USATF

TRACK COACH

2022 / ISSUE 238

Bobby Kersee
2021 Nike Coach of the Year

TRACK COACH

Winter 2022 — 238

The official technical publication of USA Track & Field

USATF

TRACK COACH

FORMERLY TRACK TECHNIQUE

238 — WINTER 2022

The official technical publication of USA Track & Field

USATF

ED FOX.....PUBLISHER
RUSS EBBETS.....EDITOR
TERESA TAM.....PRODUCTION & DESIGN
FRED WILT.....FOUNDING EDITOR

PUBLICATION

Track Coach is published quarterly by Track & Field News, 2570 W. El Camino Real, #220, Mountain View, CA 94040 USA.

Spring 2022 issue (No. 239) e-mailed to subscribers in April 2022.

SUBSCRIPTIONS

$19.95 per year, U.S. or foreign. Track Coach became a digital-only publication in 2015. Track & Field News subscribers get free access to all Track Coach articles. See www.trackandfieldnews.com. Click on "subscribe"

BACK ISSUES OF TRACK COACH

Many back issues of Track Technique/ Track Coach, #111-208, are available singly at $5.50 (U.S. delivery)/ $9.50 (foreign delivery) each postpaid. No issues previous to #111 are available.

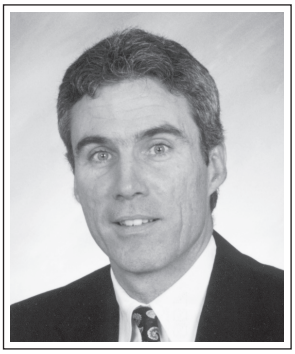
To order, send your check to

Track Coach
2570 W El Camino Real,
Suite 220,
Mountain View, CA 94040

FROM THE EDITOR

RUSS EBBETS

"LOOKING GOOD"



Body dysmorphia. It's one of those terms if you read it in an article you figure it has something to do with the body, you skip over it or you resolve to look it up later—which you forget about and never think about until you stumble over it again.

Body dysmorphia is defined an abnormal preoccupation with a body part or even the body as a whole. Google "world's largest calves" for a clearer idea. With some understanding one could conclude that body dysmorphia might be a big problem with body builders. After all the aesthetics of shape and size are what the discipline is all about. And while I'm willing to admit body dysmorphia might have a higher incidence in this pursuit, I think those who consistently top out in their competitions have the direction and discipline to keep things under control.

But body dysmorphia can also go in the other direction. An anorexic has body dysmorphia. With body weight reduced to a bag of feathers the anorexic chases a horizon they'll never approach until death does them part. The look of less becomes the goal, the appeal and the resolve to do whatever it takes is the signpost on the Road to Ruin.

I remember once in the locker room the guys having an argument over who had the skinniest arms. One after another they showcased biceps that would make Twiggy jealous. There was much laughing and kidding and it's a safe bet there wasn't 25 push-ups among the whole lot. I always questioned this state of fitness but after all runners do run on their legs, not on their arms. The festivities ended and the subject was never addressed again.

Interestingly, one of the skinny arm contestants had transferred from Kansas. At that time Kansas had the top three shot putters in the NCAA. He told how the shot putters boasted and bested each other with the number of stretch marks they had on their chests from bench pressing. Sport specific, but also results driven. They were perennial champions with the stretch marks being simply an occupational hazard of throwing far.

Training at an elite level is not a natural or healthy thing to do to the body. There are consequences to be paid for all the blood, sweat and tears that goes into athletic accomplishment. Anatomical changes, be they skinny arms or stretch marks, may be

CONTINUED ON NEXT PAGE

EDITORIAL COLUMN

Continued from page 7550

the secondary consequences of goal achievement. It can be a sobering thought and I'd argue this is not body dysmorphia.

How or why do some people go off the rails? We live in a look good = be good culture. Hollywood and the cultural influencers of yesteryear sold cigarettes, dish soap and cars. Today's influencers on Facebook, Twitter or TikTok drive body envy with slick camera angles or photoshopped images to create an ideal that is not real.

