

Exertional Heat Stroke of Max Gilpin: A Preventable Death

By: [William M. Adams](#), Luke N. Belval, [Adam P. Berg](#), Yuri Hosokawa, Rebecca L. Stearns, and Douglas J. Casa

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Abstract:

Exertional heat stroke (EHS) is a medical emergency whose likelihood in sport settings is often contingent on environmental factors, team policies, coaching strategies, and broader cultural expectations. Moreover, when it occurs, it requires immediate recognition, proper management, and care to optimize chances of survival or recovery without long-term sequelae. Max Gilpin, a secondary school American football player from Louisville, Kentucky, suffered an EHS during a football practice in August 2008, an event that resulted in his death. The purpose of this article is to use interdisciplinary methods to identify key factors that contributed to this tragedy so that similar situations do not happen again. It concludes that within a culture of inclusive gender norms and care, efforts should be made to have appropriate onsite medical expertise available to develop and implement best practices for the prevention, management, and treatment of EHS, along with coaching education specific to medical emergencies in sport and physical activity (such as EHS). This will create an environment that promotes health and safety for all student athletes participating in sport at the secondary school level.

Keywords: Cold water immersion | work-rest ratios | medical coverage | body temperature | body cooling | hegemonic masculinity | pain principle | inclusive masculinity

Article:

On August 20, 2008, Max Gilpin, a sophomore member of the football team at Pleasure Ridge Park High School in Louisville, Kentucky took the field for a practice that would be his last (Commonwealth of Kentucky v David Jason Stinson, 2009). Gilpin was, in all probability, unaware that he was inhabiting a milieu that put his health and indeed his life at risk. Nor did he recognize that within this problematic setting, those responsible for his supervision would act in a manner that would cost him everything. On this day, with a heat index of 34.4°C [94 °F], Gilpin and his teammates began a session of “gassers” in which their coach, David Jason Stinson, promised the team would continue running “til someone quits.” Sprinting four widths

(48.8m × 4) of the football field as fast as possible somewhere between twelve and thirty-five times, Gilpin pushed himself to his physical limit. As the fifteen-year old's body temperature rose to dangerous levels, he did not stop running. Then, at above 40.6°C (105°F), he experienced an exertional heat stroke (EHS). At this point, Gilpin collapsed, and without the adequate use of whole body cooling to treat this condition, he would never recover (Commonwealth of Kentucky v David Jason Stinson, 2009).

The death from the EHS that Gilpin succumbed to was preventable. Indeed, a collection of simple (and some rather obvious) measures would have saved his life. What was missing, however, was multifaceted and complementary. At the foundation of this tragedy was the absence of a culture where the practice of acknowledging pain is normal and in which healthcare is valued. If such a culture were present, moreover, the proper treatment needed to save Giplin's life would more likely have been implemented during the timeline of events that transpired on that day (Table 1). By the hands of skilled healthcare providers, Gilpin's life would have been saved. Instead, without proper medical personnel onsite at the time of collapse, nor the utilization of aggressive, whole-body cooling, Gilpin's life laid in peril.

Table 1. Timeline of events leading to Max Gilpin's exertional heat stroke and subsequent care.

Time	Event
3:00–4:00pm	Gilpin reports for weight lifting and film (air conditioned facility)
4:00–4:30pm	Gilpin required to remove cinder blocks from soccer field prior to girls' soccer game
4:30–4:50pm	Team take offs (team training drill)
4:50–5:00pm	Coach reported water break
5:00–5:20pm	Individual drills ^a
5:20–5:30pm	Coach reported water break
5:30–6:10pm	Conditioning session consisting of a reported 12 "gassers"
	8 gassers with full pads
	2 gassers without helmets
	2 gassers without helmets and pads
6:00–6:15pm	Gilpin collapses following conditioning session
6:18pm	Emergency medical service (EMS) receives call from assistant coach
6:19pm	EMS en-route to scene
6:27pm	EMS arrives to scene
6:30pm	EMS arrives to Gilpin
6:40pm	Gilpin transported to hospital
6:58pm	Gilpin arrives at hospital
7:10pm	First recorded rectal temperature measures at 41.89°C [107.4°F] ^β
7:22pm	Body temperature measured at 40.89°C [105.6°F]
7:36pm	Body temperature measured at 39.24°C [102.9°F] ^δ
7:43pm	Body temperature measured at 38.33°C [101.9°F]

