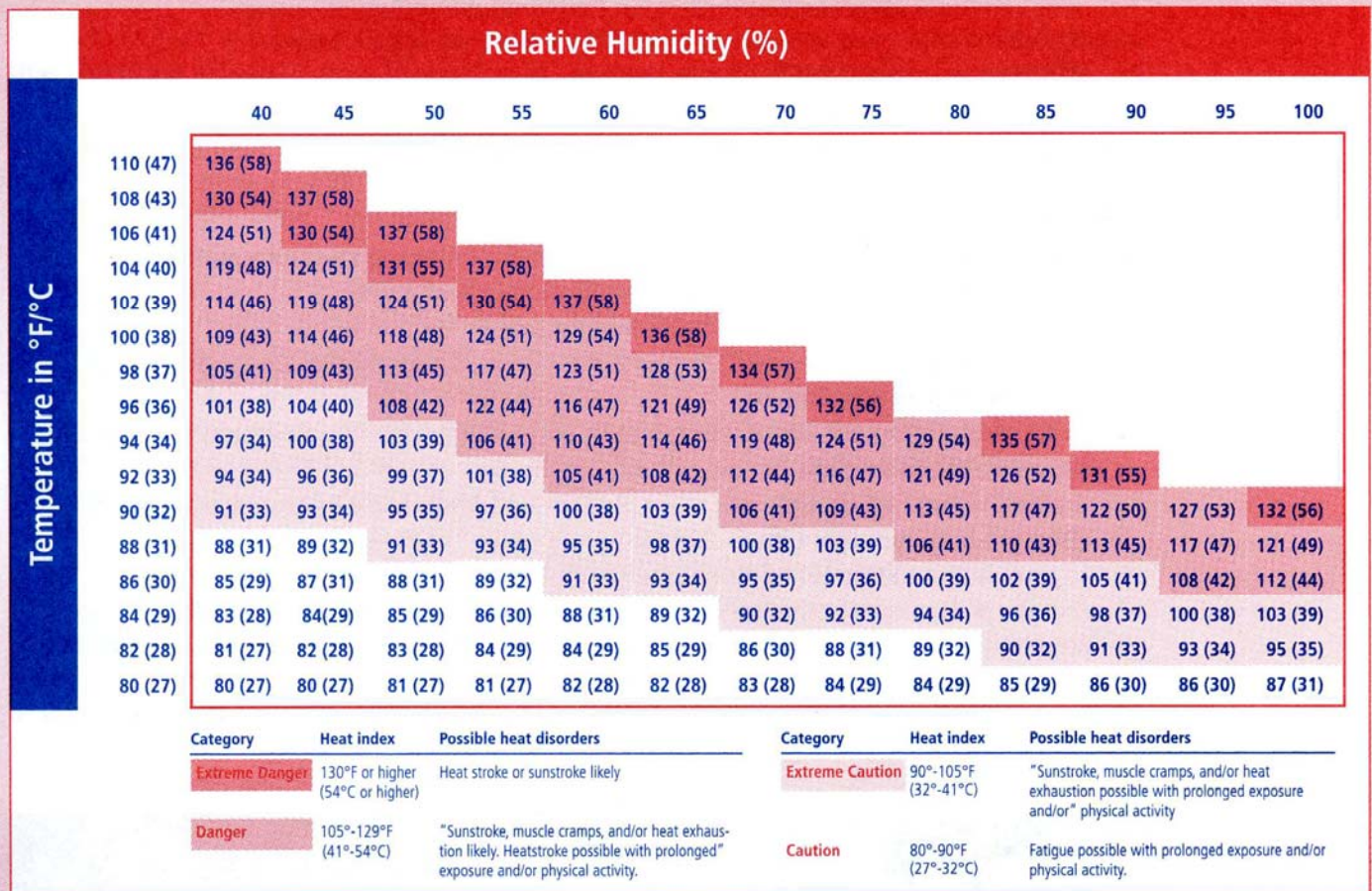


Heat-related Illness

2001 • Revised 2008

Figure 2. Heat Index Chart



* Reproduced from NWS, 2008

RECOGNITION:

The early warning signs of heat-related illnesses include:

- ⊙ Exhaustion
- ⊙ Headache
- ⊙ Muscle cramping
- ⊙ Dizziness
- ⊙ Nausea
- ⊙ Thirst
- ⊙ Decreased athletic performance

Other general symptoms include feeling hot or cold, incoherence, visual disturbances, vomiting, stomach cramps, and heart palpitations. Predisposition to heat-related illness should be recognized before it occurs, by making coaches, administrators, officials and athletes aware of individuals at-risk for heat-related pathologies.

