. The data described in the state maps are at the county subdivision level (e.g., city, township, or unorganized territory).

2. A list of data sources for vulnerable populations and risk factors identified in the section “Characteristics that increase the risk of heat-related illnesses.” The list links the characteristics



to appropriate data sources. Two types of data sources are referenced in the list: a source that contains summarized/tabulated data at the county level, and another source that contains raw data for lead agencies that may want to create maps or summaries at smaller geographic levels, such as cities or census tracts. The list of data sources can be found in Appendix F.

3. A GIS primer that describes how to use GIS to create maps of vulnerable populations and risk factors. This resource has been developed for local public health professionals and planners who already have some knowledge of ArcGIS software. It walks users through the process of joining data to shapefiles and how to display the joined data using quintiles. The primer on mapping vulnerable populations and certain risk factors can be found in Appendix G.

In 2011, MDH worked with the Minneapolis Department of Health and Family Support to develop a set of maps to help identify vulnerable populations and environmental characteristics that could aid with implementing strategies to prevent heat-related morbidity and mortality. The set of maps can be found in Appendix H. The partnership helped identify additional factors that are important for planning for extreme heat events, including mapping the locations of public air-conditioned buildings, the percentage of residential units with central air-conditioning, special residential buildings such as nursing homes and group homes, and impervious surfaces within the community. In one instance, by geographically identifying where cooling centers/cool buildings are located and comparing those locations with where vulnerable populations reside, public health staff were able to identify places that needed additional resources and were able to site cooling centers or other resources in places that were easily accessible to the at risk populations. The Minneapolis maps are meant to provide an example of some of the additional types of characteristics that may be helpful to review when planning for an extreme heat event. Local jurisdictions may discover other important characteristics to map as they develop the best strategies for their community.

Evaluation: Response plans should be reviewed and evaluated after an extreme heat event. Modifications to the plan should address lessons learned and changes in local conditions. This ensures continuous quality improvement and rectifies any challenges or mistakes observed from implementing the plan during previous events. The agencies and organizations involved in responding to the extreme heat events should partake in the evaluation process. Records on heat-related morbidity and mortality that occurred during the extreme heat event also should be collected, analyzed and used to adjust strategies and/or criteria for activating the heat response plan.

Additional strategies to prevent heat-related illnesses

In addition to those essential elements described above, there are more strategies that may be included in a local heat response plan. Not all of the following strategies will be feasible or appropriate for every location. The best strategies for any given jurisdiction utilize local resources and are tailored to the at-risk populations within the community. For a listing of some of the strategies that have been implemented in Minnesota, see Table 4 on page 3-10, which provides a checklist of response plan elements and strategies and demonstrates activities performed by Olmsted County Public Health Services and the Minneapolis Department of Health and Family Support to prevent morbidity and mortality from extreme heat. For a detailed case study of strategies and lessons learned by Olmsted County Public Health Services, see Appendix I.

Coordinate distribution of information on heat exposure symptoms and tips on how to stay cool for public broadcasts: Educating the public and communicating prevention information to them before and during an extreme heat event is critical to reducing illnesses and deaths due to extreme heat exposure. Publicly broadcasting cooling tips and symptoms of excessive heat exposure should complement broadcasts about the extreme heat conditions and help residents respond to the heat appropriately (e.g., stay well-hydrated, seek air-conditioned locations, minimize direct sun exposure). See Appendix J for a sample press release. A tip sheet for staying cool can be found in Appendix E.

Disseminate information related to preventing heat-related illnesses to community organizations and facilities with concentrations of high-risk individuals: Developing a database/list of facilities (e.g., those with mobility/health impaired residents) and organizations that serve vulnerable populations and their locations aids prioritization of prevention efforts to populations vulnerable to extreme heat and facilitates dissemination of extreme heat information to the organizations that serve these populations through faxes, emails, and/or telephone contact trees. For example, nursing homes and senior living centers that might not have air conditioning should be contacted and provided information to ensure that their populations are staying cool and are being assessed for symptoms of overexposure to heat.