Coaches can get sucked into this vortex and strive for a good look as opposed to a good performer. In the movie *Moneyball* Brad Pitt's character, GM Billy Beane, sits in amazement as his scouting team rates their baseball prospects as whether they have a "good face." Laura Hillenbrand's best-selling book *Seabiscuit* detailed how the horse had everything wrong with it. Smallish, without the classic thoroughbred lines Seabiscuit more resembled something pulling a milk wagon with a future in dog food as opposed to a Triple Crown Winner.

The big difference between the athletic adaptations and dysmorphic adaptations is intent. For the athlete there is a drive, a pursuit to achieve with the anatomical changes a serious result versus the pursuit of body changes for some narcissistic end that leaves one mentally, physically and probably spiritually damaged.

One of the fundamentals principles of training theory is that of "conscientious participation" by the athlete—know what you are doing and why you are doing it. Athletic participation should not be an endless stretch of junk miles or sets or reps. Training with intention is a pathway, or at least a direction that will change how one looks, how one feels and most importantly how one performs.

SUSTAINED SUCCESS AT THE OLYMPIC LEVEL: PERSPECTIVES ON COACH-ATHLETE RELATIONSHIPS FROM TRACK & FIELD THROWING COACHES

Input from six highly successful American throws coaches, with their views on the 4Cs: closeness, commitment, complementarity, and co-orientation.

BY CHARLES J. INFURNA

ABSTRACT

The purpose of the present study was to explore how elite level American track & field throwing coaches reflected upon their experiences of producing internationally competitive athletes over a successive period. Qualitative research methods were implemented where 6 elite coaches (1 female, 5 male) participated in semi-structured interviews. The first higher order theme was the incorporation of *Positive Coaching*. This theme included four subthemes: (a) communication skills, (b) autonomy supportive behaviours, (c) getting to know your athletes, and (d) creating an atmosphere of success. The second higher order theme was *Understanding Your Coaching Philosophy*. This theme included three subthemes: (a) an established technical model of coaching, (b) lifelong learning, and (c) a peer support system. Findings suggest that coaches would benefit from coach education programs focused on supporting the mental capacity of their athletes when

competing on an international stage.

INTRODUCTION

The interpersonal dynamics that are present between sport coaches and athletes are central to the coaching process. However, over the course of the past few decades, a marked interest in investigating how elite level sport coaches acquire knowledge and develop sport specific skills has been examined (He, et al., 2018). Most research has been focused on sport coach education programs, sport specific programs, and certification attainment (Milistetd, et al., 2018). The complexity of sport coaching research continues to permeate the literature, most specific to high performance coaches (HPC) (Buchheit, 2016) or serial winning coaches (SWC) (Lara-Bercial & Mallett, 2016). He and colleagues (2018) argue that HPC learning, and skill acquisition should not solely be focused on formal sport coach education programs, but rather acquired through the lens of a lifelong learner (Van Mullem & Dahlin, 2017; Trudel, et al., 2016; Currie & Oates-Wilding, 2012).

Although coaching education programs for various sport governing bodies have been established for decades, early studies reported that positive associations were found between coach education programs and skill development of elite level coaches (Gould, et al., 1987). Gould and colleagues (1990) reported another layer to skill acquisition of elite level sports coaches, of which influences by other elite level coaches aided in their development of effective coaching at the elite level. Similarly, in a study comprised of 21 structured interviews of elite coaches, Salmela (1995) reported that expert coaches learned the skill of coaching at the elite level from mentors. Finally, Callary, et al., (2012) also reported that elite level coaches learn from mentors and peers within a peer support system.

EARLY STUDIES REPORTED THAT POSITIVE ASSOCIATIONS WERE FOUND BETWEEN COACH EDUCATION PROGRAMS AND SKILL DEVELOPMENT OF ELITE LEVEL COACHES

It is widely acknowledged that coaches who have an important role in athletes' lives can in turn influence athletes' performance, behaviour, and psychological well-being (Jowett & Cockerill, 2003). There is a considerable gap in the current literature that pertains to sources of knowledge acquisition of elite level American track & field throwing coaches (He, et al., 2018; Milistetd, et al., 2018; Nash, et al., 2011; Nash, et al., 2008). Recently, He, et al. (2018) reported that since 2009, few studies have been conducted on knowledge and skill acquisition of elite track & field coaches, none of which focused on American track & field throwing coaches. A significant number of studies have been conducted on elite level coaches of various sports (Hodgson, et al., 2017; Nash, et al., 2011; Nash, et al., 2008). More recently, the focus of elite level coach skill acquisition has been focused on gymnastics (He, et al., 2018), soccer (Sawiuk, et al., 2018; Freitas, et al., 2013), orienteering (Celestino, et al., 2015), water polo (Currie & Oates-Wilding, 2012), and tennis coaches (Milistetd, et al., 2018).

