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## Beat the Heat: Managing Heat And Hydration In Marching Band

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**ABSTRACT:** Marching band students are athletes who practice outdoors under conditions that expose them to dehydration, heat exhaustion, and sunstroke. They suffer these heat-related injuries because breaking formation frequently to adequately hydrate is impractical. This project developed educational materials alerting the students and the director to heat-related illnesses and tested a simple method of fluid replacement that could be used during practice. A Heat Index chart was adapted to identify hazardous conditions; fluid intake recommendations were made based on the Heat Index. Students purchased a water bottle housed in an insulated belt that was worn during all outdoor rehearsals. Because water was readily available, the students were able to drink the necessary fluids without interrupting the rehearsal. These bottles have been used successfully for 3 years. Based on limited subjective data, the students reported feeling better, their mental acuity improved, and rehearsals were more productive. This article examines the effects of heat on the body and reports on a practical solution that has been found to protect marching band members from heat-related stress.

**KEY WORDS:** dehydration, fluid replacement, Heat Index, heat-related illness, marching band students

High school coaches are encouraged to watch their student athletes closely for signs of heat fatigue and dehydration. Because the marching band is administered through the arts or music department at many schools, it is often overlooked as an activity that is athletic in nature. Most music directors receive little or no training in health-related issues and do not fully understand the importance of adequately hydrating their students who practice for hours at a time in high heat-index conditions in formation, which is military-style marching on the field while carrying heavy instruments. Consequently, the students may soon exhibit nausea, muscle cramping, headache, and lack of concentration. The director encourages them to con-

tinue because once students get out of formation for water breaks, practice time is lost. Most directors and students do not understand that performance would improve if they were adequately hydrated.

Nurses who subscribe to the School Nurse Listserv were asked in June 1999 for suggestions about how they have solved this problem. Fifteen responses from all over the United States were received; no one had any suggestions, but all requested the solution be forwarded to them because they had also encountered this problem but were not able to come up with a practical solution.

Nutrients are chemicals that are essential to keep the body healthy with water being the primary one. It aids in all body processes including digestion, absorption, circulation, and transportation (Brzycki, 1999). It regulates body temperature, prevents dehydration, flushes toxins, supplies the body with oxygen and nutrients, and aids muscles in producing energy

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(Null, 1999). Sixty to seventy percent of body weight is water; losing approximately 20% of body weight to dehydration can be fatal.

Body temperature is maintained by moving heat from the exercising muscles to the surface of the skin via the blood (Bailey, 1994). As the body's core temperature rises with strenuous exercise, the circulatory system responds by having the heart pump faster to move blood to the organs more quickly and to absorb heat. The capillaries directly under the skin open up to allow heat to get to the surface, resulting in the face having a flushed appearance. Water from the blood vessels is also brought to the skin surface as perspiration, which cools the body as it evaporates (Miller & Levine, 1995). Seventy percent of the heat released through exercise is lost through the head and hands (Kashiawa & Rippe, 1987). This system works best when the outside air temperature is lower than 75°F; when there is low humidity; when there is no direct sunlight or strong, hot, dry winds; and when cool, loose clothing is worn.

Humidity hinders the body's cooling mechanism more than high air temperature (Evans, 1997). When the air's moisture content is high, perspiration does not evaporate from the skin, and this cooling mechanism is lost. With 100% humidity, the sweat simply pours off the skin as liquid, and no cooling of the body occurs.

Summers in much of the United States are generally hot. The National Weather Service estimates that 175 Americans die from heat-related illnesses each year (National Oceanic and Atmospheric Administration [NOAA], 1999). Professional athletes are not immune; Korey Stringer of the Minnesota Vikings died in August 2001 from apparent heat stroke during football practice. The National Weather Service of NOAA (1999) has devised the Heat Index, or apparent temperature scale, that predicts the body's ability to dissipate heat and indicates how safe it is to participate in activities on a given day. The Heat Index charts take into account both the temperature and humidity. NOAA Heat Index calculations can be found under Heat Index and Wind Chill Algorithms (1999). The higher the Heat Index, the more difficult it is for the body to adapt and cool itself through normal mechanisms. The National Weather Service does not take into account full exposure to the sun or strong, hot, dry winds that can raise the Heat Index value up by 15°F (NOAA, 1999). These charts are found on the Internet and are quoted in weather reports throughout the country.