Activate a heat line: An emergency heat line provides real-time advice and information during extreme heat events that can help prevent heat-related illnesses. A heat line can be activated when the response plan is activated or heat-related messages can be incorporated into more general, full-time systems (e.g., 211 line). In much of Minnesota, the United Way supports a 211 line that provides information to people during an extreme heat event. The Minneapolis Department of Health and Family Support utilizes the city's 311 information line to disseminate heat event information and track the number of calls coming in related to extreme heat issues. Monitoring heat line calls and 911 calls made during an extreme heat event can provide information about how well the community is adapting to the heat. A reverse 911 call system can be activated, so that numbers that call 911 during an extreme heat event can be dialed and notified of current information on weather forecasts and safety measures.

Identify and designate buildings with air conditioning as public cooling centers and extend hours of operation: Spending time in an air-conditioned building during an extreme heat event is one of the most effective means of reducing a person's risk of developing a heat-related illness. Work with partners to identify and designate specific public or private buildings with air conditioning as official cooling centers. If possible choose buildings with back-up generators for cooling centers. Cooling centers should be ADA accessible and monitored by appropriate staff. Information on providing full access to a cooling center can be found in Chapter 7 of the *ADA Best Practices Tool Kit for State and Local Governments*, available online at: <http://www.ada.gov/pcatoolkit/toolkitmain.htm>. Extending the hours of operation of the cooling centers increases the opportunity for high-risk individuals to spend time in an air-conditioned environment. Providing free public transportation to cooling centers helps individuals who may have limited access to transportation and financial resources to reach the center.

Work with the public and private sector to allow public gathering at buildings with air conditioning and extend hours of operation: Minnesota has had varying degrees of success with opening public cooling centers. See Appendix I for a description of Olmsted County Public Health Services experience with providing cooling centers. Allowing the public to congregate freely at air-conditioned places where they already frequent, such as shopping malls, libraries and movie theaters, can increase the use of air-conditioned buildings and minimize negative health impacts. Agreements should be made with the owners of these buildings before announcements are made to the public about visiting the facilities. Many

of the people who are at greatest risk for negative health effects from an extreme heat event may regularly visit specific air-conditioned locations and may be more likely to go to these places versus a cooling center. Hours of operation of public spaces, such as libraries and public swimming pool, may be extended to increase accessibility for working families. Providing free public transportation to cool places during an extreme heat event helps individuals who may have limited access to transportation and financial resources to reach a cool destination.

Outreach to vulnerable populations: Some high-risk individuals (e.g., elderly living alone, homeless persons) need to be contacted directly, and, preferably, observed several times a day during an extreme heat event to ensure that cooling tips are being followed (e.g., fluids are being consumed, appropriate clothing is being worn) and that any symptoms of overexposure are recognized and alleviated as early as possible. Depending on local resources, persons involved in the outreach process can include the following: social and health workers, volunteers, church organizations, other nongovernmental agencies, and the police. Additional efforts must be made to outreach and evaluate the homeless. Increased outreach efforts should be supported by authorizing officials to move individuals believed to be experiencing medical difficulties or at extreme risk to cooling shelters for observation and treatment.⁷⁵

Arrange for extra staffing of emergency support services: Extreme heat events place additional burdens on emergency medical and social support services through increased use of these services. Increasing staffing helps avert any crises that may arise from the systems becoming overwhelmed. Hospital administrators should be encouraged to prepare for increased patient loads during extreme heat events.

Suspend utility shutoffs and provide transportation and financial assistance: Local governments should develop partnerships and/or policies to prevent power and water companies from shutting off services to their customers due to nonpayment of bills during extreme heat events. Drinking water, taking cool baths/showers and using air conditioners are some of the most effective ways of preventing heat-related morbidity and mortality. Free bus passes and/or other subsidized means of transportation to cooling centers also should be provided to low-income people. Vouchers for buying air conditioners and financial aid for electricity bills are other ways of providing assistance to low-income people.

Provide water at public places: Providing sources of clean potable drinking water at strategic locations in public places (e.g., parks, malls and cooling centers) enhances people's ability to stay hydrated.

Reschedule outdoor public events when possible: Developing and implementing policies that identify when large outdoor events or activities (e.g., sports games, outdoor camps, concerts) should be canceled or rescheduled due to extreme heat can help prevent heat-related illnesses. To the extent that local officials can control these events (e.g., through permits or use of facilities), efforts should be taken to reschedule an event or, when rescheduling is not feasible, require water stations, medical staff and/or "cool zones" for attendees.