MANAGEMENT:

The key to management is early recognition of symptoms, and immediate and effective treatment and referral. Symptoms of heat illness represent a continuum, and can worsen quickly if proper care is not rendered. In all cases, appropriate actions include:

- ⊙ Cessation of activity.
- ⊙ Removing the athlete from the sun at the first sign or symptom of heat illness.
- ⊙ Assisting in cooling the body.
- ⊙ Using ice packs on sides of neck, armpits, groin and the crease at the top of the thigh.
- ⊙ Administering fluids; cool water or an electrolyte drink with a low sugar content.
- ⊙ Monitoring vital signs.

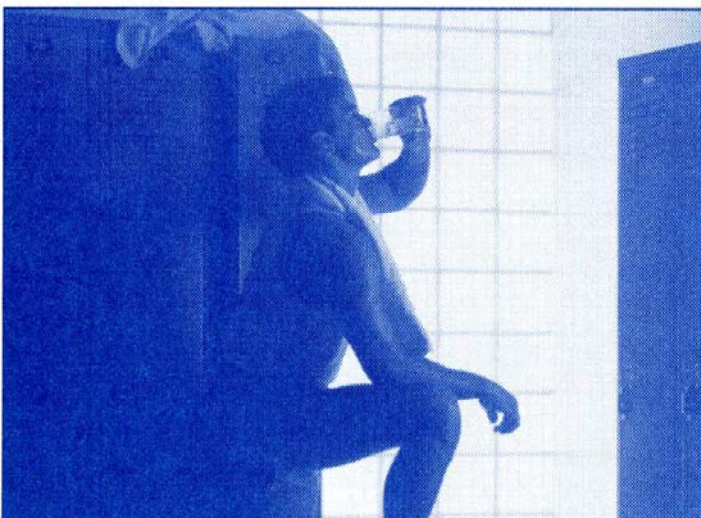
Under no circumstances should an athlete with symptoms be allowed to return to play the same day.

The best management of heat-related illness is PREVENTION.

PREVENTION:

Most heat-related illnesses are preventable through the following steps/precautions:

- ⊙ Ensure the athlete is well-hydrated prior to the start of any and all activity.
- ⊙ Allow frequent periods of rest and hydration during activity.
- ⊙ Allow unrestricted fluid replacement; encourage fluids before, during and after activity. (See Section on Fluid Replacement for more information).
- ⊙ Weigh athletes before and after activity to monitor body water loss from the activity and to ensure adequate rehydration has occurred prior to next session.
- ⊙ Gradually increase activity in the heat over a period of 7-10 days to allow adequate acclimatization.
- ⊙ Wear light-weight and light-colored clothing.
- ⊙ Schedule activities at the coolest time of day.
- ⊙ Routinely perform mandatory temperature and humidity readings on playing surfaces (indoor/outdoor).
- ⊙ Routinely monitor changing weather conditions with close attention to temperature and humidity on playing surfaces (indoor/outdoor).
- ⊙ Strongly consider postponing or canceling for extreme heat and humidity conditions (See Figure 2 – Heat Index Chart on page 37).



More on Recognition, Management and Prevention of Heat-related Illness

SIGNIFICANCE:

Heat-related illness has been a concern to participants in outdoor activity for centuries. Hot, humid weather is one of the leading causes of environmental distress in athletes. Heat stroke is one of the primary causes of activity-related death in high school athletes. Football players wearing full pads and uniform, combined with the hot, humid weather in many regions in the late spring and early autumn, are particularly susceptible to heat-related pathologies. **However, athletes practicing indoors, in non-air conditioned or poorly ventilated gyms are also susceptible.**

RISK FACTORS:

During moderate exercise, 70 to 90 percent of the energy produced by the body is released as heat. There are a number of factors that can hamper heat dissipation and put an athlete at increased risk for heat illness. These factors include:

