

PART 3: ENVIRONMENTAL CONSIDERATIONS

COMMON OCCUPATIONAL EXPOSURES AND INJURIES FOR DISASTER WORKERS

EYE INJURIES

The presence of dust, rubble, aircraft activity, and heavy equipment, common to search and rescue or medical response activities in austere environments increases the propensity for rescue workers' eyes to experience entry of a foreign body. Responders are advised to carry eye protection with them as part of their regular gear and use it when in areas of increased dust and activities that would increase the potential for eye exposure.

The symptoms of the presence of a foreign body include sudden onset of a feeling of grit in the eye, difficulties holding the eyes open, and light sensitivity. The individual should not press on the eyelid since this action can abrade the underlying structures. Tearing of the eye may help to wash away simple dust. Eye irrigation with a steady stream of water aimed at the nasal aspect of the eye can dislodge particles resting on the eye and rinse them away. Contact lens users should remove their lens with clean hands.

It is a natural reaction to feel anxious when something gets into your eye. By nature, the individual will focus on getting the particle out of the eye before conducting any other task. If another individual is with you when the accident occurs, ask them to examine your eye and confirm if anything is visible. Looking at the eye from the side with a good light will help visualize small specks. Use of a magnifying lens or in a pinch a macro camera lens; can further assist in the identification of small flecks or objects.

The lower eyelids can be pulled down for investigation and the upper lid retracted, if the assisting medical person knows the technique. You can check your vision by covering one eye

and then the other to compare vision. Covering one eye and then the other and reading something is a quick field test to help you determine ability to see. Loss of vision or change in your normal vision warrants immediate medical care.

Any chemical or solution splash to the eye should have an immediate eye flush of copious amounts of normal saline or water for at least 15 minutes. Contact lenses should be removed. Professional medical assessment should be obtained immediately following the irrigation.

Laceration, severe pain, metals or concrete pieces in the eye require medical care. Metal flecks need early removal or may result in a rust ring forming around the metal that will permanently stain the eye.

Any individual who is suffering pain in the eye can have the eye loosely covered with a patch and taped in place for transport. Pressure on the eye should be avoided in the case of foreign body or trauma. A metal shield that is available in some kits will offer added protection or a paper cup can be taped over the eye to further protect it in transport. Covering the opposite eye will decrease movement in the affected eye and decreases pain. However, individuals may feel far more anxious with both eyes covered and this anxiety may be detrimental to the calm transfer of the individual to medical care.

In summary, the steps toward maintaining your eyesight during deployment include avoidance of exposure, vigilant use of eye protection, immediate first aid, maintaining calm and medical follow-up.

HOT WEATHER

Disaster responses in areas of extremely hot weather put both the responders and the victims they serve at increased risk. These risks occur because the usual compensatory mechanisms such as shelter, air conditioning and modulated work schedules are disrupted. Individuals tend to become very involved in the tasks of treatment and recovery and are less likely to be aware of the importance of maintaining health a hot environment. This section will review the illnesses associated with environmental temperature extremes and make some practical suggestions for responders' awareness. The reader is referred to the "Heat Exposures" session in this NDMS training program for greater detail in the subject of heat-related illness and treatment.

"Illnesses associated with high environmental temperatures can include heatstroke (hyperthermia), heat exhaustion, heat syncope, and heat cramps."(8) Heatstroke is a medical emergency. Body temperature rises rapidly and the person can quickly become disoriented and suffer neurological damage resulting in death. Heat exhaustion is seen with dehydration and resulting electrolyte imbalance. Persons may present with fatigue, weakness and complaints of dizziness. The onset is more gradual, generally over several days. Faints due to heat (heat syncope) are caused by peripheral vasodilatation. Individuals can be treated by having them lie flat with feet elevated and give replacement fluids. The same is true for heat cramps. Response workers who are experiencing even early stages of feeling unwell due to heat should cease activity and rest.

