ARIZONA DEPARTMENT
OF HEALTH SERVICES

Managing Extreme Heat Recommendations for Schools: Pilot Version

A guidance document from the Arizona Department of Health Services | April 2021

Contents

Background

Arizona is one of the hottest places on earth from May to September. Heat-related illness affects all age groups. Heat-related illness occurs when the body is no longer able to cool itself properly, and can include heat cramps, heat exhaustion, and heat stroke.

Although susceptibility to heat-related illness will vary among students, several physiologic and behavioral factors can increase children's vulnerability to heat.

- Children have a greater surface area-to-body mass ratio than adults, which causes a greater heat gain from the environment on a hot day (Falk & Dotan, 2011).
- Children have a lower sweating capacity than adults, which reduces children's ability to dissipate heat by evaporation (Falk & Dotan, 2011).
- Children have less adaptive capacity to change their environment and behavior while under thermal discomfort and they have less experience recognizing the symptoms of heat stress (Kennedy et al., 2020)
- Children do not experience the same urge to drink water as adults and have less awareness of their own hydration status; dehydration is a risk factor for developing heat-related illness (Casa et al., 2015).

Annually during 2015–2019, an average of 210 children aged 5–19 years old were treated in hospital emergency departments for heat-related illness throughout the state of Arizona (Arizona Department of Health Services, 2020). Additionally, heat illness during sports or competitions is a leading cause of death and disability among U.S. high school athletes (Yard et al., 2010).

Purpose

This document provides recommendations for schools serving grades K–12 on actions to mitigate the effect of extreme heat on students and reduce the frequency of heat-related illness among students. The Arizona Department of Health Services (ADHS) recommends that Arizona school districts formally document the actions they intend to take in response to extreme heat in a written school heat policy that will be used in accordance to ARS 15-341(A) (24). To aid in the formulation of district-level heat policies, this document also provides a summary of practices that schools can consider and adopt based on each district's environment and resources.

Education

Comprehensive education and awareness programs are consistently recognized as one of the foundational strategies to address heat-related illness and an education plan should be included in every written school heat policy. (Educational materials can be found in the ADHS School Heat Safety Toolkit).

Education should target specific groups and include certain elements:

- Education of supervisory staff, such as teachers, playground monitors, coaches, and athletic staff on measures to prevent heat-related illness; as well as how recognize the signs and symptoms of heat-related illness
- Education of health staff, coaches, athletic staff, and athletic trainers on how to treat the signs and symptoms of heat-related illness and when further medical support is warranted
- Education of students on the importance of prevention of heat-related illness, especially factors under their own control, and how to recognize signs and symptoms of heat-related illness in themselves and their peers
- Education of parents on how they can send their children to school prepared for hot weather and on what to expect from their school's heat policy

Hierarchy of Controls

The next section of this document introduces actions that school districts can take to help protect students from heat-related illness. Mitigation strategies are ordered based on a framework called the Hierarchy of Controls (**Figure A**), which is defined by the National Institute for Occupational Safety and Health (NIOSH) as a guide to implementing effective controls that protect workers from occupational hazards. The hierarchy is based on the principle that control methods that lead to system-level changes will be more effective than control methods that place a large burden of responsibility on individual workers. An adaptation of this hierarchy that shows how schools districts can apply the same principle to the hazard of environmental heat is shown in **Figure B**.

Figure A: NIOSH Hierarchy of Controls for Occupational Hazards

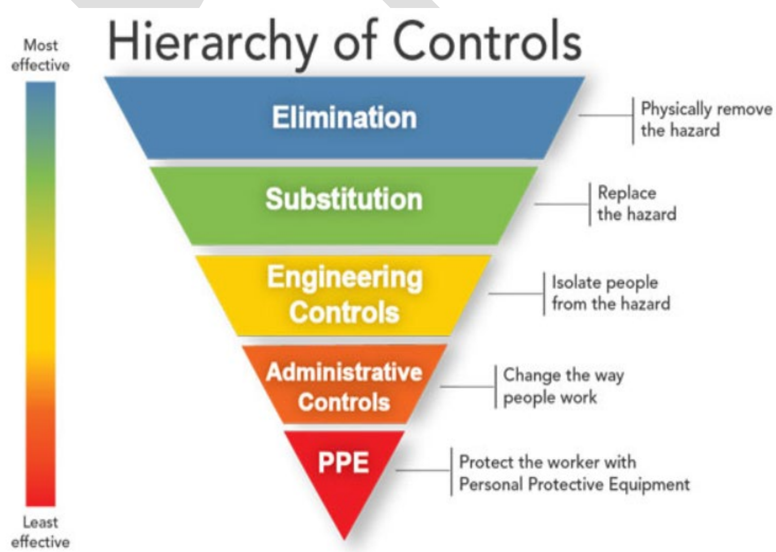
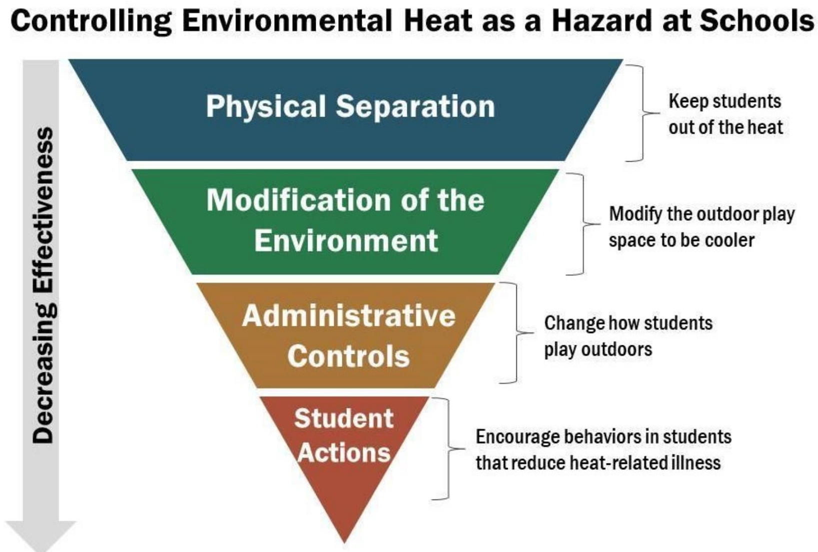