- ⊙ **Environmental** – Air temperature, combined with humidity, wind speed and the amount of radiant heat can hamper heat dissipation. Humidity influences how readily sweat can evaporate into the atmosphere; high humidity (>60%) will dramatically diminish this mechanism of heat loss.
- ⊙ **Clothing** – Dark clothing and bulky protective equipment can drastically increase the chance of heat stress. Dark colors absorb heat and protective equipment can make heat dissipation very difficult.
- ⊙ **Age** – Children acclimatize to heat more slowly and are less effective in regulating body heat than adults.
- ⊙ **Dehydration** – It has been shown that moderate levels of dehydration (three to five percent of body weight) can cause a significant decrease in performance and predispose an athlete to exertional heat illness. Lack of sufficient water to be released by the sweat glands makes it very difficult for the body to dissipate heat through evaporation. Thirst is a poor indication of hydration.
- ⊙ **Salt deficiency** – Although proper instrumentation is required to analyze sodium content in the body, proper sodium replacement is necessary. Low sodium levels may lead to a medical emergency known as hyponatremia. Hyponatremia is the opposite of dehydration. When consuming large amounts of water, salt content is diluted and additional salt is lost through sweating resulting in low electrolytes in the body. As heat intensifies, sweating increases which can magnify this condition if the body's salt content is not replaced.
- ⊙ **Pre-activity Hydration Status** – Athletes who begin activity in an already dehydrated state are at increased risk for exertional heat illness. Pre-activity hydration status may be compromised by inadequate rehydration following previous session, alcohol consumption, rapid weight loss regimes (i.e., wrestling), and febrile or gastrointestinal illness (vomiting or diarrhea).
- ⊙ **High Body Fat** – Athletes with a high body fat have greater difficulty in dissipating heat.
- ⊙ **Poor Acclimatization/Fitness Level** – Those not yet acclimatized to the heat or inadequately conditioned are at increased risk.
- ⊙ **Febrile Illness** – Any individual with a current or recent fever may be at increased risk.
- ⊙ **Medications** – Medications with a diuretic effect or that act as stimulants may increase risk.
- ⊙ **Sickle Cell Trait** – Poses an increased susceptibility to heat illness, particularly if optimal hydration and electrolytes are not maintained.

RECOGNITION:

Heat-related illnesses are typically classified, in increasing order of severity, as heat cramps, heat syncope, heat exhaustion and heat stroke. Hyponatremia, although rare, is a medical emergency related to low salt content in the body due to overhydration.

Heat Cramps

- ⊙ Painful cramping of abdominal and extremity muscles.
- ⊙ Elevated body temperature.

Heat Exhaustion/Heat Syncope (Can progress rapidly to heat stroke unless managed properly)

- ⊙ Exhaustion, nausea, vomiting and dizziness.
- ⊙ Weakness, fatigue and fainting.
- ⊙ Elevated body temperature.

Heat Stroke

- ⊙ Acute medical emergency due to thermoregulatory failure.
- ⊙ Nausea, seizures, disorientation and possible unconsciousness or coma.
- ⊙ Hot, dry skin and high body temperature (105°F).

Hyponatremia

- ⊙ Disorientation, altered mental status, increasing headache, lethargy.
- ⊙ Seizures.
- ⊙ Swelling of the hands and feet.

*Signs and symptoms of hyponatremia may be common to heat exhaustion and heat stroke. However, swelling of the hands and feet are specific to hyponatremia.

MANAGEMENT:

Heat Cramps

- ⊙ Cessation of activity.
- ⊙ Gentle passive stretching of affected muscles.
- ⊙ Drinking cool water or an electrolyte solution (low in sugar).
- ⊙ Additional sodium may be added to water or electrolyte solution:
 - one-fourth teaspoon for every 1 liter of water.
- ⊙ For severe symptoms treat as heat exhaustion.

Heat Syncope and Heat Exhaustion

- ⊙ Remove the athlete from the hot environment and rest in a cool, shaded area.
- ⊙ Remove restrictive clothing.
- ⊙ Athlete lie with legs elevated above heart.
- ⊙ Give fluids orally, if the athlete is conscious.
- ⊙ Apply active cooling measures such as a fan or ice towels if the core temperature is elevated.
- ⊙ Monitor heart rate, blood pressure and respiratory rate.
- ⊙ Refer to a physician to assess the needs of fluid/electrolyte replacement and further medical attention, especially if nausea and vomiting are present.