Gasser = Bout of sprinting consisting of high intensity running for 4 continuous widths (48 m) of an American football field

^a Coaches reports indicate water was available during individual sessions for student athletes to consume if they desired

^β Based on known passive cooling rates of 0.03°C•min⁻¹ (McDermott et al., 2009), it can be speculated that Gilpin's body temperature may have been 43.54°C [110.4°F] given that the collapse occurs at 6:15pm

^δ Roughly 81 minutes elapsed from Gilpin's collapse to a first recorded temperature under the critical threshold for cell damage

What is more, Gilpin's fate and the mistakes that led to it are not as uncommon as they should be. From 1960 to 2017, at least 145 football players died from deaths attributable to EHS, with 45 occurring from 2000–2017 (Kucera, Klossner, Colgate, & Cantu, 2018). Though the loss of Max Gilpin alone should suffice, the preventability of all these occurrences represents a call to action for American football players, coaches, administrators, and health care providers.

This paper is a response to that call. It is, furthermore, an inter-disciplinary study. As such, it means to serve as a model for twenty-first century problem-based research and practice. In a recent critique of the structure of colleges and universities, sport law historian Sarah Fields (2016) argues for reorganizing the academy “around problems, rather than around discipline-based departments” (Fields, 2016). Fields (2016) proposes “a team of individuals well trained in different disciplines” who employ diverse “disciplinary training to a specific topic, problem, or question” of contemporary concern. To that end, we consider the context of Gilpin's death from a range of perspectives with the intention of offering theory-based and hard-evidence prescriptions related to the prevention, recognition and treatment of EHS. In particular, we deploy knowledge derived from the fields of socio-historical studies of sport and athletic training to convey the importance of hiring coaches and administrators who have a critical cultural awareness. We also emphasize that it is vital to employ health practitioners ready to implement appropriate medical care. The case of Max Gilpin is tragic but is also revealing as it represents a perfect storm of mistakes. It is our hope that those reading this article will use its analysis to ensure the safety and well-being of secondary school athletes in the future.

A culture of playing through pain

Once Gilpin's body began to overheat, a cascade of failures took place, each of which will be discussed in detail below. Yet, it is important to begin by considering why Gilpin's body temperature began to rise to such dangerous levels in the first place. Due to advances in scientific understandings made as early as the 1960s and 1970s, one might expect heat-related deaths in American football to steadily decrease overtime. Instead, rates have fluctuated and tragedies such as Gilpin's continue to occur. Most recently in 2018, nineteen-year old Jordan McNair died from EHS during a spring practice at the University of Maryland. This indicates social and cultural forces are shaping the ways scientific-knowledge is emphasized or de-emphasized, interpreted, and applied by coaches, administrators, and health care providers (Schultz, Kenny, & Linden, 2014). Neither American football culture nor expectations of masculinity are monolithic and static (Connell, 1995), but dominant assumptions about American football and gender present at Pleasure Ridge Park represent key aspects in need of revision.

The cultural dynamics of American football run deep in the history of the United States. The game emerged on elite college campuses in the years following the Civil War and by the turn of the twentieth century grew into a vehicle for various groups and classes of American boys and men to exhibit an emerging form of ideal or “exalted masculinity” (Connell, 1995). The closing of the American frontier and the industrialization of labor caused many boys to be raised almost entirely by women (mothers and school teachers). At the same time, men became less likely to control their own labor. Later, the rise of a service economy, urbanization, immigration, and feminism incited concerns about American males becoming too “soft” and effeminate. In

response to this “crisis of masculinity,” social leaders turned to sports such as American football. The game became an “anti-modern” “male preserve” where (initially White, middle-class) boys and men could firm up masculine authority by performing “essential” male traits. Toughness, strength, physical dominance, self-control, and self-sacrifice became markers of manhood obtained through the gridiron game (Dunning, 1986; Kimmel, 2012; Messner, 1988; Oriard, 1993, 2001).