Figure B: Adaptation of the Hierarchy of Controls for Controlling Environmental Heat as a Hazard at Schools



Physical Separation (Elimination/Substitution)

Physically separating students from heat by keeping them in a cooled indoor environment is the most effective way of preventing heat-associated illness in children. If a school has an alternative cooled indoor environment that can be made available for student physical activity, then utilizing the indoor space during extreme heat is an ideal way to protect students.

If an indoor environment that allows for physical activity is not available, an alternative is an indoor space designed for learning (e.g. classrooms or libraries) that does not allow for physical activity or exercise. A substantial body of literature has shown that denying students access to recess, physical education, and nature has negative consequences on health, behavior, and learning. Therefore, schools that cannot offer an alternative indoor play space should consider restricting the use of this alternative for only those days defined in the school policy as the highest risk. Schools can sign up for school heat alerts and stay informed about the days with extreme heat warnings when the risk is the highest for outdoor activities.

Modification of the Environment (Engineering Controls)

Engineering and design controls can modify outdoor play environments to keep them cooler and usable in increasingly hot temperatures. Evidence-based modifications are outlined in **Table 1**.

Table 1: Environmental Modifications for Consideration

Modification	Rationale	References
1. Plant trees to provide natural shading of outdoor play spaces	Trees reduce air temperature, glare, and UV radiation. Shade provided by mature trees could also reduce surface temperatures by as much as 60ºF.	(Vanos et al., 2016)
2. Use artificial shading (canopies, tents, sails, umbrellas) to shade outdoor play spaces	Shade can decrease the perception of air temperature by 15ºF. Without shade, a surface temperature can get up to 188ºF at noon, while a shade sail can bring the surface temperature down to 114ºF, closer to the air temperature.	(Vanos, Herdt, & Lochbaum, 2017)
3. Design play places to provide extra windflow in the summertime	Increased windflow will help increase thermal comfort. Wind roses or weather radials should be used to understand weather patterns such as prevailing summer wind directions during the hottest days and best understand expected weather factors that will consistently influence the thermal comfort.	(Kennedy et al., 2020)
4. Avoid materials and surfaces that radiate high amounts of thermal heat	Concrete, black asphalt or black rubberized synthetic surfaces can intensify hot conditions. Use natural surfaces as much as possible (where allowed) and if a surface has to be used for the safety of children, make sure it is shaded. The caveat is that selection of highly reflective surfaces or application of paints on existing surfaces can increase reflectivity and reduce ambient air temperatures.	(Hyndman, 2017)
5. Increase the number of water fountains, water coolers, or bottled water coolers	Increased access to drinking water can help encourage student behaviors to stay hydrated. Districts need to follow the Arizona Law which requires at least 2 drinking fountains per 100 students (grades K-8) and 1 drinking fountain per 100 students (grades 8-12).	(Hyndman, 2017)
6. Water misters	Reduce air temperature up to 30 degrees in dry environments.	(Bossenmeyer, 2014)
7. Position play spaces so that they are naturally shaded by existing buildings and structures during the warmest time of year and hottest part of the day	Building shade (human-made shade) can be beneficial and reduce surface temperature to near air temperature. In Arizona, this can be achieved by placing playgrounds on the North side of a building to block south sun, or on the east/west side of the building to block west (afternoon) or east (morning) sun depending on the school's recess schedule.	(Kennedy et al., 2020)

Administrative Controls

Administrative controls refer to changing when, how, and for how long students are exposed to environmental heat. Written policies can be very effective in outlining the procedures that govern how outdoor play will take place.

Table 2: Administrative Controls

Modification	Rationale	References
1. Acclimatization period	During the acclimatization period, changes occur as the body adapts to the stress of repeated exposure to heat. There is a strong evidence base that acclimatization can reduce heat-injuries among student athletes. Similarly, when students return to school in August, schools can consider implementing an acclimatization period for recess and physical education, where duration and intensity slowly increase over the course of a two week period.	(Casa et al., 2015; Council on Sports Medicine and Fitness and Council on School Health et al., 2011; National Center for Chronic Disease Prevention and Health Promotion, 1997; Rodgers, Slota, & Gamboni, 2018; Tripp, Eberman, & Smith, 2015; Yard et al., 2010)
2. Scheduled rest/hydration breaks	Scheduling rest and hydration breaks in shade into outdoor play time can encourage students to modify their behavior. Proper hydration can help to reduce core body temperature. Dehydration of as little as 2% can negatively impact thermoregulation.	(Casa et al., 2015; Council on Sports Medicine and Fitness and Council on School Health et al., 2011; National Center for Chronic Disease Prevention and Health Promotion, 1997; Pryor et al., 2018; Rodgers, Slota, & Gamboni, 2018)