Heat Stroke

- ⊙ This is a MEDICAL EMERGENCY.
- ⊙ Activate EMS immediately.
- ⊙ Monitor core body temperature, if possible, and lower it as quickly as possible.
- ⊙ Remove as much clothing as possible.
- ⊙ Immersion in an ice bath has been shown to be the best method to decrease core temperature.
- ⊙ Apply ice packs in the armpits, groin and neck areas.
- ⊙ Monitor airway, breathing and circulation at all times.
- ⊙ Continue cooling efforts until EMS arrives.

Hyponatremia

- ⊙ This is a MEDICAL EMERGENCY.
- ⊙ Activate EMS immediately.
- ⊙ EMS will administer intravenous fluid to restore sodium levels.
- ⊙ If suspected, do not administer oral fluids until a physician consultation.

PREVENTION:

- ⊙ Educate all participants, coaches, officials and administrators regarding the signs and symptoms of heat-related illness.
- ⊙ Individuals with a previous history of heat illness, with sickle cell disease, or on certain medications may be at higher risk for heat injury and should be monitored closely.
- ⊙ Allow adequate acclimatization to the heat. (Acclimatization is achieved by gradually increasing activity in the heat over a period of 7-10 days.)
- ⊙ Wear light-weight and light-colored clothing.
- ⊙ Provide frequent periods of rest and hydration during activity.
- ⊙ Allow unrestricted fluid replacement before, during and after activity:
 - See section on Fluid Replacement in this handbook.
- ⊙ Schedule activities at the coolest time of day.
- ⊙ Weigh each athlete before and after each practice to monitor body water loss during the practice. During two-a-days, athletes should gain back at least 90 percent of the water weight lost in the first practice before being allowed to participate in the second.
- ⊙ Every institution should have a plan and means to assess environmental conditions.
 - The environment should be monitored for both temperature and humidity prior to activity, with the practice schedule adjusted accordingly. (See Figure 2 – Heat Index Chart on page 37)
 - The use of the WBGT Index is the most widely used to assess the combined impact of humidity, ambient temperature, solar radiation and air movement. The following guidelines are recommended when using the WBGT Index:

<65°F	Low risk
65-73°F	Moderate risk
73-82°F	High risk
>82°F	Very high risk

- ⊙ An alternative method for assessing heat and humidity is the weather guide or heat index. Figure 2 on page 37 is an example of a heat-humidity index table that defines low, moderate, high and extreme risk zones. An example of a heat index calculator can be found on the Oregon School Activities Association (OSAA) Web site: <http://www.osaa.org/heatindex/default.asp>.
- ⊙ Considerations for Games:
 - Check the environment one hour before the scheduled contest.
 - If a high risk is present, consider altering game conditions.
 - If a very high risk is present, consider postponing or canceling the contest.
- ⊙ Considerations for Practices:
 - When a dangerous heat index is indicated, consider canceling or shortening the practice session, or rescheduling to early morning or late practice sessions.

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- National Weather Service (NWS). 2008. Heat Index Chart.

Fluid Replacement for Athletes

2002 • Revised 2008

SIGNIFICANCE

A loss of just one to two percent of body weight (1½ to 3 pounds for a 150-pound athlete) can negatively impact performance. A loss of three percent or more can increase the risk for exertional heat-related illness (See Section on Heat-related Illness). In general, athletes do not voluntarily drink sufficient water to prevent dehydration during physical activity. However, drinking behavior can be modified by education and implementation of a hydration protocol to prevent dehydration.

RECOGNITION

Dehydration is common in sports and can occur within an hour of exercise. It can occur even more rapidly if the athlete begins the session less than fully hydrated.

Signs and Symptoms of Dehydration:

- ⊙ Thirst (however, one can be dehydrated without feeling thirsty)
- ⊙ Irritability
- ⊙ Headache
- ⊙ Weakness
- ⊙ Dizziness
- ⊙ Cramps
- ⊙ Chills
- ⊙ Nausea and vomiting
- ⊙ Heat sensations in the head or neck
- ⊙ Decreased performance

PREVENTION OF DEHYDRATION

Implementation of a hydration protocol is the key to the prevention of dehydration. Athletes, coaches, athletic trainers, team physicians, officials and parents must realize the importance of maintaining proper hydration status (not only during, but prior to and following activity) and the steps required to accomplish this goal.