Consequently, with such a great emphasis placed on behavioural observations of elite level coaches, there is yet more to be explored regarding the reasoning behind their actions, both in practice and competition scenarios (Hodgson, et al., 2017). For example, the current literature suggests that elite level sport coaches can say the right thing at the right time during practice or competitive settings, yet our understanding of this knowledge base is limited (Hodgson, et al., 2017; Cushion, et al., 2003).

Coaching effectiveness is therefore "not dependent upon the efficient application of a sequential process but on the quality of interactions between coach, athlete(s), and the context" (Cushion, et al., 2006, p. 88). Therefore, the aim of this qualitative study is to examine how elite American track and field throwing coaches acquire skills and knowledge that have allowed them to cultivate and develop elite level throwers who participate on an international stage (Olympic Games and/or World Championships). It is in the reflection of the coaches' knowledge and skill acquisition that would further reveal how they have been able to maintain high levels of coaching success in the preparation of coaching Olympic Games and World Championship throwers over a successive period.

THEORETICAL FRAMEWORK

Coach-athlete relationships are essentially defined as social situations shaped by the interpersonal beliefs, thoughts, and behaviors of the coach and athlete (Jowett, 2017).

As described by Jowett and colleagues (2003; 2016) the coach-athlete relationship is composed of

four succinct qualities: a) closeness, b) commitment, c) complementarity, and d) co-orientation (Jowett, 2017). Closeness reflects the interpersonal feelings encapsulated by mutual respect, trust, appreciation, and a sense of liking each other. Commitment reflects how coaches and athletes are able to maintain a relationship over the course of their experiences together. Complementarity is a reflection upon how coaches and athletes correspond with each other. Finally, co-orientation reflects shared understanding and views when looking within their coach-athlete dyad. In essence, "the 4Cs provide operational meaning to the quality of the coach-athlete relationship (Jowett, 2017, p.8).

At the most basic function, coaching involves two people, the athlete and the coach. It is in this relationship both the coach and athlete hold power that will ultimately allow each member to achieve or not achieve his or her individualistic goals (Jowett, 2017). A coach-athlete-centered approach supplies a solid basis from which to understand not only the entire process and practice of coaching, but also, it's effectiveness (Kim, Kim, and Won, 2018; Jowett, 2017; Hodgson, et al., 2017).

There is a plethora of evidence that suggests neither coaches nor athletes achieve their goals on their own, but rather they need each other to achieve their desired results and success in sport. In the sport of track & field, and more specifically with regards to the throwing events (shot, discus, javelin, and hammer) the notion of a coach-athlete-centered approach allows both coaches and athletes to achieve success while supported by the quality of the connection between coach and athlete (mutual trust, respect, open communication, commitment, and collaboration) (Jowett, 2017; 2016).

To further conceptualize the essence of the coach-athlete relationship, the operational framework emphasized in this paper is focused on how the complexities of coaching can be managed or "orchestrated" (Jones, Bailey, & Thompson, 2013). This notion of orchestration between coach and athlete brings a sense of order through interpersonal behaviours that are engaging, interacting, communicating, reflecting, empowering, trusting, respecting, and understanding (Jones, et al, 2013). The findings of previous qualitative studies that explored the content and functionality of the coach-athlete relationship through the lens of the 4Cs of coaching (Jowett, 2017) found that the 4Cs of coaching were instrumental to the success, well-being, and performance of both athlete and coach (Kim, et al., 2018; Jowett & Carpenter, 2015; Jowett, 2008b; Jowett & Cockerill, 2003). This study aims to further examine the role of coach-athlete relationships as they pertain to the continued serial successes of Olympic track & field throwing coaches over the course of their coaching careers.