If the body's cooling system is taxed by lack of fluid replenishment, dehydration occurs. The blood itself heats and thickens. In this state, despite the heart pumping harder, blood flows more slowly, and the blood-oxygen exchange is impaired in the lungs (Loeb, 1991). Ultimately, oxygen delivery to vital body organs and muscles is limited by increased circulatory

demands and the disruption of the ability of the blood to transport sodium and potassium, which are essential to maintain optimum muscle contraction and relaxation. The muscles are not able to produce energy without a constant oxygen supply. This manifests itself in clumsiness, vertigo, disorientation, and poor judgement (Bailey, 1994).

Mild dehydration occurs when only 1% of body weight is lost (1.5 pounds in a 150-pound student). If fluid loss continues without replacement, there is a gradual decline in athletic performance and an increase in symptoms (Grandjean & Rund, 1994). By the time 4% of body weight is lost (6 pounds in the 150-pound student), there is a 20 to 30% decline in athletic performance. It is estimated that collapse is likely when 7% of body weight is lost (Sizer & Whitney, 1997). The pulse rises eight beats for every 2.2 pounds of fluid lost, which decreases endurance, strength, and mental alertness (Tamborlane & Weiswasser, 1997). Performance declines are marked when the body is dehydrated.

People in higher risk categories, such as small children, the elderly, those with alcohol or weight problems, and those taking tranquilizers and anticholinergic medications, are more sensitive to the effects of high Heat Index than the rest of the population (NOAA, 1999). Heat-related illnesses are possible when the Heat Index rises to between 90 to 105°F. The intensity of activities that last 15 minutes or longer should be reduced whenever the humidity, solar radiation, and air temperature are above critical levels (American Academy of Pediatrics, 1999–2000).

Heat stroke occurs when the body's core temperature has increased to the point that the natural cooling system shuts down completely (Bailey, 1994; Handal, 1992). Blood flow to the skin and perspiration decreases to conserve water to the major organs. The brain, which can only function in a very narrow temperature range, begins to overheat and fail. When perspiring stops, the body temperature rises quickly to a fatal level. By this point, the victim may become disoriented, combative, and argumentative and may experience hallucinations, confusion, seizures, and loss of consciousness. The body temperature may be as high as 106°F.

Evans (1997) found dehydration resulted in decreased endurance, increased heart rate, increased lactic acid in the muscles, increased body temperature and decreased strength, eventually leading to heat-induced disorders such as heat cramps, heat exhaustion, and heat stroke. Treatment involves moving the victim to a cool, shady area; application of cool, wet compresses to the neck, wrists, and underarms; loosening clothing; and oral fluid replacement if the victim is alert and oriented (Loeb, 1991; NOAA, 1999; Table 1). If symptoms of abdominal or lower extremity cramping are present, firm massage to the cramp is advised. Heat stroke is a life-threatening condition.

Emergency personnel should be called and the victim put into the shock position.

Water must be replaced in the body as it is lost through perspiration, or dehydration will be inevitable (Neilitz, 2002). Thirst is an imprecise sign of dehydration because it is generally believed that when thirst is experienced, the body is already dehydrated (Wellesley, 2000). Activity may actually impair the thirst mechanism, causing thirst to become detectable only after fluid stores are depleted (Sizer & Whitney, 1997). A normal, sedentary adult should drink six to eight 8-ounce glasses of water daily to replenish the 1 gallon of fluid lost through normal bodily processes (respiration, perspiration, urination, and defecation). Fluid needs increase during exercise in hot and humid climates, in high altitudes, when taking some prescription medications, and while dieting (Rabkin, 2000). With exercise, the need to replace fluids increases depending on heat, humidity, sunlight, wind conditions, and the type of clothing worn. It is common to dehydrate from 2 to 6% of body weight during exercise in the heat (Wellesley, 2000).

As a general rule, it is recommended that athletes hydrate before exercise, every 15 minutes during exercise, and up to 2 hours afterward (American Academy of Pediatrics, 1999–2000). The amount of fluid replacement needed will depend on the size of the student and the amount of fluid lost to perspiration; sources vary in their recommendations (Table 2). Water should be 40 to 50°F, with cooler temperatures being acceptable (Bishop, 1995). Drinking 4 to 8 ounces (two to three mouthfuls) every 10 to 15 minutes provides optimal rehydration. At this rate (16 to 30 ounces per hour), the stomach can efficiently absorb the fluid and excrete it into the intestine, where it is reabsorbed into the bloodstream and delivered to the

working muscles. This system is more efficient with cooler than warmer temperatures (Evans, 1997).