Within this context, to allow one’s performance to be hindered by pain or injury meant risking one’s identity as a “real man” (Curry, 1993; Rodgers, 2014). For over a century, popular narratives of American football emerged in newspapers, books, radio, film, and television depicting this dynamic (Oriard, 1993, 2001; Trujillo, 1995; Vogan, 2014). This viewpoint became so culturally engrained over the decades that many administrators, coaches, and players came to understand it as the “natural” or “normal” way of the world (Curry, 1993; White, Sabo, & Gordon, 1995). Moreover, such representations have consistently involved older men pushing younger men through grueling physical trials, developing resilience, team cohesion, and a will to win. Often these portrayals encompass athletes playing through injuries, overcoming exhaustion, and suppressing their thirst for water. One athletic trainer calls this the “Junction Boys Syndrome,” a reference to legendary college coach Bear Bryant who forced his 1954 Texas A&M squad through ten days of training camp in a barren Texas desert with temperatures hovering around 37.8°C (100 °F) (Anderson, 2012). Seventy-six of 111 of Bryant’s players quit before camp was over, but observers credited Bryant’s harsh tactics for the Aggies undefeated season two years later (Dent, 1999).

Sport sociologists have described such occurrences and thinking as manifestations of “the pain principle,” the belief that experiencing pain is the passageway to manly success, enhancing character and social worth (Sabo, 1994, 2009). Forcing players to work through perilous conditions in the face of pain, fatigue, and dehydration has continually been romanticized in this way. For example, in the 2000 film *Remember the Titans*, one of the top grossing sport films of all time (Gartland, 2017), Disney creation Herman Boone punishes his players’ with “up-downs.” When a player named Blue asks for a “water break,” coach Boone refuses. “Water is for cowards,” Boone announces to the team; “water makes you weak; water is for washing blood off that uniform and you don’t get no blood on my uniform”. Instead, Boone avers, “we are going to do up downs until Blue is no longer tired and thirsty”. The obvious implication is that Blue must cast his physical discomfort aside and do as he is told. Indeed, taken literally, Blue’s suppression of his subjective state appears the only way for the up downs to finally stop. In the film, this “tough love” pays off. Boone’s newly integrated team overcomes racial animosity and goes on to an undefeated season of its own. But first, like Bear Bryant’s “Junction Boys,” the high schoolers had to “survive” three practices a day during the heat of the summer, taking hydration breaks only when allowed (Bruckheimer, Oman, & Yakin, 2000).

The cultural messaging is clear. Coaches know best and their direction should be followed. Furthermore, physical hardship is worthwhile, and pain should be repressed. As common refrains preach: players should “toughen up,” “suck it up,” and “play through it,” for “no pain, no gain.” These assumptions were at work, perhaps to an extreme, when Max Gilpin died. As many football players before him have done, Gilpin consented to authority and ignored the signals his body was sending to avoid being labeled “weak,” while searching for his coach’s, family’s, and

community's approval (Curry, 1993; Rodgers, 2014; Sabo, 1994, 1994; White et al., 1995). Gilpin did not always enjoy football. He quit in middle school but gave it a second try when high school started. He considered quitting again freshman year, but his parents talked him out of it. His father attended his practices and set high athletic expectations. Yet, Gilpin expressed more interest in being a mechanic than an athlete. Days before his death he complained to his girlfriend about being on the football team (Lake, 2010).

Meanwhile, coach Stinson wholeheartedly internalized the pain principle, likely taught to him during his playing days. Stinson was two degrees of separation from Bear Bryant himself. Stinson's college coach, Howard Schnellenberger, played for Bryant and was known for making players run gassers while banning water at practices (Lake, 2010). Stinson followed in these footsteps, employing physical hardship as a pedagogy for development. As he told his team moments before Gilpin's collapse, "We're gonna run till somebody quits!" (Commonwealth of Kentucky v David Jason Stinson, 2009). Though some players reportedly vomited, and another left for the hospital because of trouble breathing, Stinson did not stop the drill. Rather, as he admitted later in a deposition, his practices entailed players pressing through injuries. "If we stop the drill every time somebody got hurt," Stinson stated, "we wouldn't have any drills left to do". When asked if there were anything that would have led him to stop the gassers because players might be overheating, Stinson replied bluntly: "Not that I could think of" (Commonwealth of Kentucky v David Jason Stinson, 2009).

Although Stinson taught and performed a hardnose, dangerous – perhaps "toxic" – version of masculinity, the community he acted within also deserves admonishment. During Stinson's eventual trial for reckless homicide, assistant coaches and other observers testified the day's practice included nothing out of the ordinary. They saw using gassers as a punishment and threatening physical harm as a normal, regular and thus appropriate thing to do (Schultz et al., 2014). Most of the Louisville town supported their coach, even helping raise funds for his legal defense when he was charged with reckless homicide and wanton endangerment. While these comments and actions were meant to exonerate Stinson of guilt, they could also be read as an indictment of the larger culture that enabled Stinson's approach to secondary school sport (Lake, 2010). The pain principle and masculinist undertones were not just internalized by Stinson, they were normalized within the community at large. It is through this ideological lens that Stinson's behavior can be viewed as normal and morally defensible.