METHODS

Participants

In total, six coaches agreed to participate in the study. Upon receiving WIRB approval from the researcher's university, the American throwing coaches were contacted via email and informed of the purpose and nature of the study. They were advised of informed consent and willingly participated in the study.

To ensure their elite status, the selection criteria for the potential participation in this study consisted of the following: a) at least 10 years of continuous coaching experience and, b) coached multiple throwers to have competed at an Olympic Games and/or World Championships competition during their coaching career. The criteria to define an elite American throwing coach has not been well established, however this selection process was deemed acceptable largely because it allows for comparison of coaching philosophy and methodology between the findings reported in this study and of previous research focused on elite coaching (Hodgson, et al., 2017; Hanton, et al., 2005; Fletcher & Hanton, 2003; Holt & Hogg, 2002; Bloom, et al., 1997). To ensure anonymity, each coach that volunteered to participate in this study was given a pseudonym and was referred to by their pseudonym throughout the written reprint.

The final sample of participants was comprised of six American-born throwing coaches aged 34 – 62. Their collegiate and/or club coaching experience specific to working with elite throwers (shot, discus, hammer, javelin) in the United States ranged from 10 – 32 years. All the coaches have experience being the lead coach for athletes who have participated in international competitions (Olympic Games and/or World Championships). One of the coaches was female. One of the male coaches was not affiliated with a collegiate program, but rather has his own sanctioned USATF club in which post-collegiate throwers train and are affiliated with.

Procedures

Upon receiving WIRB approval to conduct the study, the researcher

contacted American-born throwing coaches in the United States via email. They were informed of the overview and nature of the study. Also included in the introductory email was the interview guide. The researcher scheduled dates and times for the coaches who voluntarily agreed to participate in the study.

All six participants took part in semi-structured interviews that lasted between 60 and 120 minutes. The interview guide was included in the initial email sent to the coaches. The interview guide was again sent to the coaches when a confirmed interview date and time was scheduled. Each interview was conducted via Zoom on a date and time convenient for the participating coaches. The researcher has accumulated over 10 years of collegiate coaching experience, as well as involvement coaching collegiate national champion throwers. The researcher would be familiar with the experiences and terminology used by the participating coaches.

The interview guide consists of two overarching sections: 1) coaching, coaching relationships, and coaching effectiveness, and 2) coaching style and motivational climate. Each section is made up of several questions pertaining to the larger section. The coaching, coaching relationships, and coaching effectiveness section is made up of several questions pertaining to effective coaching (*what do you view as essential for effective coaching at the elite level?, how do you evaluate your success as a coach at the elite level, and in your experience to what extent is it necessary to have a level of personal relationship with the elite athletes you work with?*). The coaching style and motivational climate section are made up of several questions pertaining to the coaching environment, atmosphere, individual athlete motivation, and the relationship between athlete and coach (*what do you try to accomplish per coaching session and why, how do you motivate your athletes, and how do you know what to say and when during training sessions and competition?*). All six of the coaches who participated in the study were asked the same questions, as well as follow-up and clarifying questions based on their initial responses.

THE INTERVIEW GUIDE CONSISTS OF TWO OVERARCHING SECTIONS: 1) COACHING, COACHING RELATIONSHIPS, AND COACHING EFFECTIVENESS, AND 2) COACHING STYLE AND MOTIVATIONAL CLIMATE.

Data Analysis

An inductive-deductive content analysis was implemented to analyze the six coaches' interviews (Patton, 2002). The process consisted of several steps. First, after the interviews were conducted, the audio portion of the interviews were transcribed by a third-party transcription service outside of the researcher's university. The transcription process produced 125 pages of single-spaced text. The transcriptions were read, reread, and reread again by the researcher to become familiar with the content.

The second step of the process involved the identification and coding of individual raw data items. The second step also involved the review of the transcripts by a second researcher with multiple decades of qualitative research experiences. This second researcher supported the lead author in the review of the transcripts and the identification of and coding of the raw data items. Multiple levels of coding were incorporated and developed to refine coded categories until data saturation was reached. First order and second order themes were established. The support of a second researcher established trustworthiness of the data (Patton, 2002; Marshall & Rossman, 1995). Following the suggestion of Patton (2002), all six coaches were sent their interview transcript for review. No coaches provided amendments to their transcripts.