3. Schedule recess prior to lunch	Some districts have found that this strategy helps reduce the haste some students feel to eat lunch quickly to have time for recess. This schedule also gives students a chance to rest and rehydrate before returning to the classroom.	(Casa et al., 2015; Council on Sports Medicine and Fitness and Council on School Health et al., 2011; Kerr et al., 2013; Rodgers, Slota, & Gamboni, 2018; Tripp, Ebarman, & Smith, 2015; Yeargin et al., 2016)
4. Move outdoor activities to cooler times of day	Rescheduling activities during the mornings will reduce student exposure to extreme heat. Some studies have found that exertional heat illness is most likely to occur during mid-day activities, when the temperature is hottest.	(Casa et al., 2015; Council on Sports Medicine and Fitness and Council on School Health et al., 2011; Kerr et al., 2013; Rodgers, Slota, & Gamboni, 2018; Tripp, Ebarman, & Smith, 2015; Yeargin et al., 2016)
5. Move outdoor activities to an air-conditioned space	Air-conditioning is the number one protective factor against heat-related illness. Moving activities from outside to an air-conditioned space during extreme heat has been shown to prevent additional cases.	(Centers for Diseases Control and Prevention, 2016; O'Neill et al., 2009)

Acclimatization procedures pertaining to modification of play for school activities such as recess and physical education courses have not been documented well in the scientific literature. Alternatively, procedures have been developed for school sports to build up a physiological response. Although not a perfect fit, **Table 3** provides examples of elements that could be considered during the school day. The following would need to be adapted for activities such as recess and physical education classes as part of tools to address heat illness. More information can be found at the Korey Stringer Institute heat-acclimatization guidelines website.

Table 3: Heat-Acclimatization Guidelines for Sports (Needs Adaptation to Recess)

Area of Practice Modification	**Practices 1-5**		**Practices 6-14**
	Days 1-2	Days 3-5	
Number of Practices Permitted Per Day	1		2, only every other day
Equipment	Helmets only	Helmets & Shoulder Pads	Full Equipment
Maximum Duration of Single practice Session	3 hours		3 hours (a total maximum of 5 hours on double session days)
Permitted Walk Through Time	1 hour (but must be separated from practice for 3 continuous hours)		
Contact	No Contact	Contact only with blocking sleds/dummies	Full, 100% live contact drills

NOTE: warm-up, stretching, cool-down, walk-through, conditioning, and weight-room activities are included as part of practice time.

Student Actions

Interventions that require students and their parents to comply consistently are considered to be the least effective, as they must be adhered to 100% of the time to be effective and might also require behavior change. While it is still important for school staff to promote these behaviors, they will be most effective when coupled from interventions that occur at higher levels of the hierarchy.

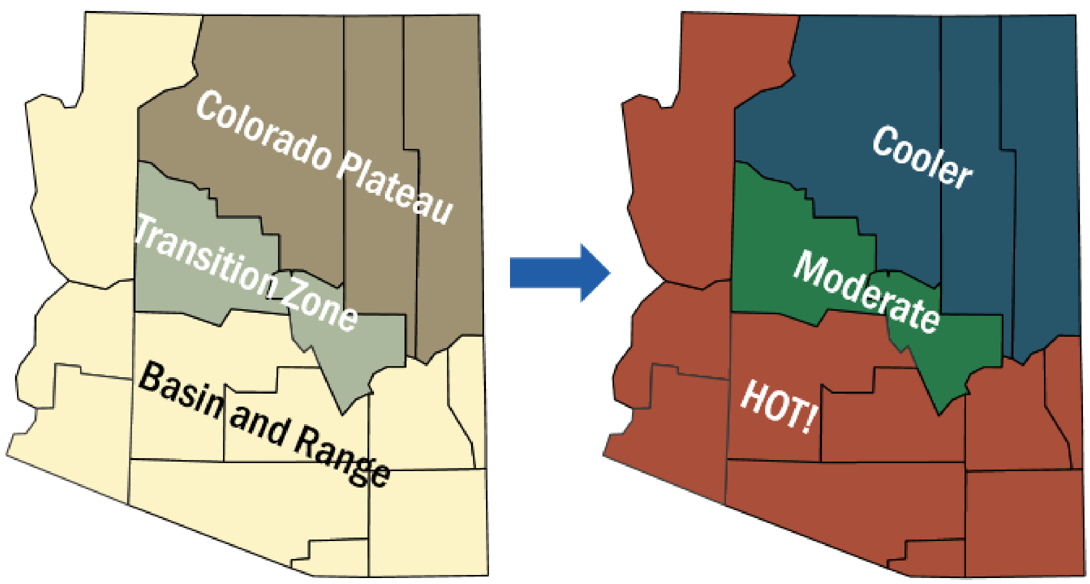
Student level actions that can help to prevent heat-associated illness include:

1. Protect skin with sunscreen, lip balm, hats, sunglasses, clothing, shade, and limit exposure during peak midday UV
2. Wear light-weight, long-sleeved protective clothing (Bossenmeyer, 2014; Council on Sports Medicine and Fitness and Council on School Health et al., 2011; National Center for Chronic Disease Prevention and Health Promotion, 1997; Pryor et al., 2018; Rodgers, Slota, & Gamboni, 2018; Watson, 1995)
3. Hydrate adequately before, during, and after outdoor activity and allow water bottles in class

Weather Triggers

There are many different meteorological measures that can be taken into account when making decisions about how to modify student activities. Measures that are relatively easy to obtain or deduce include temperature, humidity, and heat index. Much of the literature in the sports medicine world relies on the use of wet-bulb globe temperatures (WBGT), which accounts for influences of sun exposure, air temperature, humidity, and wind speed, and is a better measure of heat stress. While WBGT is the most popular method for assessing heat stress in sports and occupation, policies should consider a school district or school's access to relevant meteorological data when determining thresholds and trigger points for action. Follow the National Weather Service to get daily forecasts and signup for School Heat Alerts if you would like access to public health recommendations and heat safety resources. National Weather Service Heat Warnings generally will fall at a higher temperature than the thresholds for children within this document, due to a variety of factors. In comparison to the highest risk category, if these values are not feasible, schools should use an Excessive Heat Warning Alert as the signal for highest risk and the most amount of interventions, such as keeping kids indoors should be heeded.

Figure C. Map of Arizona Counties Assigned to Climate Region



Suggested Strategies for Increasing Hierarchy of Controls in Each Climate Zone

Basin and Range

Corresponds to: Cochise, Greenlee, Graham, La Paz, Maricopa, Mohave, Pima, Pinal, Santa Cruz, and Yuma Counties.

The Basin and Range area is the **warmest climate region** in Arizona. For the Cities of Yuma (Yuma County) and Phoenix (Maricopa County) area, heat attributable illness is identified in higher ranges of the air temperature, providing time to incorporate interventions early. Suggestions are to begin pre-heat activities with environmental modifications such as planting trees, installing artificial shading and adding water misters in the spring season when temperatures are cooler. Education to staff, students and parents can also occur during the spring season in anticipation of increasing temperatures and heat associated with risk for illness.

The lowest attributable risk, found at 96-100 °F, is the time to implement a heat acclimation period, rest and hydration sessions and encourage student use of sun protection. Physical separation from heat needs to be considered at the highest attributable risk, found at temperatures over 101°F. Avoiding outdoor play and using indoor cooled space for all physical activity when temperatures rise above 101°F has been identified as one of the most effective means to avoid heat-related illness.

Transition Zone

Corresponds to: Gila and Yavapai Counties.

The Transition Zone area is a **moderate climate region** in Arizona between the hottest and cooler parts of the state. For the Black Canyon City (Yavapai County) area, heat attributable illness is identified at more moderate ranges of the air temperature, providing the spring season to plan and implement interventions. Suggestions are to begin pre-heat activities such as environmental modifications, which can include planting trees, installing artificial shading and adding water misters at the start of spring season when temperatures are cooler. Education to staff, students and parents can also occur during the early spring season in anticipation of increasing temperatures and heat associated with risk for illness. The lowest attributable risk, found at 81-85°F, is the time to implement a heat acclimation period, rest and hydration sessions and encourage student use of sun protection. Physical separation from heat needs to be considered at the highest attributable risk, found at temperatures over 86°F. Avoiding outdoor play and using indoor cooled space for all physical activity when temperatures rise above 86°F has been identified as one of the most effective means to avoid heat-related illness.

Colorado Plateau

Corresponds to: Apache, Coconino, and Navajo Counties.

The Colorado Plateau area is the **coolest climate region** in Arizona with some of the lowest temperatures throughout the year. For the Flagstaff (Coconino County) area, heat attributable illness is identified at a lower range of the air temperatures, suggesting a shorter timeframe to plan and implement interventions. Suggestions are to begin pre-heat activities such as environmental modifications, like planting trees, installing artificial shading and adding water misters, at the end of winter when temperatures are still much cooler. Education to staff, students and parents can also occur during the end of winter/early spring season in anticipation of increasing temperatures and heat associated with risk for illness. The lowest attributable risk, found at 76-80°F, is the time to implement a heat acclimation period, rest and hydration sessions and encourage student use of sun protection. Physical separation from heat needs to be considered at the highest attributable risk, found at temperatures over 81°F. Avoiding outdoor play and using indoor cooled space for all physical activity when temperatures rise above 81°F has been identified as one of the most effective means to avoid heat-related illness.

ARIZONA DEPARTMENT OF HEALTH SERVICES

Table 4: Trigger Points Actions and Time by Climate Zone

Percent of Heat-Attributable Emergency Department Visits by Daily Maximum Temperature Ranges (°F) (8 AM to 8 PM)									
Climate Zone		**(76 to 80)**	**(81 to 85)**	**(86 to 90)**	**(91 to 95)**	**(96 to 100)**	**(101 to 105)**	**(106 to 110)**	**(>=111)**
Basin and Range	Pre-heat Season	1%	4%	8%	15%	21%	27%	18%	5%
Transition Zone		11%	16%	29%	26%	9%	1%	0%	0%
Colorado Plateau		21%	30%	19%	5%	0%	0%	0%	0%