Body weight changes during exercise provide the best indication of hydration status, thus obtaining a body weight before and after practice is recommended. The athlete should be dressed in only a T-shirt and shorts for each weigh-in.

General Guidelines and Strategies

- ⊙ Educate athletes regarding the risks of dehydration and overhydration on health and physical performance.
- ⊙ Inform athletes, coaches and parents how to monitor hydration status.
- ⊙ Establish individual and team hydration protocols, based on athlete sweat rate, sport dynamics (rest breaks, exercise intensity and duration, fluid access), environmental factors (heat and humidity), state of acclimatization and training, and individual needs.
- ⊙ Implement a hydration protocol during all practices and games, and adapt as needed.
- ⊙ Encourage coaches to mandate rehydration during practices and competitions.
- ⊙ Provide the optimal oral rehydration solutions (water, carbohydrates [CHO], electrolytes) before, during and after exercise. For intense or sustained activity (longer than 45 minutes), access to a sports drink with six to eight percent CHO concentration is recommended.
- ⊙ Closely monitor weight changes and hydration status in hot and humid environments and adapt hydration protocols accordingly.

Fluid Guidelines: Dehydration is largely preventable when proper strategies are employed to optimize hydration before, during and after exercise. The following guidelines are provided to assist in the development of these strategies:

Before Exercise

Athletes should begin all sessions well hydrated. To ensure proper pre-exercise hydration:

- ⊙ Confirm adequate rehydration following previous exercise session by pre-exercise, body-weight monitoring. Assuming proper hydration, pre-exercise body weights should be consistent across exercise sessions.
- ⊙ Drink 16 ounces of water two hours before exercise.
- ⊙ Drink another 8-16 ounces of water 15 minutes before exercise.

During Exercise

Fluid replacement during exercise should approximate loss of fluids through sweat and urine output, with the goal of minimizing dehydration to less than two percent loss of body weight.

- ⊙ Drink early and often. Do not let thirst guide fluid intake.
- ⊙ Allow unrestricted fluid replacement.
- ⊙ In general, drink 4-16 ounces of water every 15-20 minutes.
- ⊙ Modify protocol as necessary for athletes with a high sweat rate, in sports where breaks or fluid access is limited, and during high intensity training.
- ⊙ Ideally, individual fluid containers should be readily available and flavored to athlete preference (individual containers allow monitoring of individual's fluid intake).

After Exercise

Post exercise hydration strategies should be aimed at correcting any fluid loss occurring during practice or competition.

- ⊙ Ideally, lost fluids should be replaced within two hours following completion of exercise.
- ⊙ Rehydration should consist of water to restore hydration status, CHO to replenish glycogen stores and electrolytes to speed rehydration as appropriate.
- ⊙ Drink 24 ounces of an appropriate sports drink or water, as indicated, for every pound of weight lost due to exercise.
- ⊙ Weigh athletes before and after activity to monitor body water loss from the activity and to ensure adequate rehydration has occurred prior to next session. If there is a significant decrease in body weight, athletes should not be allowed to participate, especially in hot weather, until they are rehydrated back to previous weight.