Findings

The analysis of the six elite American track & field coach interviews produced two higher order themes. The first higher order theme was *Positive Coaching*. This theme included four subthemes: (a) communication skills, (b) autonomy supportive behaviours, (c) getting to know your athletes, and (d) creating an atmosphere of success. The second higher order theme was *Understanding Your Coaching Philosophy*. This theme included three subthemes: (a) an established technical model of coaching, (b) lifelong learning, and (c) a peer support system.

POSITIVE COACHING

Communication skills

When the coaches were asked to define what effective coaching meant to them, the immediate responses were about how they can

communicate with their athletes. Donald, who has coached three different Olympic athletes said, "Obviously, number one, you have to be able to communicate well. Number two is you must be personable. You have to be able to develop relationships with your athletes."

Gabby, who has coached multiple Olympic Games and World Championship competitors said,

> I think one of the things that has made me an effective coach is my ability to communicate with my athletes. In an Olympic final, I know that I need to communicate just enough to make sure they understand their cues and what they are trying to accomplish in the circle. It is something I constantly think about because there are times when I cannot be close to the circle, so when I have the opportunity to say something, it has to be clear and consistent with what the goal of the competition is.

Another perspective given by the coaches was about the incorporation of common language used at both practice and competition. Anthony, who has coached Olympic Games and World Championship participant throwers said, "I think effective coaching really just kind of comes down to relating to the athlete and being able to have a common language at practice and meets". Similarly, Rick said, "Being able to communicate with your kids is really important. The way I discuss cues and technical information is the same at practice and at meets. It brings consistency to my coaching".

Finally, Bill, who has coached Olympic Games and World Championship participants at multiple colleges over the tenure of his coaching career said,

> I think everyone starts at a different level mentally and physically. And I must get into tune with where they are in their life, and where they are in their development, and where they are mentally, where they are in terms of their goals, and where they are in terms of what their reality is. The only way I can do that is to be able to communicate with my athletes in a way that shows them I care about them not only as an athlete, but as a person too.

ESSENTIAL TO ENHANCING THE QUALITY OF COACH-ATHLETE RELATIONSHIPS IS A COACH'S ABILITY TO ALLOW ATHLETES THE OPPORTUNITY TO BE PART OF THE DECISION-MAKING PROCESS

Autonomy supportive behaviours

Essential to enhancing the quality of coach-athlete relationships is a coach's ability to allow athletes the opportunity to be part of the decision-making process (Ryan & Deci, 2002). Coaches shared how they ensured that their athletes had an opportunity to be part of the decision-making process that would create a path towards their training for, qualifying, and competing on an international stage. "In this approach, empowerment of the athlete is the central concern and focus" (Lee, et al., 2009, p. 306). Bill, who has coached multiple collegiate throwers who represented the United States on an international stage said,

> But I think, leading up to the Olympics, one or two years out, we do the cliché day at a time, weeks at a time. We know we have to do the boring, mundane things. We work on the plan together. The athlete has much more input if they are trying to make a second Olympic team. The plan is always coming down to getting the best technique we can when it matters most, at the Olympic Trials. But the athletes, especially if they are post-collegiate, have a lot of authority in when we practice, for how long, and what the goals for the season are. By that point they know themselves better than I do.

Gabby spoke about how her and her athletes discuss goals for the season. She said,

> I think a theme that I was taught over time over the years is to break down a big goal into little tasks and little goals. After 2004, it was obvious the goal was to go back and win in 2008, but it isn't that easy. It's a daily thing at practice. He had a lot of say leading up to the 2008 Olympic Trials. It was thinking about a small goal or win for the day. I would ask what he wanted to work on for the day, and that is what we focused on. After two Olympic Games, athletes know more about what they need than I do. It's my role to provide support and what we can do together to get 1% better each session.