Time to Take Action/Season	Action to Take
Early on in anticipation of policy implementation Pre-heat season, spring	Environmental modification: • Plant trees • Install artificial shading • Install water fountains and water misters *Consider checking functionality of the water fountains, misters and artificial shading periodically and do upgrades, maintenance (misters cleaned, landscaping), or replacements as needed. These activities can occur anytime during the cooler season. Create a "water wise" environment and do not run the misters when children are not around to avoid wastage of water.
Lowest positive attributable risk by climate zone • Basin and Range – 81-85 °F • Colorado Plateau – 76-80 °F • Transition Zone– 76-80 °F Pre-heat season, spring	Education of supervisory staff, health professionals staff, parents and students on heat-related illness prevention, recognition, and treatment. Sign up for Heat Alerts or be aware of how to receive them.
One category below highest positive attributable risk for climate zone	Administrative control – Acclimation period, scheduled rest/hydration, recess before lunch, move activities during the cooler part of day. Student actions – use of sunscreen, lightweight clothing and frequent hydration.
Highest attributable risk for climate zone	Physical separation – Avoid outdoor play using indoor cooled space for all physical activity.

Each color in the table has intervention recommendations. Both Table 4 and 5 can use the information in the "Time to Take Action/Season" and "Actions to Take" chart. Also, the temperatures found to the right of the "highest attributable risk for each climate zone" or red category are shown to have fewer cases. This does not mean that risk at these temperatures decreases or schools should stop implementing interventions above the red category. It is possible that adaptations or interventions may have been adopted at this point and people may be more likely to already be indoors and protected. The red category emphasizes the temperature at which people may be caught most off guard thus causing the peak in risk.

Table 5: Trigger Points Actions and Time for Maricopa and Pima Counties

Percent of Heat-Attributable Emergency Department Visits by Daily Maximum Temperature Ranges (°F) (8 AM to 8 PM)										
Age Group	County		(76 to 80)	(81 to 85)	(86 to 90)	(91 to 95)	(96 to 100)	(101 to 105)	(106 to 110)	(>=111)
5-10	Maricopa	Pre-heat Season	0%	4%	10%	16%	23%	29%	14%	3%
	Pima		3%	7%	15%	26%	29%	17%	4%	0%
11-18	Maricopa		0%	2%	5%	11%	19%	30%	24%	8%
	Pima		2%	5%	13%	25%	31%	20%	5%	0%

In the table above, an analysis was conducted for Maricopa and Pima Counties. The population of these counties represents the majority of the state population. Having a sufficient amount of cases as is true with these two counties allows for a more detailed analysis. The percent of heat-attributable emergency department visits was higher in Pima County for both age groups for temperature ranges up to 100°F compared to Maricopa County. More studies are necessary to identify why Pima county has more cases occurring at lower temperatures than Maricopa County, but it is not surprising based on differences in climatology. Simply, there are more days in the lower temperatures categories in Pima County versus Maricopa County. Generally, looking at the data for the last twenty years, Phoenix had 8.2% of days where the maximum temperature was in the 91-95°F range while Tucson had 12.6% of days in that range. With this 4.4% addition in Tucson this will lead to more cases in this range. Additionally, the 90th, 95th, and 99th percentiles for the hottest days, Tucson temperatures are 5-6 degrees lower than Phoenix. Relatively, we would expect to see the same impacts in Tucson at 105°F degrees as we would in Phoenix at 110 °F degrees. There is no significant change in thresholds between children ages 5-10 and those that are 11-18.

The goal of this county specific chart, although we were unable to replicate it for other counties, is to have the most accurate reflection on what is occurring at the county level. If your school district is part of one of the other thirteen counties, please refer to **Table 4** for aiding your decision-making based on the specific climate region. For those schools in Maricopa and Pima counties, using **Table 5** as a reference point in planning heat safety interventions, please refer to the appropriate measures for the age group of students your school serves.

Comparison with NOAA/National Weather Service HeatRisk

NOAA/National Weather Service (NWS) HeatRisk is a service that provides a level of potential heat impacts based on the high and low temperature forecast for the next seven days. HeatRisk is available through an interactive website. A screenshot is displayed below in **Figure D**. HeatRisk is portrayed in a numeric (0-4) and color (green/yellow/orange/red/magenta) scale which is similar in approach to the Air Quality Index (AQI) or the UV Index. Black hash marks in Figure D represent areas under a NWS Excessive Heat Warning. It provides one value each day that indicates the approximate level of heat risk concern for any location, along with identifying the groups who are most at risk. This product is complimentary to official NWS alerts (which are primarily based on HeatRisk) and is meant to provide continuously available heat-related guidance for those decision makers and heat sensitive populations who need to take actions at levels that may be below current NWS alerting thresholds.

It is important to note that this tool was not designed specific to child-health outcomes. The aim of this document and the analyses presented were to make specific school-age children guidance. It is also important to compare the NWS HeatRisk data and the heat recommendation levels found in **Table 4** and **Table 5**. With the help of the NWS, HeatRisk categories were matched to the temperature ranges within **Tables 4** and **Table 5**. Results from the comparison show that values match similarly in terms of Low, Moderate, and High HeatRIsk with some values for highest attributable risk in **Tables 4** and **Table 5** being 5 degrees lower. Therefore, HeatRisk could be an alternate proxy but should be taken in context with generalizability for adults.