It is interesting to note in comparison that in the 2016 case of the State of Alabama v. Joyce Hardin Garrard, defendant Joyce Hardin was found guilty of capital murder for forcing her nine-year-old granddaughter to run until she collapsed and later died (State of Alabama v. Joyce Hardin Garrard, 2015). Max Gilpin faced a similar fate when forced to continue to exercise until someone on his team quit. Nonetheless, in contrast to Hardin, Stinson was ultimately acquitted. One way to explain this discrepancy is that cultural assumptions related to gender slanted jurors' interpretations of events. Because of masculine expectations and masculinity's association with American football, a football coach running a group of young men until someone gave up appeared a normal day at training camp. Yet, perhaps due to feminine norms, a woman forcing a young girl to run until she collapsed became murder. It thus seems that the social construction of gender transformed something deemed legal and typical into a criminal act worthy of a life-

sentence. If socio-historical processes can affect a juror's interpretations of murder, undoubtedly, they will also influence secondary school students in their everyday lives.

To prevent deaths such as Max Gilpin's as well as safeguard the overall health and wellbeing of secondary school aged athletes, there are therefore several cultural changes worth considering. There may be some truth in the pain principle. Perhaps it just needs to be doled out in limited doses. Some secondary school athletes may even thrive through its guidance. However, it should not be treated as an essential truth, something necessary for all boys or girls to become adults. It certainly should not be construed as a fundamental tenet to achieving a gender-appropriate identity. Rather, throughout secondary education, a pluralism of alternative masculinities, femininities, and queer identities should be celebrated. This should further enable a culture of care and concern for health. It should be normal for students and coaches to have basic knowledge of potential sport injuries and treatments. It should also be a regular occurrence for athletes to wield a level of agency over their own wellbeing, not to mention, of course, gender expression. Another strategy is to hire coaches and administrators with a critical cultural awareness, people who understand the malleability and power that gender norms and identities have with secondary school athletes. In the end, neither coaches nor players should assume physical suffering is an ideal educational tool and students should not feel pressured to suffer through extracurricular activities to gain social approval. This may be easier said than done, but one place to start to produce this type of ethos is to implement the policies we discuss below. Prioritizing these policies over traditional versions of exalted masculinity can promote both gender pluralism and health, two mutually enforcing objectives.

Lack of application of coaching education policies

Although healthcare may not be a coach's primary responsibility, secondary school coaches should be prepared to act appropriately should an emergency arise within secondary school sports. Along with shifts in cultural mores, this requires continual instruction and training. Especially in the absence of medical care professionals (i.e., athletic trainer or physician), as occurred in the case of Max Gilpin, it is essential that all coaching personnel obtain appropriate education on the prevention, recognition and management of sport-related emergencies, especially EHS (Casa et al., 2013, 2015, 2012). In truth, one does not need the depth of understanding acquired by an athletic trainer to be prepared to undertake the best practices soon to be discussed in detail. Nevertheless, research has shown that secondary school football coaches often lack fundamental knowledge of EHS, specifically related to prevention and recognition of the condition (Adams, Mazerolle, Casa, Huggins, & Burton, 2014).

This shortcoming appears to be a systemic flaw, which only further implicates a culture that downplays the importance of health care. At the time of Gilpin's death, for example, the Kentucky High School Athletics Association required that only head coaches receive state-mandated health and safety education (Kentucky High School Athletics Association, 2009). In Gilpin's case, head coach David Jason Stinson had this training but he was not involved in any aspect of Gilpin's care. Instead, Gilpin's treatment fell into the ill-equipped hands of assistant coaches, whom may have had the best intentions when treating Gilpin, but had no knowledge of what to do as they were not mandated to receive the minimal training required of head coaches (Commonwealth of Kentucky v David Jason Stinson, 2009). Although first aid, cardiopulmonary