Tap water is the optimal fluid replacement for exercise of up to 2 hours. It is not necessary to replace nutrients and electrolytes beyond the water replacement during that length of time. If exercise lasts longer than 2 hours, some sources recommend liquid carbohydrate (sports drinks) (Bishop, 1995; Evans, 1997). Sports drinks are excellent sources of carbohydrates and electrolytes (sodium, potassium, chloride, phosphorus, calcium, and magnesium.) They enhance fluid absorption from the small intestine. Small amounts of sodium also increase the thirst mechanism. Salt tablets are not advised; they concentrate a large percentage of sodium in the stomach, drawing fluid from the blood, when it would be better utilized at the skin surface. After exercise, the carbohydrates in sports drinks are readily absorbed, and the body is more responsive to restoring the glycogen in the muscles, liver, and blood.

To prevent heat stress in marching band students, hazardous weather conditions must be identified. The National Weather Service Heat Index chart was adapted using only three colors rather than the usual four found in other sources. The colors chosen were red, yellow, and green because these are easily identifiable as representing a state of alertness to the general population (Figure 1). The combination of the three-color format and easily remembered recommendations for marching band practice make this chart relevant for the band director. The director was encouraged to check the weather report daily either through the morning newspaper or via the Internet (<http://>

**Table 1.** Heat-Related Illness: Symptoms and Treatment

Heat Disorder	Symptoms	Treatment
Heat cramps	<ul style="list-style-type: none"> <li>◆ Painful cramping, usually in the legs or abdomen.</li> <li>◆ Heavy perspiration.</li> <li>◆ Nausea.</li> </ul>	<ul style="list-style-type: none"> <li>◆ Move to a cool, shady area.</li> <li>◆ Firm, gentle massage to cramp.</li> <li>◆ Drink at least 4 oz of fluid every 15 min.</li> </ul>
Heat exhaustion	<ul style="list-style-type: none"> <li>◆ Dizziness, headache.</li> <li>◆ Normal temperature possible.</li> <li>◆ Weakness and fatigue.</li> <li>◆ Heavy perspiration.</li> <li>◆ Nausea.</li> <li>◆ Cold, pale, clammy skin.</li> </ul>	<ul style="list-style-type: none"> <li>◆ Move to a cool, shady area.</li> <li>◆ Loosen clothing; fan student.</li> <li>◆ Drink at least 4 oz of fluid every 15 min.</li> <li>◆ Apply cool, wet cloths to the neck, forehead, and underarms.</li> </ul>
Heat stroke	<ul style="list-style-type: none"> <li>◆ Hot, red and dry skin.</li> <li>◆ Absence of sweating.</li> <li>◆ Rapid, strong pulse.</li> <li>◆ Nausea/vomiting.</li> <li>◆ Confusion, incoherent speech.</li> <li>◆ Possible seizures.</li> <li>◆ Possible loss of consciousness.</li> <li>◆ Body temperature ranges from 102° to 106°F.</li> </ul>	<ul style="list-style-type: none"> <li>◆ Call 911, medical emergency.</li> <li>◆ Move to a cool or air-conditioned area; fan student.</li> <li>◆ Loosen clothing.</li> <li>◆ Cool with cool bath or sponging.</li> <li>◆ Take temperature if possible.</li> <li>◆ Lie on the back with feet elevated.</li> <li>◆ If vomiting, turn on the side.</li> <li>◆ Do not give fluids if unconscious, confused or seizing. Use caution.</li> </ul>



www.noaa.gov/wx.html) for the predicted Heat Index to plan the length and location of rehearsal.

## WATER BOTTLE BELTS

Band members must drink water while they practice on the field. A practical solution was found with the discovery of water bottles that are carried in a nylon belt that has an insulated pouch to hold the bottle and keep the fluid cool. These belts resemble fanny packs (Figure 2). Each student and the director were required to purchase and use these during outdoor rehearsals. They can be positioned on the front, side, or back of the body, depending on which instrument is being played, and are adjustable to the size of the student. The standard bottles hold 22 ounces of fluid. The belts have zippered pouches on each side of the water bottle pouch, which are ideal for carrying inhalers, change, keys, and earplugs for the percussionists. The student's names were written on the belts with whiteout pen; permanent markers were used on the bottles.