Figure D. Example of NWS HeatRisk data

HeatRisk

More Information

Heat affects everyone differently. In order to better address heat risk and allow you to prepare for upcoming heat events, the NWS has developed the experimental HeatRisk forecast. The NWS HeatRisk forecast provides a quick view of heat risk potential over the upcoming seven days. The heat risk is portrayed in a numeric (0-4) and color (green/yellow/orange/red/magenta) scale which is similar in approach to the Air Quality Index (AQI) or the UV Index. In a similar way, it provides one value each day that indicates the approximate level of heat risk concern for any location, along with identifying the groups who are most at risk. This product is supplementary to the official NWS heat watch/warning/advisory program and is meant to provide continuously available heat risk guidance for those decision makers and heat sensitive populations who need to take actions at levels that may be below current NWS heat product levels.

Category	Level	Meaning
Green	0	No Elevated Risk
Yellow	1	Low Risk for those extremely sensitive to heat, especially those without effective cooling and/or adequate hydration
Orange	2	Moderate Risk for those who are sensitive to heat, especially those without effective cooling and/or adequate hydration
Red	3	High Risk for much of the population, especially those who are heat sensitive and those without effective cooling and/or adequate hydration
Magenta	4	Very High Risk for entire population due to long duration heat, with little to no relief overnight

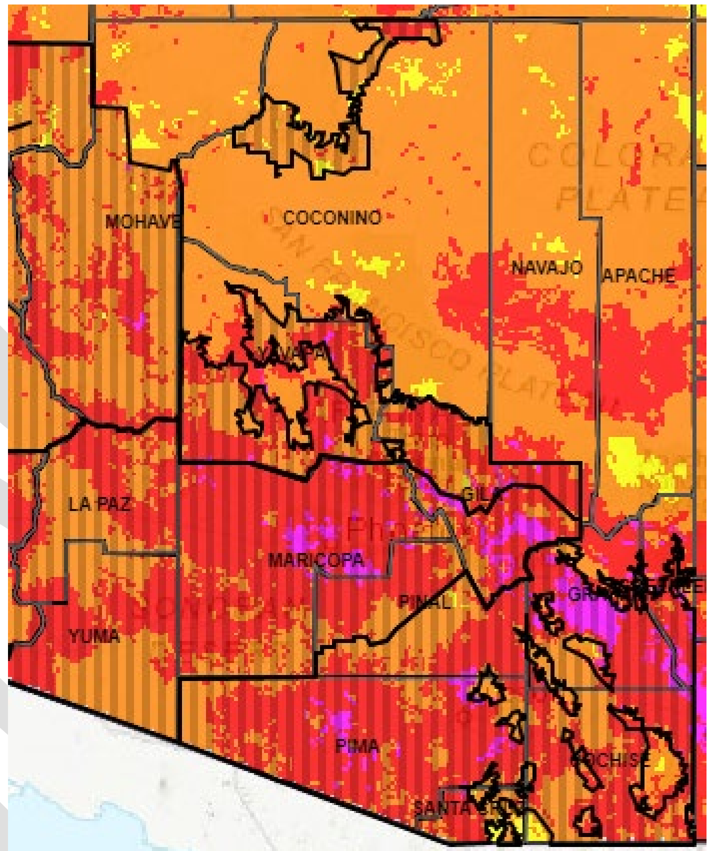


Table 6. NOAA/NWS HeatRisk Categories Comparison to Table 4 and 5

<table>
<tr><th>Climate Zone</th><th>76-80</th><th>81-85</th><th>86-90</th><th>91-95</th><th>96-100</th><th>101-105</th><th>106-110</th><th>111+</th></tr>
<tr><td>Basin and Range</td><td colspan="3">Low</td><td colspan="2">Moderate</td><td colspan="3">High</td></tr>
<tr><td>Transition</td><td colspan="2">Low</td><td colspan="2">Moderate</td><td colspan="4">High</td></tr>
<tr><td>Colorado Plateau</td><td colspan="2">Low</td><td colspan="2">Moderate</td><td colspan="4">High</td></tr>
<tr><td>Maricopa County</td><td>None</td><td colspan="3">Low</td><td colspan="2">Moderate</td><td colspan="2">High</td></tr>
<tr><td>Pima County</td><td colspan="3">Low</td><td colspan="2">Moderate</td><td colspan="3">High</td></tr>
</table>

Note for interpreting Table 6: Temperature thresholds are based on baseline high temperature inputs for HeatRisk. Data obtained via the web may be different due to time-of-year adjustments and inclusion of low temperatures in calculations.

Elements of a District-Level Heat Policy

Considerations

The Arizona Department of Health Services (ADHS) recommends that every school district in Arizona have a formal heat policy. If your district may already have a policy in place, ADHS advises to review your polices and update them as needed, or you can use the information provided in this document to round out or enhance your existing policies. A formal heat policy can be a stand-alone document, or it can be incorporated into a school wellness policy or emergency preparedness plan. Given the climatic variability in the state, extreme heat affects all school districts differently. Each school district should consider the climate in their area and consider if extreme heat is a problem the district faces regularly or if it is a rare occurrence. School districts that only rarely experience extreme heat might consider addressing heat waves as part of their emergency response planning. School districts in warmer climates might wish to develop a more extensive policy designed for routine use. Districts can find more information and data on historical extreme heat days across the state at the Arizona Environmental Public Health Tracking website. It is recommended to use maximum temperature instead of heat index as a threshold, due to Arizona State University health studies showing a better association with local data in Arizona (Petitti et al., 2016). The heat index is not widely used in public communication related to summer temperatures in Arizona compared to other places. The heat index is often below air temperature in Arizona during the summer (pre-monsoon), which creates the potential for some confusion among practitioners and the public. The heat index also requires information about atmospheric humidity. Forecasts for heat index will inherently contain more error than those for temperature alone.