Common sense approaches will modify the risk for workers who are at risk for heat related illness. These include increases in fluid intake to 2 – 4 glasses per hour, starting work slowly and monitor the pace, use of hats, light loose clothing, and avoidance of hot or heavy

meals. Attempt to move work to a shaded or cooler environment if possible. Avoid alcoholic beverages in heat. Alcohol intake can cause you to lose more fluid. Use sunscreen. There is an increased loss of body fluids when sunburn affects your body's ability to cool itself. Use of mechanical devices such as fans is helpful but has limitations. "Although the use of fans may increase comfort temperatures <90 F (<32.2 C), fans are not protective against heatstroke when temperatures reach ≥ 90 F (≥ 32.2 C) and humidity exceeds 35%."(8)

COLD WEATHER

Extremes of cold can also put responders and victims at risk. Like heat-related illness, the effects of cold can be of varied levels of seriousness and consequences. Please refer to the "Cold Exposures" session in this NDMS training program for a more in-depth treatment of the subject.

The causes of injury and illness due to cold exposure are primarily due to the loss of either core or local body heat. Frostbite is the freezing of tissue and is divided into degrees of severity. The cause is the actual freezing of the tissues and/or the obstruction of blood supply to tissues.

Trenchfoot or immersion injuries are non-freezing injuries that can occur because the body part is exposed to cold wet environments for a long time, generally about 12 hours. An example of this would be long-term exposure to wet boots, socks or mittens, resulting in tissue damage.

The term hypothermia is used when the body's core temperature is at or below 95 F (35 C). "The body loses heat by five main mechanisms: radiation, convection, conduction, evaporation, and respiration.

1. Radiation is heat transferred to the surrounding environment via infrared radiation.
2. Convection is the loss of heat via air/water movement.
3. Conduction is the direct contact transfer of heat from a hot to cold object.
4. Evaporation is the conversion of water from the liquid phase to a gaseous phase. A certain amount of heat is lost in this process.
5. Respiratory heat loss is actually a form of evaporative heat loss. Warm humidified air from the body's core is exhaled into the atmosphere carrying heat with it." (9)

Mild hypothermia can range from sensation of chilliness and shivering with impairment of fine movement, to gross muscular uncoordination and confusion. Severe hypothermia is marked by the cessation of shivering, confusion, irrational behavior, severe coordination deficits, unconsciousness and progression to death.

Frostbite can appear with progressive changes in severity, from redness, tingling or burning, to blisters, edema and loss of feeling, to complete freezing of a part. If frostbite occurs, slow rewarming is the method advised for saving tissue. Do not rewarm a part if there is a chance of it refreezing, as this will only further damage the tissue. The individual involved should be removed to a stable environment where the part can be rewarmed and medical care provided.

Prevention is key. Common sense, awareness and good planning will help to keep responders safe from the effects of cold and wet. Dress to keep comfortable, avoid constrictive clothes and sweating. Use layered, dry and insulated clothing including head covers. Avoid the use of cotton clothing, as it accumulates moisture next to the skin, thereby exacerbating the problem. Change wet clothing immediately. Where possible, use mittens instead of gloves and do not touch extremely cold metal with bare hands. Hands can stick,

resulting in frostbite and tissue damage. Increase food and fluid intake and seek shelter. If on the road in cold deployment, keep extra survival gear, food, fluid, and communication ability with you if possible. Let others know where you are going and when you will be back.

HIGH ALTITUDE DEPLOYMENTS

High altitude deployments and altitude sickness are other areas for potential concern. Ascent into higher altitude and its lower specific air pressure decreases the body's ability to oxygenate. This can result in sleeping disorders, headaches, acute hypoxia, disorientation, cerebral edema, pulmonary edema, and death. (10) For many people, slow ascent to the higher altitude decreases the probability of altitude-related sickness, but this option may not be available to team members responding to a high-altitude disaster. DMAT members with known pulmonary problems or obesity should decline deployment to a high altitude site. The 5,300 foot altitude of Denver may be enough to provoke problems in some people; deployment to a site at 9,000 feet can be expected to (at least mildly) affect many of the responders who normally live near sea level. Responders should completely avoid alcoholic drinks, and should seek a high-carbohydrate (>70%) diet during the acclimatization period. Acetazolamide is a successful therapeutic intervention for symptoms of altitude sickness, but the surest cure is to take the victim rapidly to a lower altitude. If possible, responders to a high altitude event should try to sleep at a lower altitude. More specific information on this issue can be found in the "High Altitude Medicine" chapter in Paul Auerbach's book *Wilderness Medicine*.