Donald spoke about the goal setting

process and how he helps instill and build confidence in his athletes. He said,

> The other thing we look at is the building blocks to becoming a good thrower. Are you getting stronger? The stronger you get usually applies to throwing farther. We look at nutritional and recovery goals. If there is an improvement in their diet and whatever other goals they set for themselves that year, then we pat them on the back for that. We also encourage distance's improving as well. We try to build confidence in our athletes. They lead the discussions about goals, but we as coaches need to hold them accountable. Then I praise the wins along the way. It shows them that just because their distances aren't always going up, they are accomplishing other things. We know what it takes to make a World Championship team and throwing far is important but other factors play a role as well. That is why we allow the athletes to have multiple things to focus on during a season.

Aligned within the goal setting framework, some of the coaches shared that part of the yearly process or Olympic quad was going to require each thrower to participate in and complete mundane tasks (Chambliss, 1989). Anthony said, "Yeah, even though the goal might be to win a medal at the Olympics, it takes a certain number of high-level training sessions to get there. Unfortunately, some of those training sessions are rather boring, but the work needs to get done." Donald shared similar experiences with his athletes. He said, "We know that this isn't a very exciting lifestyle. My athletes train upwards to six hours a day. Most of the time we do the same thing repeatedly, but we know those little daily tasks are going to produce big results in the future."

Gabby talked about her routine with her athletes. She said, "We keep our routine the same. From a daily perspective, we warm up the same and focus on similar drills and movement patterns. We know they are boring, but those little things are what have helped us the most during our training sessions." Rick said, "We probably complete the same four or five drills thousands of times between international competitions. They may seem boring at the time, but if you look around, at that (Olympic) level, your technique has to be spot on when the pressure is on."

WE KEEP OUR ROUTINE THE SAME. FROM A DAILY PERSPECTIVE, WE WARM UP THE SAME AND FOCUS ON SIMILAR DRILLS AND MOVEMENT PATTERNS

Getting to know your athletes

When asked to discuss their success as a coach in context to what effective coaching looks like and means to them, the coaches shared their thoughts about getting to know their athletes on an interpersonal level assisted in their effectiveness as a coach. This tenet of developing positive interpersonal relationships with your athletes has been previously reported in the literature. Anthony said,

> Every athlete you come into contact with is going to be different. And everyone's on a different timeline as far as what their goals are, or where their talent level it. Whatever it may be, talent-wise, I won't get the best out of them unless I get to know them on a more personal level. Winning championships is great. Going to the Olympics is nice, but at the end of the day if I don't know much else about them, then I didn't do a good job preparing them for life after throwing.

Currie and Oates-Wilding (2012) reported in their qualitative study consisting of eight Olympic level coaches that developing a quality coach-athlete relationship was critical to their abilities to coach at the Olympic level. Developing interpersonal relationships was also reported by Jones and colleagues (2003), which highlighted the positive influence having an interpersonal relationship with their athletes had on their successes as coaches. After relocating to a different institution, Donald said this about working with his athletes,

> I have to coach differently here. And the main reason is the level of talent is way different here than it was at my old school. So there are a few changes with that, and a way to overcome the potential difference in talent is by having a stronger relationship with the throwers on my team. To be able to break down barriers here, I need to get to know my throwers on a more personal level. In my opinion, that is what makes the biggest difference with success. At the Division 1 level almost all of the throwers are on a level playing field when it comes to talent. The ones who break through are the

coaches who can better reach their kids on a personal level. Once that trust and respect is established, the athletes will walk through walls for you.

Olympic coaches have stressed the critical importance of developing positive coach-athlete relationships with their athletes as a direct influence on their (the athletes) success at qualifying for and competing at an Olympic Games or other international competition (Dieffenbach, et al., 2008). Rick summed up his experiences like this,

> By the time I've worked with an athlete for two or three years after I worked with them in college, I'm not really their coach anymore. I'm more like a Sherpa. I already know a lot about them, so keeping open communication after they have graduated from college is critical, but at this point it's different. I'll get them where they want to go, but at this point they are the ones who are doing all the work. I'm working with them to achieve their goal, but I need to tap into something more at this point. I act as an emotional guide as well.

Gabby said, "At this level, I'm not just getting to know my throwers, but their families as well. Some of my athletes are married, so I'm not just working on building relationships with my throwers, but everyone involved within their support system." Sam added perspective when working with elite collegiate throwers as well. He said, "When coaching collegiate throwers, you definitely need to get to know them on a personal level. They oftentimes tell you things that they wouldn't tell others because they trust you. That personal relationship is what helps break down barriers between coaches and athletes, which should allow the throwers to compete at a higher level because they trust you."