Provide information to pet owners on protecting their pets from extreme heat: Some pet owners are reluctant to leave their homes to go to a cool place if they cannot bring their pets with them. Providing messages to pet owners on tips for keeping their pet cool and hydrated can help to alleviate their anxiety. Also, pet owners can be encouraged to call their veterinarian if they have any specific concerns. If possible, identify a local cool place that may be willing to accept people and their pets.

Table 4: Checklist of response plan elements and strategies implemented by Olmsted County and the City of Minneapolis

Strategies	Olmsted County	City of Minneapolis
Response Plan Elements¹		
Lead agency responsible for the response plan	✓	✓
Criteria for activating and deactivating the plan	✓	✓
Assigned roles and activities of agencies and organization involved with the plan	✓	✓
Communications plan for communicating heat-related information to partners and the public before and during an extreme heat event		✓
Identification of vulnerable persons	✓	✓
Strategies for preventing morbidity and mortality from extreme heat (see below)	✓	✓
Evaluation of the response plan	✓	✓
Response Plan Strategies		
Prediction		
Establish partnership with local National Weather Service (NWS) station to ensure access to weather forecasts capable of predicting extreme heat conditions a few days in advance of an event	✓	✓
Ensure timely transfer of weather forecasts to lead agency	✓	✓
Assessment, Activation and Notification		
Review activation criteria based on predicted meteorological characteristics and health impacts and determine activation of the response plan	✓	✓
Coordinate distribution of information about the anticipated timing, severity, and duration of extreme heat event; heat exposure symptoms; and tips on how to stay cool during an extreme heat event for public broadcasts	✓	✓
Implementation		
Disseminate information related to preventing heat-related illnesses to community organizations and facilities with concentrations of high-risk individuals	✓	✓
Activate a heat line		✓
Identify and designate buildings with air conditioning as public cooling centers and extend hours of operation	✓	✓
Work with the public and private sector to allow public gathering at buildings with air conditioning and extend hours of operation		✓
Outreach to vulnerable populations	✓	✓
Arrange for extra staffing of emergency support services		✓

¹ Table and strategies adapted from U.S. Environmental Protection Agency. 2006. Excessive heat events guidebook. www.epa.gov/heatisland/about/heatguidebook.html.

Response Plan Strategies (cont.)		
Suspend utility shutoffs and provide transportation and financial assistance	✓	✓
Provide water at public places		
Reschedule outdoor public events when possible	✓	✓
Provide information to pet owners on protecting their pets from extreme heat		
Prepare strategies for a power outage		
Evaluation		
Evaluate heat response plan after implementation	✓	✓
Mitigation		
Support and promote programs and policies to reduce effects of urban heat islands		

Prepare strategies for a power outage: If a wide-spread power outage occurs during an extreme heat event, air conditioning may be unavailable. Ideally, messages regarding tips on how to stay cool and hydrated have already been provided to the public and vulnerable populations. People who do not want to leave their homes and are without air conditioning should be encouraged to drink plenty of water and take cold baths or showers to cool off. Buildings where vulnerable populations reside, such as hospitals, nursing homes, etc. may want to consider buying a back-up generator to ensure that their building will stay cool if there is a power outage.

Mitigation/adaptation to extreme heat

It is important to support and promote programs and policies to reduce effects of urban heat islands. Although strategies to reduce the urban heat island effect typically are not included within a response plan, they are important for long-term adaptation to climate changes and to help reduce the severity and duration of urban residents' exposure to high-heat conditions.⁷⁶ Programs and policies that increase urban vegetation, especially shade trees, and encourage the use of cool building materials can help reduce the urban heat island effect. Some strategies that help reduce the urban heat island effect can provide multiple health benefits. For example, green roofs can help reduce the urban heat island effect, can help capture and clean stormwater, and can provide a green space for mental health benefits for people in the city.

Training and resources for extreme heat

MDH created a training module on extreme heat and public health for local government staff and public health practitioners. The training module provides a basic overview of extreme heat and its impacts on public health and contains some of the information within this document. The training was created as a PowerPoint presentation with detailed notes so that professionals could use the presentation to train others on extreme heat and public health. A copy of the presentation with detailed notes can be found on the MDH website at: <http://www.health.state.mn.us/divs/climatechange/extremeheat.html>.

MDH developed a list of links to additional online resources. Appendix K provides a listing and brief description of several websites that contain additional information on extreme heat events.