resuscitation and automated external defibrillator training is strongly encouraged for all coaches, (Casa et al., 2013, 2015, 2012) this training is inadequate as it fails to cover topics related to other sport-specific emergencies, such as cervical spine injuries, brain trauma, exertional heat stroke, and exertional sickling. Continuing education on factors associated with sudden death in sport and physical activity should be a commonplace (if not institutional) policy for all secondary athletic coaches. This training should include the leading causes of death in sport and physical activity, observable signs and symptoms of a potential medical emergency, and the coach's role in managing the situation until appropriate medical care arrives. Even though no athletic trainer was available, if all coaches interacting with secondary school athletes had mandated to attain the education necessary to identify a potential medical emergency and elicit activation of the appropriate medical response, then, assistant coaches on site may have been able to save Gilpin's life (Casa et al., 2013). It likely, moreover, that greater understanding of best practices during health care emergencies will facilitate the (re)examination of cultural assumptions pertaining to appropriate training techniques.

Failure to address EHS risk

While EHS is not 100% preventable, there are a myriad of strategies that can be utilized to reduce risk. Once again, within a culture of care and inclusivity, it should become the norm to both implement and seek out these practices within secondary school sport. Providing access to water for all athletes to minimize fluid losses based on individual fluid needs, and modifying training and competition based on regional environmental conditions are two easily implemented strategies to assist in the prevention of EHS by attenuating the rise in body temperature (Armstrong et al., 2007; Casa et al., 2015; Chevront & Haymes, 2001; Huggins, Martschinske, Applegate, Armstrong, & Casa, 2012; Montain & Coyle, 1992; Sawka, Young, Francesconi, Muza, & Pandolf, 1985). On the day of Gilpin's collapse, access to water during the conditioning session was not permitted and equipment modifications were not taken into consideration until 75% of the conditioning session was completed despite a recorded heat index of 34.4°C [94°F] (*Commonwealth of Kentucky v David Jason Stinson*, 2009).

Prior literature has extensively examined the association between hydration status exercising body temperature; findings purport that for every 1% of body mass that an individual is dehydrated, exercising body temperature is elevated by a magnitude of 0.22°C (Casa et al., 2010; Huggins et al., 2012; Lopez et al., 2011; Montain & Coyle, 1992; Sawka et al., 1985). Physiologically, this is attributed to the reduction in blood volume and sweat rate that occurs with dehydration, which results in a reduced ability to dissipate body heat through the biophysical methods of convection and evaporation of sweat from the skin's surface (Coyle & Montain, 1990; Cramer & Jay, 2016; Davis, Baker, Barnes, Ungaro, & Stofan, 2016). Allowing athletes to have unlimited access to water, utilizing pre- and post-practice body weights to educate athletes on fluid losses during activity, and promoting an environment that stresses the importance of minimizing fluid losses based on individual need are steps that can be taken in athletics settings to optimize hydration status during activity.

Similarly, evidence has clearly shown the strong association between the risk of EHS when environmental conditions become more extreme (DeMartini et al., 2014; Hosokawa et al., 2018). As ambient temperature and relative humidity rise, the ability for an individual to dissipate body

heat by convection, radiation and evaporation of sweat from the skin's surface is reduced, which increases risk (Gagge & Gonzalez, 1996, 2011). Heat strain is further exacerbated in sports such as American football where protective equipment covers approximately 75% of body surface area, further limiting heat dissipation from the body (Armstrong et al., 2010). By altering work-to-rest ratios, including the extent of protective equipment that can be worn, based on regional environmental conditions, individuals are better protected from environmental extremes (Armstrong et al., 2007; Casa et al., 2015; Grundstein, Hosokawa, & Casa, 2018; Grundstein, Williams, Phan, & Cooper, 2015).

Lack of appropriate medical coverage and care

Because it is impossible to fully guarantee safety in sport, a person knowledgeable and experienced with sport-related injuries (e.g., athletic trainer) should be present when individuals engage the athletic fray. This too should be a cultural expectation which, moreover, manifests in the structure of high school sport. Athletic trainers are an imperative part of the sports medicine team at the secondary school level as they are trained in the prevention, management and care of sport-related injuries, including sport-related emergencies such as EHS (Armstrong et al., 2007; Binkley, Beckett, Casa, Kleiner, & Plummer, 2002; National Athletic Trainers' Association, 2005). Notably, at the time of Gilpin's death, Athletic Trainers were required to have competence in the following areas related to EHS (National Athletic Trainers' Association, 2005):

1. Explain the importance and proper procedures for measuring body temperature (e.g., oral, axillary, rectal).
2. Normalize body temperature in situations of severe/life-threatening heat or cold stress.
3. Explain the principles of effective heat loss and heat illness prevention programs. Principles included, but are not limited to, knowledge of the body's thermos-regulatory mechanisms, acclimation and conditioning, fluid and electrolyte replacement requirements, proper practice and competition attire and weight loss.
4. Interpret data obtained from a WBGT or other similar device that measures heat and humidity to determine the scheduling, type, and duration of activity.