Elements

At a minimum, a heat policy should document the intended actions that schools will take in response to extreme heat during school hours, including recess, physical education classes, and field trips. Policies that also address after-school activities, such as club meetings, athletic practices, and competitions, can help to enhance the lines of communication between staff present during school hours and staff present before or after school hours. School districts that are members of the Arizona Interscholastic Association (AIA) are also subject to Bylaw 14.17 — *Heat Acclimatization and Exertional Heat Illness Management Policy*. Any district-level heat policy that includes actions related to interscholastic sports for grades 9–12 must not violate these standards.

ADHS recommends that a district-level heat policy include the following elements:

1. Roles and responsibilities
    a. Identify the individuals at the district or school level who will be responsible for making and communicating decisions on the modification of student activities in response to extreme heat. Consider identifying a primary and alternate individual who can serve in this role.
    b. If a school-district hosts before or after-school programs, including interscholastic athletics, consider delegating a decision-maker that will be available during these hours and describing communication channels.
2. A plan for educating students, parents, faculty, and athletic staff on heat-illness
    a. One of the best ways of preventing heat-related illness is ensuring that students, parents, faculty, and athletic staff are educated on heat-illness and know how to recognize and treat early signs and symptoms.
    b. Consider integrating heat-education into school's professional development or student health education curriculum.
3. Define trigger points for implementing various administrative controls
    a. **Note:** If not feasible to use the thresholds in **Table 4 and Table 5**, consider using National Weather Service Excessive Heat Warnings as the highest priority action level to decide whether to keep children indoors. It is recommended though to start interventions at lower temperatures. Additional guidance on triggers for the general population at lower levels can be found in the National Weather Service HeatRiskTool.
4. Plan for administrative controls
    a. The plan will take into account school resources (such as access to cooled indoor space for physical activity, access to shaded outdoor play spaces, etc.).
    b. Consider implementing control measures across the hierarchy of controls

Resources

Additional resources that might be of use for developing and implementing policies and control measures:

- ❑ Apply for grants to fund shade structures: American Academy of Dermatology (AAD) Shade Structure Grant Program .
- ❑ Sign up for the ADHS school heat alerts at the ADHS Communications sign up page.
- ❑ Resources for educating staff, parents, and students on heat illness: ADHS School Heat Toolkit.
- ❑ Guidelines for preventing Exertional Heat Illness in athletes: Korey Stringer Institute.
- ❑ Arizona Interscholastic Association: Heat Acclimatization Protocol .
- ❑ Water Access in Schools: CDC guide for schools on steps to take to help students drink more water during the day.
- ❑ Review Arizona's safety policies and practices in preventing sudden deaths in sports.
- ❑ Recess before lunch toolkit: This guide was developed by the Missouri Department of Health and Senior Services that implemented a Recess Before Lunch schedule in their state and can serve as an example to support other schools nationwide that are interested in developing one.
- ❑ NOAA/NWS Information
    - ❑ HeatRisk (Forecast)
    - ❑ HeatRisk (Historical)
    - ❑ Check Current Wet Bulb Globe Temperature (WBGT) Values
    - ❑ General Forecast Information
      https://www.weather.gov/Phoenix https://www.weather.gov/Tucson
      https://www.weather.gov/LasVegas https://www.weather.gov/Flagstaff

Partners

The Arizona Department of Health Services would like to thank the many partners and agencies who contributed to the formation of this document:

- Arizona Department of Education
- Arizona School Facilities Board
- Arizona School Districts
- Arizona State University
- Centers for Disease Control & Prevention, Climate and Health Program and Environmental Public Health Tracking Program
- NOAA/National Weather Service

Acknowledgements

This document was supported by the Centers for Disease Control and Prevention cooperative agreements CDC-RFA-EH16-1602: Enhancing Community Resilience by Implementing Health Adaptations (Award 5 NUE1EH001318) and CDC-RFA-EH17-1702: Enhancing Innovation and Capabilities of the Environmental Public Health Tracking Network (Award 1 NUE1EH001339). The contents of this document do not reflect the official views of the U.S. Department of Health and Human Services or the U.S. Centers for Disease Control and Prevention.

Questions/Concerns

Please contact the Arizona Department of Health Services, Office of Environmental Health, Climate & Health Program by email at: extremeweather@azdhs.gov or call (602) 364-3118.

Suggested Citation

Managing Extreme Heat Recommendations for Schools Guidance Document: Pilot Version. Arizona Department of Health Services, Office of Environmental Health, Climate and Health Program (April 1, 2021).

