RISK REDUCTION GUIDANCE

WORKER PROTECTIONS

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ABSTRACT

With rising global temperatures, workers may be increasingly required to work in hot environments, and will be more susceptible to heat stress, occupational injuries, and potentially decreased productivity. Importantly, heat stress for workers derives from both external sources of heat in the environment as well as internal sources including metabolic activity, which is increased during physical activity. Heat stress can be amplified by personal protective equipment that reduces evaporative cooling through sweating. Workers are at risk for dehydration, occupational injuries, absenteeism, and chronic kidney injury, as well as decreased productivity, which can affect wages. Individuals working in industries that require strenuous physical activity, outdoor operations, and exposure to high-temperature environments are the most vulnerable. Worker protections are interventions put in place to protect workers from heat exposure and heat stress, and generally fall into the categories of infrastructure changes, administrative or work practice changes including empowering workers to pace themselves in their work, and personal protective equipment. Policies may be implemented at multiple levels but ultimately play out at the worksite and workers individually. There is a wide range of specific potential interventions, with varying costs, implementation timelines, and degrees of environmental sustainability. Consensus recommendations for US workplaces are available. While some more effective interventions have higher upfront costs, these costs are likely to be at least partially offset through increased worker health, productivity, and retention.

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What is the intervention?

Workers exposed to heat on the job are at risk for dehydration, occupational injuries, absenteeism, and chronic kidney injury, as well as decreased productivity, which can affect wages (Gubernot et al. 2014; Calkins et al. 2019; Ioannou et al. 2021, 2022). By the end of the century, under a lower emissions scenario, approximately one-half of the population will be exposed to dangerous outdoor temperatures, including workers in highly affected industries (Mora et al. 2017). Outdoor workers including those in construction and agriculture are at greatest risk, as are workers in tourism and other outdoor industries (ILO 2019).

Worker protections are interventions that are implemented in order to minimize risk factors for occupational injuries including heat stress, to reduce injury rates and facilitate recognition and recovery, and ensure worker safety and productivity. There are many different methods of reducing the risk of occupational heat stress and heat-related illness and injury, with these methods generally falling within three categories: infrastructure changes; administrative or work practice changes; and interventions aimed at improving individual worker fitness and heat dissipation. Interventions may also include temperature-specific guidance for worksite activities (Sabrin et al. 2021). Consensus recommendations for promoting heat safety in the US workplace have been developed (Morrissey et al. 2021).

Infrastructure changes include methods such as installing more efficient air ventilation systems to circulate air, air conditioning systems to actively cool the air within a workspace, misting fans, and insulating surfaces to block off sources of heat. These changes can also include automation and other mechanical assistance with work activities (Ioannou et al. 2021).

Administrative and work practice changes include educating staff about heat injury and heat risks, scheduling physically demanding tasks during cooler parts of the day, providing recovery areas and cool water, providing recommendations for rehydration and electrolyte repletion, scheduling work-rest cycles, and monitoring workers – especially those at increased risk of heat stress (Morris et al. 2020).

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Personal protective equipment such as reflective clothing, water-cooled or ice-cooled garments, ventilated garments, and other equipment that circulates air around the body can also significantly reduce risk for heat injury (Heat Stress Guide).

A recent review considered occupational interventions for reducing heat strain from a sustainability perspective and identified cooling garments, physiological acclimatization, improving worker aerobic fitness, cold water immersion, planned breaks, shading, and ventilation as the most promising sustainable strategies (Morris et al. 2020).

How effective is the intervention at protecting people's health?

Worker protection guidelines generally follow common-sense changes, with many of the suggested interventions having relatively little supporting evidence. There are also a number of endpoints to consider, including thermal comfort, core temperature, vital sign parameters (heart rate, etc.), productivity and wages, injury rates, and health care utilization, which complicates evidence accumulation.