NATURE'S EXPOSURES: SUN, PLANTS, BUGS AND BITES

THE ENVIRONMENT

Most disasters disturb the environment around us and thus increase health risks. Perhaps the easiest way to review the risk is to consider the aftermath of floods. "Flooding is the most common type of natural disaster worldwide, accounting for an estimated 40% of all natural disasters."(11) There are multiple environmental consequences of flooding. Water and sewer system are disrupted, chemical spill and fecal contamination are possible. Decaying animal carcasses, waste collection problems, and disposal of tons of rubbish may all be part of the flood aftermath. Vector problems may abound with the increases of standing water that will serve as a breeding ground for insects, especially mosquitoes. Floodwaters disturb natural habitats increasing risk for snakebites. Bites from domestic animals can occur when lost and frightened animals approach humans unknown to them.

SUN EXPOSURE

Sun exposure can increase in the recovery operation after virtually any disaster. Transport of patients, provision of medical treatment in open areas, decrease in available shelter, field living, and environmental clean up can put workers and victims in increased jeopardy. Long sleeves, sunscreen, fluids, procuring shelter and using it, are sensible ways to reduce risk.

BUGS

Insect and other bug exposures will likely increase in disaster areas. Allergy to insect sting is variable and can range from a local reaction that will demonstrate over one to two days and resolve in two to seven days. "Individuals with large local reactions rarely (less than 5 percent) have a subsequent systemic reaction. Systemic reactions range from mild erythema to

fatal shock. Although skin reactions are most common, the majority of adults also have respiratory symptoms, which may involve laryngeal edema or more diffuse bronchospasm, and approximately 30 percent have vascular symptoms, which may lead to hypotension and death.”

(12) The individual may develop swelling around the eyes or mouth. Acute significant reactions will require epinephrine or use of an epinephrine injection kit and may include airway management and vascular support. Corticosteroids may be used and the individual monitored for progression to more serious reactions. This is especially true if the person has had a history of severe respiratory or circulatory collapse in the past.

Specific measures to prevent sting are based on avoidance of exposure, i.e. not walking barefoot, and avoiding areas where bees, wasps and yellow jackets are noted, such as around garbage cans, blooming plants, and obvious nests. Spider bites can often be avoided by examining beforehand an object you are about to pick up. Bites and reactions should be reported as soon as possible.

TICKS

Tick bites can result in serious consequences, such as Lyme disease and Rocky Mountain Spotted Fever. The risk for Lyme disease is higher in some regions of the U.S. than in others. Workers should closely examine their skin and clothing to be sure that they have not carried ticks in from the field or brush environments. Asking a buddy to check over your clothing in areas you cannot visualize is helpful. If a tick is noted, timely removal is important to prevent subsequent irritation and possible infection. Research has found that disease transmission often does not occur until the tick has been attached for more than 24 hours. (13) Many outdoors-oriented stores carry a light plastic tick removal tool that should be included in the gear needed for any deployment in a tick-infested region.

In the United States, tick bites most often result from exposure to underbrush or animals. Some deployments may expose responders to both. If these conditions exist, the use of long-sleeves and long pants, enhanced by the application of a good insect repellent (100% deet is the best), provides primary prevention. Daily showers with soap and water help dislodge ticks, and provide an excellent opportunity for “tick patrol.” Any unexplained fevers or dermatological conditions that occur during or after deployment to a region infested by ticks should be immediately examined by a professional health care provider. Be sure you inform the provider of your potential exposure. Some ticks bite and drop off without ever being noticed, so don’t discount the possibility that you may have been bitten.

Team Safety Officers should take note of nests, insect hills, or infestation, then report and eliminate the hazards when feasible. Reduction of risk requires team effort and individual responsibility and action.