References

Bossenmeyer, M. (2014). *Keeping kids cool at school.* Peaceful Playgrounds. https://peacefulplaygrounds.com/download/pdf/Cool-in-School-Article-Set-083015.pdf

Casa, D. J., DeMartini, J. K., Bergeron, M. F., Csillan, D., Eichner, E. R., Lopez, R. M., Ferrara, M. S., Miller, K. C., O'Connor, F., Sawka, M. N., & Yeargin, S. W. (2015). National Athletic Trainers' Association Position Statement: *Exertional Heat Illnesses. Journal of athletic training, 50*(9), 986–1000. https://doi.org/10.4085/1062-6050-50.9.07

Centers for Diseases Control and Prevention. (2016). Keep Your Cool in Hot Weather. https://blogs.cdc.gov/yourhealthyourenvironment/2016/06/21/keep-your-cool-in-hot-weather-5

Council on Sports Medicine and Fitness and Council on School Health, Bergeron, M. F., Devore, C., Rice, S. G., & American Academy of Pediatrics. (2011). Policy statement—Climatic heat stress and exercising children and adolescents. *Pediatrics, 128*(3), e741–e747. https://doi.org/10.1542/peds.2011-1664

Falk, B., & Dotan, R. Temperature regulation and elite young athletes. (2011). *Medicine and sports science, 56,* 126–149. *https://doi.org/10.1159/000320645*

Hyndman, B. (2017). 'Heat-Smart' schools during physical education (PE) activities: Developing a policy to protect students from extreme heat. *Learning Communities: International Journal of Learning in Social Contexts [Special Issue: 2017 30th ACHPER International Conference]*, 21, 56-72. https://doi.org/10.18793/LCJ2017.21.06

Kennedy, E., Olsen, H., & Vanos, J. (2020). Thermally Comfortable Playgrounds: A review of literature and survey of experts (Technical Report). *National Program for Playground Safety, University of Northern Iowa,* 37 pp. + Appendices. https://www.scc.ca/en/about-scc/publications/general/thermally-comfortable-playgrounds

Kerr, Z. Y., Casa, D. J., Marshall, S. W., & Comstock, R. D. (2013). Epidemiology of exertional heat illness among U.S. high school athletes. *American journal of preventive medicine*, *44*(1), 8–14. https://doi.org/10.1016/j.amepre.2012.09.058

National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention. (1997). Guidelines for school and community programs to promote lifelong physical activity among young people. *The Journal of school health, 67*(6), 202–219. https://doi.org/10.1111/j.1746-1561.1997.tb06307.x

ARIZONA DEPARTMENT OF HEALTH SERVICES

O'Neill, M. S., Carter, R., Kish, J. K., Gronlund, C. J., White-Newsome, J. L., Manarolla, X., Zanobetti, A., & Schwartz, J. D. (2009). Preventing heat-related morbidity and mortality: new approaches in a changing climate. *Maturitas*, *64*(2), 98–103. https://doi.org/10.1016/j.maturitas.2009.08.005

Petitti, D. B., Hondula, D. M., Yang, S., Harlan, S. L., & Chowell, G. (2016). Multiple Trigger Points for Quantifying Heat-Health Impacts: New Evidence from a Hot Climate. *Environmental health perspectives*, *124*(2), 176–183. https://doi.org/10.1289/ehp.1409119

Pryor, R. R., Casa, D. J., Yeargin, S. W., & Kerr, Z. Y. (2018). Sports medicine staff size influences exertional heat illness policies in high school football. *International journal of athletic therapy and training, 23*(4), 172 - 177. https://doi.org/10.1123/ijatt.2017-0090

Rodgers, J., Slota, P., & Zamboni, B. (2018). Exertional Heat Illness Among Secondary School Athletes: Statewide Policy Implications. *The Journal of school nursing : the official publication of the National Association of School Nurses, 34*(2), 156–164. https://doi.org/10.1177/1059840517706104

Tripp, B. L., Eberman, L. E., & Smith, M. S. (2015). Exertional Heat Illnesses and Environmental Conditions During High School Football Practices. *The American journal of sports medicine, 43*(10), 2490–2495. https://doi.org/10.1177/0363546515593947

Vanos, J. K., Herdt-Marc, A. J., & Lockbaum, R. (2017). Effects of physical activity and shade on the heat balance and thermal perceptions of children in a playground microclimate. *Building and Environment, 126*(2016), 119 – 131. https://doi.org/10.1016/j.buildenv.2017.09.026

Vanos, J. K., Middel, A., McKercher, G. R., Kuras, E. R. & Ruddell, B. L. (2016). Hot playgrounds and children's health: A multiscale analysis of surface temperatures in Arizona, USA. *Landscape and urban planning, 146*(2016), 29–42. https://doi.org/10.1016/j.landurbplan.2015.10.007

Watson, B. (1995). When the weather turns severe: A guide to developing a severe weather emergency plan for schools. National Weather Service. https://www.weather.gov/media/aly/School%20Weather%20Safety%20Plan.pdf

Yard, E. E., Gilchrist, J., Haileyesus, T., Murphy, M., Collins, C., McIlvain, N., & Comstock, R. D. (2010). Heat illness among high school athletes--United States, 2005-2009. *Journal of safety research*, *41*(6), 471–474. https://doi.org/10.1016/j.jsr.2010.09.001

Yeargin, S. W., Kerr, Z. Y., Casa, D. J., Djoko, A., Hayden, R., Parsons, J. T., & Dompier, T. P. (2016). Epidemiology of Exertional Heat Illnesses in Youth, High School, and College Football. *Medicine and science in sports and exercise*, *48*(8), 1523–1529. https://doi.org/10.1249/MSS.0000000000000934