Surely, having an athletic trainer onsite would have afforded the ability to appropriately triage Gilpin based on his observable clinical signs and symptoms and initiate the standard methods for treating the condition.

In short, athletic trainers are vital for the implementation of evidence-based policies and procedures to appropriately recognize and care for such emergencies such as EHS (Adams, Hosokawa, & Casa, 2015; Casa et al., 2012). Yet, at the time of Gilpin's collapse, Pleasure Ridge Park High School did not have an athletic trainer at practice (Commonwealth of Kentucky v David Jason Stinson, 2009). Coaches are trained to coach, not to provide medical supervision. Thus, coaches should not be relied upon to provide appropriate care in the event of a medical emergency. The fact that an athletic trainer was not on site to properly identify EHS and treat it, thus, represents an obvious structural shortfall and reveals context in which health was indeed undervalued. As we will see, for a collection of reasons, having an athletic trainer available could have saved Gilpin's life.

Identifying EHS. To treat a medical emergency, it must first be accurately identified. EHS, is defined as a rectal temperature greater than 40.5°C accompanied by central nervous system dysfunction (e.g., altered mental status, personality change, confusion, aggression, irritability, hysteria), is caused by a failure of the body's thermoregulatory system causing the body's internal temperature to surpass the critical threshold for cell damage (~40.83°C [105.5°F]) (Casa et al., 2015). The diagnosis of EHS can be quite challenging as it can appear quickly and also be misinterpreted as a less severe condition (such as heat exhaustion) or other conditions exhibiting altered mental status (Casa, Pagnotta, Pinkus, & Mazerolle, 2009). This is why immediate recognition of clinical signs and symptoms coupled with confirmation of body temperature using rectal thermometry is critical for EHS treatment (Casa et al., 2015). Aural, oral, axillary, and other temperature assessment methods that assess temperature at the skin's surface has been shown to lack validity and reliability when compared with rectal temperature, thus rendering these devices as inappropriate for assessing internal body temperature in exercising individuals. Unfortunately, without a trained medical professional onsite, this time sensitive critical step was overlooked in Gilpin's case. Gilpin's life was in the hands of people who did not recognize nor fully appreciate the severity of his condition (Commonwealth of Kentucky v David Jason Stinson, 2009).

Cool First, Transport Second. Once EHS is identified, to optimize patient outcomes, it is essential to reduce internal body temperature below the critical threshold of cell damage as quickly as possible (Adams et al., 2015; Armstrong et al., 2007; Casa et al., 2015). Prompt recognition and onsite cooling has been shown to ensure 100% survival from EHS (Adams, Hosokawa, Huggins, Mazerolle, & Casa, 2016; Demartini et al., 2015), thus prompting the utilization of "cool first, transport second" to reduce the risk of morbidity and mortality (Armstrong et al., 2007; Belval et al., 2018; Casa et al., 2013; Casa, Armstrong, Kenny, O'Connor, & Huggins, 2012; Casa et al., 2015). The goal for cooling is to reduce body temperature below the critical threshold for cell damage within 30 minutes to minimize the risk of long term medical complications (Armstrong et al., 2007; Belval et al., 2018; Casa et al., 2015). For Gilpin (Figure 1), onsite cooling using an appropriate cooling modality was not provided even though the school had a fully functioning cold-water tub inside the school at the time (Commonwealth of Kentucky v David Jason Stinson, 2009), thus subjecting Gilpin to a cascade of physiological processes leading to multi-organ dysfunction and subsequently death (Bouchama & Knochel, 2002; Epstein & Roberts, 2011). To provide an additional perspective, Stearns et al. (Stearns, Casa, O'Connor, & Lopez, 2016), presents two cases of individuals suffering EHS during a marathon road race. For the runner whose treatment was delayed, the extent of injury and subsequent recovery was greater than the runner who was treated immediately. Furthermore, a dataset of 274 EHS cases shows that with prompt recognition and care 100% is ensured with 95% being discharged from medical care shortly after treatment (Demartini et al., 2015).