A parent volunteer obtained estimates of the cost from different sources and purchased the bottle belts in bulk. Quotes were obtained from chain stores as well as local athletic stores. They ranged from \$11 for a belt without the side zippered pockets to \$20 for those with the pockets. One hundred bottle belts with pockets were purchased from a local sporting goods store at a reduced price of \$15, which included the water bottles. This purchase of 100 bottle belts will last several years. Obtaining the belts alone and having the students provide their own bottle would have saved only \$1. The cost of the belt was added to the fee for participation in marching band. Attempts were made to acquire donations of the belts and bottles from local merchants, but because of the cost, no merchant expressed an interest in this proposal.

The bottles were stored in large plastic tubs at school. Students did not take them home on a regular basis to prevent their being lost or forgotten. Every 1 to 2 weeks, the bottles were taken home by a parent volunteer for cleaning and run through the dishwasher. Names were touched up as needed. It was necessary to wash the belts only after band camp and once in fall after they had been worn in extreme heat. The

**Table 2.** Fluid Replacement Guidelines

Time	Amount Advised
30 min to 2 hours <i>prior</i> to exercise	8 to 16 oz
Every 15 to 20 min <i>during</i> exercise	6 to 12 oz
<i>After</i> exercise	16 to 32 ounces or 16 oz for every pound lost

*Note.* Avoid caffeinated or carbonated drinks. They will cause a feeling of fullness and dehydration. Water or sports drinks are best.

	Temperature								Relative Humidity (%)									
(F)	90.0	80.0	70.0	60.0	50.0	40.0	30.0	20.0	10.0									
75	79.7	76.7	75.8	74.8	73.9	72.9	72.0	71.1	70.1									Green Zone
80	88.2	85.9	84.2	82.8	81.6	80.4	79.0	77.4	76.1									Below 80
85	101.4	97.0	93.3	90.3	87.7	85.5	83.5	81.6	79.6									
90	119.3	112.0	105.8	100.5	96.1	92.3	89.2	86.5	84.2									Yellow Zone
95	141.8	131.1	121.7	113.6	106.7	100.9	96.1	92.2	89.2									80 to 100
100	168.7	154.0	140.9	129.5	119.6	111.2	104.2	98.7	94.4									
105	200.0	180.7	163.4	148.1	134.7	123.2	113.6	105.8	100.0									
110	235.6	211.2	189.1	169.4	151.9	136.8	124.1	113.7	105.8									Red Zone
																		Above 100

**Green Zone:** Outdoor conditions ideal.

**Yellow Zone:** Heat exhaustion possible with prolonged exposure & activity.

**Red Zone:** Heat cramps & exhaustion likely with prolonged exposure. Heatstroke possible. Limit or cancel outdoor rehearsals.

**Figure 1.** Heat Index Chart

belts were put through the gentle cycle of the washing machine and air dried.

Bottles were filled with a combination of water and ice by parent volunteers or students before practice and at breaks. Tubs of ice and water coolers were placed in several locations to expedite this process. The insulated pouches on the belts kept the water cold for 2 to 3 hours. Care was taken not to fill the bottles too full with ice because it often did not melt despite the outdoor heat. Breaks were taken every hour for rest and to refill bottles. During rehearsals, the drum major or director would remind students to "drink!" every 15 minutes to keep within the required fluid replacement recommendations.

A 30-minute educational program was presented by the school nurse on the first day of band camp. It will be repeated annually with students and the band director required to attend. The program was divided into three sections: (a) the physiology of hydration and the effect of heat in causing dehydration; (b) the signs, symptoms, and treatment of dehydration and heat-related illness; and (c) how to manage the heat and dehydration during marching band practices. The nurse used charts (Tables 1 and 2, Figure 1) for visual learners. These were later posted in the band room.