I THINK WE ALL TEND TO OVERCOACH, ESPECIALLY IN COMPETITION.

Creating an atmosphere of success

The coaches interviewed spent a lot of time sharing their ideas about creating an environment conducive to consistently being able to produce elite level throwers. Most of the coaches shared their thoughts about creating a culture built upon positive relationships. Donald shared,

> And at that point when they can start to open up to me and the coach doesn't seem that scary, and the coach is almost somebody that you want to go to to be helpful, I know we've created a positive atmosphere and culture. Then it's really awesome because before any meet, or during practice, when an athlete pulls me aside and says I need to talk to you about something, it usually isn't throwing-related. It is related to something else going on in their life. That tells me that our environment is safe enough for them to share things with me that they probably wouldn't talk about with their parents.

Similarly, Rick has coached multiple collegiate national champion throwers, some of whom were national champions during the same collegiate season. He said,

> That's all I'm trying to do. I try to find where's your current as a thrower. I'm just going to go for a swim with that. I do that with all my throwers, but having Michelle was different. She helped elevate the other throwers. I can train them for strength and power with their current, but having your best thrower be your hardest worker helps set the tone for everyone else.

In their qualitative study focused on SWC, Lara-Bercial and Mallet (2016) reported that coaches shared this belief in creating an atmosphere that stimulated athlete growth, fostering a feeling of trust, and their abilities as coaches to develop positive relationships with the athletes.

When asked about their experiences as coaches and coaching in competition, the coaches discussed how the interpersonal relationships they had developed with their throwers allowed them to know when to or not to say something either during a training session, competition, at the Olympic Games and or at the World Championships. This is what Anthony said about knowing when to speak or not. He said,

> I think I'm guilty of knowing when I need to keep my mouth shut and still going. I think we all tend to overcoach, especially in competition. And it starts with practice. I think the whole idea of thinking before you speak is key. Is what I have to say meaningful and worthwhile? Or am I just talking to talk? And understanding like be careful with praise. It comes down to knowing each of your athletes as individuals. Some may re-

quire consistent feedback and cuing. Others don't want you to say anything. It's the same for practice and the Olympic Trials. You just need to know your kids.

When asked about coaching in the Olympics, Bill said, "You need to know when to give feedback, the type, and how much. You don't have a lot of time to talk at the Olympics, that is why knowing your athlete and understanding their needs will help. You can't talk at the Olympics like you do in practice".

Gabby shared her initial concerns about her athletes thinking she didn't know enough. She said,

> So I knew enough, but there were definitely holes in my knowledge. And so I didn't have all of the technical knowledge. But I still got success out of those athletes because even though I wasn't the most knowledgeable coach, we had a very good relationship and I knew what they needed of me during competition. I was able to instill confidence with the little I was able to say.

Donald talked about trial and error when knowing when to say something or not to say anything at all. He said,

> I think its just trial and error. When I first started coaching, I coached the way I would want to be coached. How would I want somebody to respond to my performance at this meet? Now I try to think about what I would need in that position. But the whole idea of knowing what to say and when to say it is about how well do I know my athletes. Some athletes are used to hearing something after every throw in practice. And I could respond quickly to them. Other athletes don't need much in the way of speaking, sometimes it's just a look. It takes a lot of communication to get to know how your athletes want to be coached.

I THINK THAT AT THE ELITE LEVEL YOU HAVE TO BE INCREDIBLY DISCIPLINED WITH YOUR TECHNICAL MODEL. I BELIEVE IN WHAT I'M DOING BECAUSE I'VE HAD SUCCESS OVER THE YEARS

Sam spoke about his ability to read body language when giving coaching cues. He said,

> I think it's reading them and understanding their body language and knowing how to handle stress. My best weightlifters will stare at a wall the whole time. I know they are focused on what they need to do. I think that's where it's got to be up to the coach to learn the tendencies of each specific athlete and know what communication they handle the best. I don't coach much during training, maybe just a cue or two cues the whole session. We can't work on much during a meet, and I try to coach in practice like at a meet so they know what to expect of me too. It just comes down to knowing what type of feedback they like to receive in the situation. We talk about that a lot.