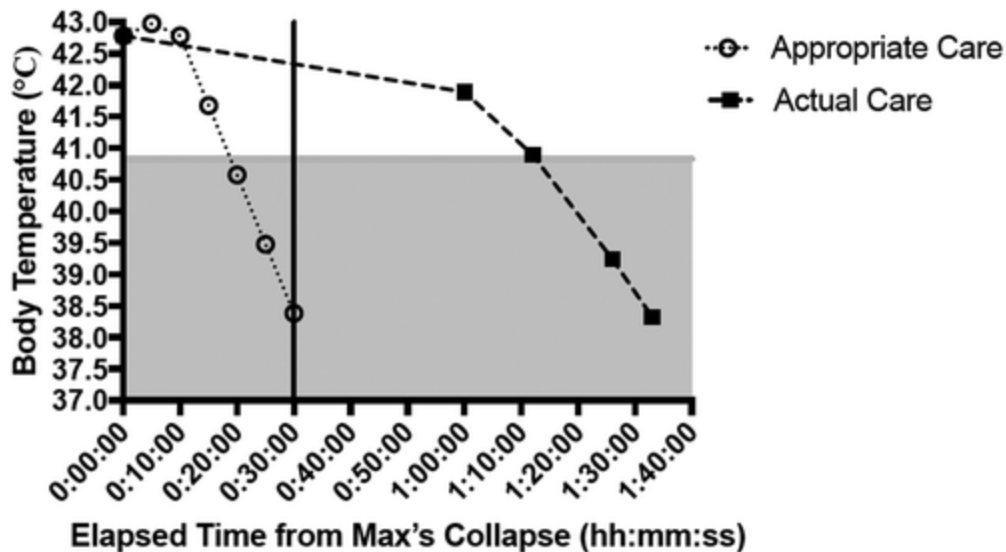


Figure 1. Change in reported Gilpin's body temperature with the suboptimal care he received (\square) and a theoretical model of appropriate care (O) assuming onsite medical care (i.e., athletic trainer), immediate recognition and cooling using CWI (cooling rate, $0.22^{\circ}\text{C}\cdot\text{min}^{-1}$) were utilized. This model assumes that Gilpin collapsed at 6:10pm and the treatment he received on the field (ice bags and water hose) resulted in a cooling rate of $0.03^{\circ}\text{C}\cdot\text{min}^{-1}$ and cooling rate at the hospital being $0.10^{\circ}\text{C}\cdot\text{min}^{-1}$. The shaded gray area refers to the body temperature zone below the critical threshold for cell damage and the vertical black line depicts the 30-minute window to reduce body temperature below the critical threshold to ensure optimal outcomes. The body temperatures were obtained via rectal temperature starting at minute 60. Prior to minute 60, the trend line is based off known cooling rates of the cooling modalities utilized prior to hospital admission.

Appropriate Cooling Modalities. For EHS, the mode of cooling must have a cooling rate (CR) of at least $0.155^{\circ}\text{C}\cdot\text{min}^{-1}$, with whole body cold-water immersion (CWI, CR $0.22^{\circ}\text{C}\cdot\text{min}^{-1}$) being the gold-standard method of treatment as it is the only treatment method that has had a reported 100% survival rate when executed appropriately (Casa et al., 2007; Demartini et al., 2015; McDermott et al., 2009). CWI can cool an individual four times faster than that of air; this is due to water's 24-fold greater thermal conductivity (water, $630.5\text{ mW}/\text{m}^2$; air, $26.2\text{ mW}/\text{m}^2$) and 3500 times greater volume-specific heat capacity than air (Casa et al., 2007). Alternatively, other methods such as tarp-assisted cooling (TACo) has been shown to be effective in reducing body temperature well above the acceptable cooling rate (Hosokawa, Adams, Belval, Vandermark, & Casa, 2017; Luhning et al., 2016). TACo is an abbreviated version of CWI that utilizes a tarp (or other impermeable sheet) that allows for the EHS patient to lay in a semi-recumbent position while ice and water is poured to cover as much of the body's surface area as possible (Adams, 2019). The two methods used to treat Gilpin, ice bags (CR, $0.03^{\circ}\text{C}\cdot\text{min}^{-1}$) and spraying water from a garden hose (CR, $0.07^{\circ}\text{C}\cdot\text{min}^{-1}$) (Commonwealth of Kentucky v David Jason Stinson, 2009), do not have the cooling capacity to reduce internal body temperature of EHS patients before organ and cellular damage ensue (Butts et al., 2016; McDermott et al., 2009). Using the known cooling rates of CWI ($0.22^{\circ}\text{C}\cdot\text{min}^{-1}$), ice bags ($0.03^{\circ}\text{C}\cdot\text{min}^{-1}$) and spraying water from a water hose ($0.07^{\circ}\text{C}\cdot\text{min}^{-1}$) we can estimate the amount of time it would have taken Gilpin (initial rectal temperature, 41.89°C (107.4°F)) to cool to 38.89°C (102°F), the threshold to