High-level policies regarding worker protection from heat have demonstrated effectiveness, with a 13% reduction in occupational injuries and a 28% reduction in injury payouts after implementation (Su et al. 2020).

Certain interventions at the level of the worksite and individual workers have stronger evidence than others. Air conditioning is strongly protective, and time spent in air-conditioned areas is the most significant protective factor against heat injury (Ito et al. 2018; CDC 2022). Use of personal cooling garments such as looser clothing and water-cooled equipment have been shown to reduce heart rate and sweat loss, decrease mean skin temperature, increase work efficiency, and also decrease subjective feelings of stress (Tumram 2020). Rehydration and electrolyte repletion, work-rest cycles, and ventilated garments have also been found to be protective in outdoor worksites, while mechanization increased productivity without significantly increasing physiologic signs of heat stress (Ioannou et al. 2021).

How long does the intervention take to implement?

There are two potential timelines to consider regarding intervention implementation. As worksites and processes vary, risk assessment and adaptation planning, including solicitation of worker input regarding risks, priorities, and preferences regarding potential interventions, is often a necessary first step that can take months to years to complete (Soler et al. 2010). The time required to implement chosen interventions will vary widely depending on the type of intervention and the scale at which it is implemented. For

example, providing workers with rehydrating fluids or cool water can be implemented quickly, while installing vents and air conditioning systems would take significantly longer, and is infeasible at many outdoor work sites. The scale at which these interventions are implemented can also influence the time that it will take. Installing a portable air conditioning system in an office is a task that could be accomplished in a day, while installing ventilation and cooling in a warehouse would take much longer.

How much does the intervention cost?

The cost of worker protection interventions are variable depending on the type of intervention and the scale at which the intervention is implemented. For example, educational interventions, changes to work schedules, and implementation of work-rest cycles may require no additional outlays, and provision of rehydration and electrolyte repletion stations are inexpensive interventions. More capital-intensive interventions, from misting fans to evaporative coolers to air conditioning and ventilation modification in worksites where this can be done are more expensive and take longer to implement. The installation of a window air conditioning unit ranges from $150 to $800, for instance, while installation of central air conditioning often costs several thousand dollars to purchase and install (Hawkins 2023).

As noted above, several strategies are considered to be more environmentally and financially sustainable and there are frameworks available for incorporating these considerations into adaptation choices (Morris et al. 2020). It is also important to note that the up-front costs of implementing worker protections may be off-set in the longer term by increased worker health, productivity, and retention. Heat-related worker health issues and the loss of productivity during high-heat times can result in a loss of 1% of annual work hours, which can lead to financial loss for both workers and companies (Vanos et al. 2019).

Are there downsides to consider?

An important downside of more capital intensive strategies is high upfront costs. While increasing worker protections may lead to increased worker productivity, as previously mentioned, upfront costs may pose a significant barrier to the initial implementation of these protective measures. Another downside is the potential for policies, for example piece-work, or payment for productivity, to worsen heat exposure and related health impacts.

What other strategies should be considered?

Educating workers about occupational heat risk and empowering workers to pace themselves in hot conditions is an important central principle to occupational heat

adaptation. Other behavioral interventions and lifestyle changes that individuals can enact on their own may also be helpful to consider, including but not limited to: wearing appropriate clothing; using fans; using evaporative coolers; staying hydrated; replacing electrolytes; cooling off with showers, self-dousing, foot immersion, wet clothes, and misting; and monitoring others who are at high risk for heat injury (CDC 2022). These strategies are important to keep in mind, especially for individuals who are at high risk for heat injury, such as people 65 and over, people who perform manual labor especially in the outdoors, and people with chronic medical conditions (Tips for Preventing Heat-Related Illness 2022).

What are some good sources of additional information?

OSHA Guide on Managing Heat Stress
American Society of Safety Professionals on How to Recognize and Prevent Occupational Heat Stress
Consensus recommendations for strategies and resources to protect US workers from heat stress in the workplace are available here.

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