The physiology section was a simple overview of the effects of heat and exercise on the body. It included a summary of the research cited at the beginning of this article with emphasis on the role dehydration plays in diminished performance. It was pointed out that the human body is 60 to 70% water. Normally, adults lose about 4 gallons of fluid per day in normal sedentary activities, but an active athlete can lose from 1 to 3 gallons per hour. If not replaced, the body enters a state of dehydration. The Heat Index is a reflection of the temperature the body feels, taking into account both air temperature and humidity. Sweating is one of the mechanisms the body uses to cool itself and works best in temperatures up to 80° with low



**Figure 2.** Water Bottle Belt

humidity. The higher the Heat Index, the more difficult it is for the body to rid itself of heat and the easier it is to become dehydrated. When the body is fully hydrated, all body functions are working at maximum capacity. When dehydrated, performance declines. There is a marked decline in performance when only 4% of body weight is lost (6 pounds in a 150-pound student). Students were reminded that when dehydrated, they would not be able to concentrate on the music or drill, and they would feel ill, and thus practice time would be less efficient.

Section 2 concentrated on the signs and symptoms of heat illness and appropriate treatment. Table 1 was enlarged and reviewed verbally. Students were encouraged to note these symptoms both in themselves and their classmates and to treat them immediately. It was pointed out that even when dehydration is mild, affected persons will experience decreased coordination, fatigue, mental irritation and depression, and impairment of judgment. Students and the director need to be familiar with and follow the recommended fluid replacement guidelines (Table 2).

Section 3 emphasized the practical aspects of dealing with heat, dehydration, and the prevention of heat-induced illness during marching band practice. The nurse pointed out that marching band is an athletic activity that requires students to be outdoors for long periods of time. Students were encouraged to use sunscreen liberally and to wear hats and light, loose clothing. Because valuable practice time is lost when band members break formation for water breaks, the director and students were required to wear a water bottle and belt when outdoors. Students were told

that the drum major or director would remind everyone to drink about 4 ounces of fluid every 15 minutes, and students were encouraged to drink water whenever standing at ease. The students were reminded that thirst is a poor indicator of hydration status and that despite best intentions, students may feel ill on the field. It was stressed that students who become dehydrated were not to continue practicing but to leave the field immediately for assistance at the sidelines, where parents would assist them with water and cool towels.

The 75-member band tested the belts during the 1999–2000, 2000–2001, and 2001–2002 seasons. Students were encouraged to drink 8 to 16 ounces of water before practice and 16 to 32 ounces of water after practice, in addition to frequent drinking (4 to 8 ounces every 15 minutes) while on the field. The director or drum major reminded students to “drink” or “chug” every 15 minutes. Subjectively, the number of students exhibiting symptoms of heat-induced illness decreased from previous years. Parent volunteers noted that fewer symptomatic students left the field. The drum major stated that students were better able to concentrate during rehearsals, and the director felt the rehearsals were more productive. He was happy to have found a solution that pleased the parents and solved a health-related problem. No calls were made to summon emergency services, which had been done twice in the previous year.

The students and director generally drank more

than the recommended amount of water because it was readily available. It was noted that extra bathroom breaks were not necessary. At times, each instrumental section practices separately; thus, waiting sections were able to drink while another section was practicing, yet all were in formation ready to go when the entire group practiced a drill together.

As a result of the educational materials, students were more aware of the symptoms of heat-related illness and were better able to recognize problems early in themselves or their classmates. This allowed them to leave the practice field on their own for treatment, if necessary, rather than fainting on the field, which had occurred weekly in previous years. The director was more understanding of problems and encouraged students to leave at the first sign of illness. The adapted Heat Index chart gave the director an objective system to use to determine if outdoor rehearsals should be shortened or canceled due to the Heat Index being unsafe for students' health. The red-yellow-green format with simple parameters was easy to remember, thus improving compliance.

Parent or student volunteers are vital components of the system. These individuals obtained the ice and water and monitored problems on the field. If the cafeteria ice machine was unavailable, ice was purchased and carried to rehearsal. A parent volunteer took the bottles home for washing every 1 to 2 weeks. This could be improved; however, it is a logistically difficult task to carry home and wash 75 bottles and belts. Consideration should be given to asking the cafeteria staff to wash the bottles or having each student take his or her own bottle home on a weekly basis. Clean, used bottles and belts from graduating seniors could be kept on hand for short-term use for students who forget to bring theirs to practice.