terminated cooling; the timing of cooling would have been 13.64 min, 100 min, and 42.86 min for CWI, ice bags and water hose respectively. The cooling options Gilpin was provided exceed the 30 minute treatment window that is optimal for survival.

In all, death from EHS becomes unlikely when an athletic trainer, a licensed healthcare provider trained in the proper recognition, assessment, and treatment of EHS, is onsite and implements current best practices. An athletic trainer will understand and execute best practices to treat the condition. They will efficiently identify EHS, immediately begin cooling treatment, and ensure an appropriate treatment modality is used. None of this occurred on August 20, 2008. In the case of Max Gilpin, no athletic trainer was present and therefore no one was available with the requisite knowledge and experience to save Gilpin's life.

Poor guidance given to coaching staff during EMS call

Max Gilpin did not have access to an athletic trainer. Nor were his assistant coaches prepared to treat him appropriately. However, the responding EMS personnel could still have changed the outcome of his case. Yet, forgoing optimal treatment, the EMS dispatcher instructed coaches to spray water over Gilpin's body (Commonwealth of Kentucky v David Jason Stinson, 2009), which provides insufficient cooling as compared to CWI (Deacon, 2008). In addition, Gilpin was also not appropriately cooled during transport (Commonwealth of Kentucky v David Jason Stinson, 2009). While EMS training may be outside the purview of sport administrators, coaches, and athletes' responsibilities, it is important to note even modified cooling methods like rotating cold-wet towels could have provided a benefit over passive cooling in the back of an ambulance. When the minutes matter, it is important to ensure that the patient is given every opportunity possible to survive. In the last moments of Gilpin's life, this did not occur.

Summary

While Max Gilpin's struggles could be skewed to be seen as an isolated incident, it must be highlighted again that Gilpin was not the only athlete to struggle or suffer from a heat related illness the day he died (Commonwealth of Kentucky v David Jason Stinson, 2009). About fifteen minutes before Gilpin, the first player collapsed and was sent off the field to be treated with water and ice packs. In addition, at least five other teammates of Gilpin's struggled to continue during the same conditioning session that caused Gilpin to succumb to EHS (Commonwealth of Kentucky v David Jason Stinson, 2009). Nor has Gilpin been the only football player to die from heat-related causes over the decades (Schultz et al., 2014). The discussion points above demonstrate that, rather than by random chance, Gilpin succumbed to EHS from a mix of factors that were not adequately addressed or recognized.

Some of the changes considered here exist at the level of culture while others are (perhaps more modifiable) issues of policy and practice. But all these aspects are related. Within a culture of care and inclusivity, the ideal health care procedures discussed above become more liable to take place. When such practices occur on a regular basis, this should, moreover, help shape cultural perceptions regarding the importance and appropriateness of science-based treatments. Indeed, the mere presence of an athletic trainer at practices may wield significant cultural influence, bringing athlete well-being and care closer to the center of everyone's consciousness. And of

course, aware of and focused upon proper health care, with trained medical staff present, greater awareness of the risks involved in using pain as a developmental tool, proper prevention strategies, and appropriate procedures all become more likely. Proper care for medical emergencies such as EHS will then be avoided or at the least mitigated.

Many facets of the treatment and care that Gilpin received are directly attributable to his death. Thus, his case provides an example of ways in which addressing these failures could prevent similar circumstances in future instances. State high school athletics associations, state sports medicine advisory committees and individual schools need to take a proactive stance and make a concerted effort to establish and follow theory- and evidence-based standards that are in the best interest of athletes.

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