MANAGEMENT OF DEHYDRATION

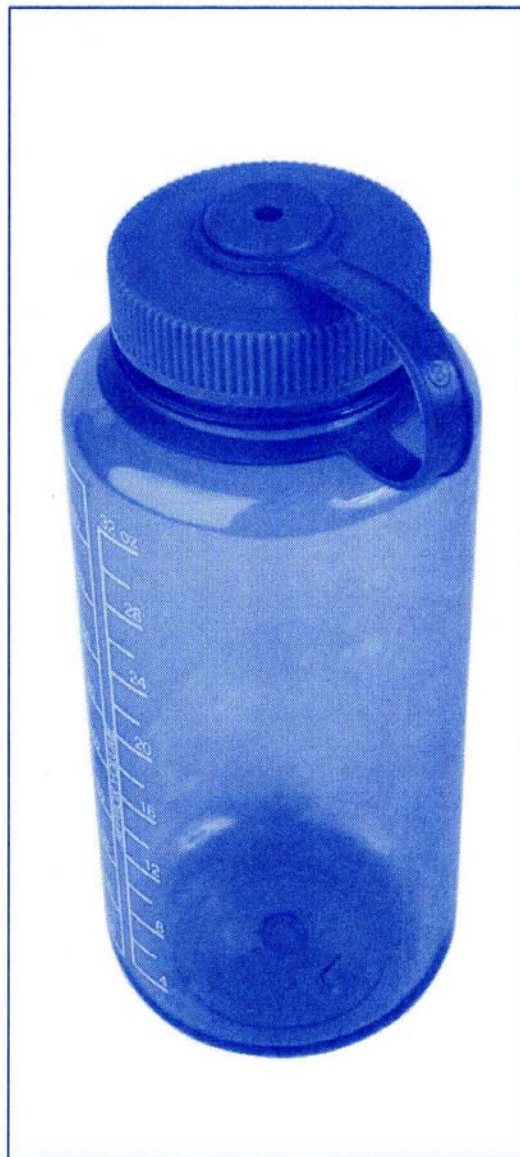
Dehydration of more than three percent loss of body weight dramatically increases an athlete's risk of heat illness (See Section on Heat-related Illness).

- ⊙ The key to management is prevention.
- ⊙ Those supervising athletes should be able to recognize signs of dehydration.
- ⊙ If signs of dehydration are recognized:
 - Aggressively rehydrate through oral consumption of beverages if the athlete is conscious, coherent and without gastrointestinal distress.
 - Transport for medical care if the athlete shows signs of mental compromise, gastrointestinal distress (nausea, vomiting, etc.) or signs of heat-related illness (See section on Heat-related Illness).

More on Fluid Replacement

WHAT TO DRINK DURING EXERCISE

- ⊙ Fluids are best consumed when beverages are cold.
- ⊙ For most athletes, water is the best fluid for pre-hydration, maintaining hydration during exercise and for re-hydration.
- ⊙ Some athletes may benefit from including CHO-containing beverages e.g., sports drinks, in their hydration protocol.
 - Include appropriate sports drinks with CHO and salt, if activity is intense or lasts longer than 45 minutes.
 - Appropriate sports drinks should contain CHO in the range of six to eight percent (Greater than eight percent will slow rate of gastric emptying and fluid absorption).
 - "Energy drinks," fruit juices, carbohydrate gels and sodas are not recommended as a beverage during an exercise session.
- ⊙ A CHO-containing beverage will ideally also have a modest amount (0.3 to 0.7g/L) of salt to offset salt loss in sweat. This can minimize medical problems associated with electrolyte imbalances (e.g., muscle cramps) and can stimulate thirst to increase voluntary intake.
- ⊙ Avoid carbonated beverages, which can cause one to feel full and may reduce voluntary intake.
- ⊙ Athletes should be aware that nutritional supplements are not limited to pills and powders. Increasingly popular "energy drinks" contain large doses of caffeine, as well as other additives that may be dangerous during exercise. Like other supplements, these drinks are not regulated by the FDA and thus their purity and contents cannot be guaranteed.



Considerations for Heat Exposure and Acclimatization

- ⦿ Sweat rate is generally greater after 10-14 days of heat exposure, requiring greater fluid intake for the same bout of activity.
- ⦿ Closely monitor hydration during the first week of exercise in a warm environment. Moving from a cool to warm environment will increase overall sweat rate.
- ⦿ Increases in dietary salt intake may be warranted during the first three to five days of heat exposure, particularly if athletes are prone to exercise-related muscle cramping. After 5-10 days, sodium concentration in sweat decreases, and normal sodium intake suffices.

Considerations for Tournaments and Large-scale Events

- ⦿ Plan in advance to ensure adequate access and availability to water and appropriate sports drinks when indicated.
- ⦿ For multiple day events, check hydration status daily to ensure adequate rehydration from previous day before allowing the athlete to continue.
- ⦿ Modify events as environmental factors dictate (See section on Heat-related Illness).
- ⦿ Recruit additional help to ensure hydration availability and that access is maintained at all venues and break stops throughout the competition.

References:

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