PLANTS AND CONTACT DERMATITIS

Skin lesions can occur from coming in contact with poisonous plants. “ In the United States, poison ivy, poison oak, and poison sumac produce more cases of allergic contact dermatitis than all other contactants combined.” Habif (14)

Primary prevention is facilitated through recognition of the poison plant, avoidance in tracking through brush where the walkway is not visible, and the use of long pants, boots, and long sleeves. If exposure occurs remove clothing that has come in contact with plants of suspicion and wash both the clothing and yourself in hot soapy water. If the mission circumstances do not allow access to facilities to wash clothing, items can be confined to a

plastic bag and sealed until appropriate washing facilities are available. Team members need to recognize that sap from plants can be the cause for further contact and reaction.

Untreated contact dermatitis such as from poison ivy, poison oak or sumac can last several weeks. Corticosteroids work within 12 to 24 hours and should be considered with severe or extensive reactions. It is important to give these medications for an adequate time in order to prevent flare-up.

“Vesiculating allergic contact dermatitis or oozing irritant dermatitis benefits from intense but brief wet dressings. Dryness is affected by wetting and slow evaporation.”(15) A simple wet dressing can be made with a piece of gauze or sheeting. Covering with plastic is not advised since this can cause the skin to break down and retard drying. Wet dressing over two days is usually adequate to assist with drying. Creams that rub into the skin may also help because they have a water base. Ointments that have a petrolatum or mineral oil base do not help dry but will trap water in the skin and are not generally of benefit in these reactions.

SENSITIVITY AND ALLERGIC RESPONSES

Asthma is a disease of the airways. Stimuli cause the airways to be reactive and narrow, resulting in cough, wheezing, difficulty breathing, and complaints of tightness in the chest. Most of the time these symptoms occur together but an individual can have asthma and not necessarily wheeze.

The stimuli that can cause asthma are multiple. “Seven major types of stimuli can provoke acute episodes of asthma: allergens, exercise, infections, and occupational, environmental, pharmacological, and emotional stress.” (16) Reactions that cause an asthmatic attack can be multiple but for the purpose of this section we will focus on allergens. This is of

particular concern given the disturbed environments, dust, smoke, fumes, and pollens in the air, that may follow in a disaster.

“Most experts believe that a suspect or proven allergic component can be found in up to 35 to 55 per cent of asthmatic patients. Most of the allergens that provoke asthma are airborne, and in order to induce a state of sensitivity, they must be reasonably abundant in the environment for considerable periods of time. However, once sensitization has occurred, minute amounts of the offending agent can produce exacerbations of the disease.”(16) This view suggests that workers who have repeated exposure may demonstrate changes in sensitivity over time.

“Unfortunately, there is no easy way prospectively to identify the asthmatic who is particularly prone to bronchospasm in relation to specific levels of environmental irritant exposure.”(17) Persons with environmental allergies should monitor their responses, have adequate medications with them, and use masks if dust and smoke aggravates their condition. The good news is that: “For many classes of occupational allergens, there is no evidence that the asthmatic has a greater chance than the nonasthmatic of becoming sensitized.”(17) That said, persons with breathing difficulties and environmental allergies need to be aware of the potential of high level irritant exposures. These would include the burning of rubbish, increased allergens in the air secondary to natural disturbance of wind and rain, dust, or disturbances in air-conditioning.

SUMMARY

Fitness and good health are important and in fact a defining issue for participation in deployments. Each of us experiences times in our life that stress us physically or mentally. Hopefully, these are temporary events with full recovery. Team members and team leaders must recognize limitations that affect our members and encourage and allow members to gracefully select themselves out during times of personal stress. If the goal is to begin to help the disaster victims in recovery, we must first start with protecting ourselves.

Fitness for duty is a constant reassessment during deployment. Prevention is the key to avoiding many of the ills that beset members during activation. Thus, the focus is on safety, prevention, awareness, early first aid, and early procurement of medical care if needed. These actions will help to keep the member functioning optimally and the team whole.

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Table:

1. Vaccine Requirements for National Disaster Medical Assistance (NDMS) Teams