Adaptations to this system have been made (Janet Gray RN, NCSN, personal communication, Whiteville City Schools, Whiteville, NC). In Whiteville, North Carolina, the band purchased individual belts for the 180-member band. Students provided their own water bottles and kept them clean. The belts were purchased by the band program and issued to the students with their uniforms. They found the pockets on the belts provided a place for valuables, eliminating the need for purses (one of which was stolen the previous year). Their band plans to use the belts when they march in a parade during the warm months of late spring.

Promoting student health during the school day is an important aspect of the school nurse's role. The nurse is a bridge between health care and educational professionals. The challenge is to present information factually and assertively, in a manner that ensures educators will understand the importance of recommended changes. Dealing with heat, humidity, and

the resulting dehydration in students is something many educators have difficulty comprehending. The band director is an example of a teacher put into the position of being in charge of an arts-based group; due to the nature of marching band, students are exposed to potential heat-related illnesses normally seen only in athletes. The marching band director and students may have difficulty understanding the pathophysiology and implementing the changes necessary to prevent heat illness.

As a health educator, the school nurse must take the initiative to observe marching band practice to see if proper procedures are in place because the director, students, or parents may not realize a problem exists. Often the school nurse will find that rehydration of band members at recommended levels is difficult because of the nature of the practices. Once a need has been identified, the nurse should approach the director with suggestions for change. Some initial resistance is to be expected because band directors are under deadlines, work with large groups of students, and are used to autonomy and control of the practice situation. They may have "done it this way" for many years and do not have the background knowledge to realize the potential health risks.

The nurse needs to discuss the implications of long practices in the heat and the need for frequent fluid replacement. Pointing out how frequent fluid replacement and reduced practices in the heat will benefit the director and band program is an excellent approach. The nurse could cite information regarding dehydration and the subsequent effects on the body, especially decreased endurance and strength, decreased level of concentration, physical manifestations of the heat, and the possibility of medical emergencies. The nurse should also discuss the Heat Index, pointing out the physiology of heat dissipation in the body and the need for reduced time outdoors when the Heat Index is high. Suggesting a way to replace fluids without the students needing to break formation frequently meets the director's need for control yet addresses the needs of students.

Coordinating procedures with parent volunteers is vital because they are an important component of many band programs. It is a rare parent who is not concerned about the health implications of students practicing in the heat. Consequently, parents need to be given the same information. Finding and implementing a solution to the lack of fluid replacement is usually an easy sell with parents. They often purchase the equipment and assist in maintaining it; their enthusiasm and participation will be invaluable during implementation.

An educational program should be arranged. The program will inform students, parents, and the director about the potential for heat-related illness and a solution that has been tested. The nurse must emphasize that no one is exempt from the requirements. Pe-



riodic visits to practices should be implemented to check compliance, answer questions, and give recognition to those following the instructions.

Heat-induced illness is common during marching band rehearsals. Students generally do not want to call attention to themselves by leaving the field during rehearsal, so they tend to continue rehearsing, hoping the symptoms they feel will disappear. Students and directors need instruction on how heat and dehydration affect the body and its performance. The educational program should increase their understanding of the importance of constant fluid replacement, especially when the Heat Index is high. Water must be readily available for students to use, or they will go without it, risking serious health consequences. Wearing bottle belts during rehearsals should be required for all marching band members. Initially, the students feared "looking like nerds," but that issue was resolved when everyone was required to wear them.

Lack of adequate fluid replacement was a problem recognized by parents, students, and staff before 1999, but at the time, no one could come up with a solution that did not involve the band breaking formation every 10 to 15 minutes or having multiple students sharing one water container on the practice field. The band has used these water bottle belts for 3 years. Their use is not questioned because their value has been demonstrated. Before their use, students were physically exhausted and had frequent complaints of nausea, headache, and muscle cramping. Students passed out on the field as they did not recognize symptoms or respond to them. One was admitted to the emergency room suffering hallucinations. The band director and parents were in conflict, with the parents demanding frequent water breaks and the director reluctant to allow this because of the resulting loss of valuable practice time.

Today, the students ask to wear the bottle belts. Many no longer remember a time when water was not constantly available to them. They remind each other to "drink" and have been overheard telling a classmate complaining of a headache to "drink a big glass of water." They recognize the symptoms of heat-induced illness and dehydration and will come off the field voluntarily for assistance when symptoms first occur. The amount and quality of the practice time has increased. Use of these bottle belts has provided a

cost-effective means of addressing a major health and safety concern while balancing the needs of the group.

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