UNDERSTANDING YOUR COACHING PHILOSOPHY

An established technical model of coaching

When the coaches were asked to describe what effective coaching meant to them, all six coaches first referenced that they had an established technical model of coaching that they were comfortable implementing with their athletes. Each coach discussed how they have developed their technical model of coaching that they believe has allowed them to be successful over the course of their coaching careers.

Gabby, who has coached throwers of different disciplines to competing at an Olympic Games shared this thought, "I think that at the elite level you have to be incredibly disciplined with your technical model. I believe in what I'm doing because I've had success over the years". Anthony, who has coached at multiple levels at the collegiate level, had this to say about the importance of having an open mind within his technical model. He said,

> I think a democratic style is absolutely the way to go. And that may not work for everyone's situation. It very much works for mine. I think that getting input from my seniors, getting input from my captains helps give me a pulse of how training is going. I think one of the biggest mistakes any coach makes and the biggest mistake I think I made early in my career was that I was forcing a model on my kids. They are all different, and technique is not always a one-size-fits-all model.

Previous research on the topic of coaching philosophy was shared by Lara-Bercial and Mallett (2016). In this study composed of SWC, the coaches reported that having a grounded and stable coaching model helped to ensure optimal outcomes for their athletes.

Sam discussed teaching his technical model in relationship to defining clear expectations for his athletes. He said,

> But I think it always comes back to that clear expectation. I just think that the best way to get the kids to do what I need them to do is communicate my expectations with them. I tell them this is what I want them to look like in the circle. I show them videos. They know my stuff works, but I have to explain it differently to some of them because they learn differently. I just have to adapt my way of communicating, but I want them to look a certain way when they throw.

Similarly, Din, et al., (2015) reported that athlete successes were predicated on the coach's ability to articulate a clear and cohesive coaching philosophy and vision of excellence. Bill took the discussion of his technical model in a different direction. After over 30 years of collegiate coaching experience he had this to say about training,

> Everyone has X's and O's, but what makes the good coach or great coach is intentionality. I think I have an ability to say the right things, intentionally say wrong things and see what reactions may be, to see where I need to go. I'm good at communicating what I want the kids to do when they throw. Not just how to communicate and teach technique, but because I have a vision at seeing what I think is going to work best for each thrower. You can't put a square peg in a round hole. We got to figure out what works best for that person and have them understand where they are.

Lifelong learning

When reflecting on their time as throwing coaches, an aspect of lifelong learning was mentioned by all the coaches. When asked about structuring practice sessions and the specific purpose of each session, each coach discussed that they continue to build upon their prior knowledge in order to best meet the needs of their athletes. An example they each shared was about continuous growth as a coach. Bill shared his thoughts about coaching athletes from all over the world. He said,

> And now I'm starting to coach some more international kids, which I've never done before very much. And so now I'm trying to learn that, how to do that. Deal with athletes from different cultures, different families and all that. So it's another piece of a puzzle I'm trying to put together for the kids to help them throw farther.

Anthony, who also shared that he is coaching more international athletes, had this to say about learning more about different cultures. He said,

> Throwing far and achieving these results is a means to an end of a journey, right? You're on this journey to challenge yourself and know how far you can push the athletes. I care about my athletes and I want them to do well. I need to figure out how to better coach athletes that come from different cultures and backgrounds. They need to be coached differently, and I'm learning how to do that. I'm learning more about the throwing cultures of where they are from. I try to apply that. It isn't easy, but the kids see I'm making an effort which helps with team culture and buy-in.

Sam spoke about the biomechanical challenges he faces as a throwing coach. He said,

> I think for me, I need to learn more about how the body works. I'm able to explain what I want them to look like in the circle, but sometimes I'm asked why I want them to look the way they do. I watch YouTube videos. I'm trying to learn this stuff, but it is difficult sometimes to explain.

Peer support system

The coaches spent ample time discussing a network of peers that they could share their thoughts with and ask questions to. Gabby, not having an initial strong background in throwing, had this to say about her early coaching support systems. She said,

> I did not have a strong throwing background in college. When I started coaching hammer throwers, I didn't know what to do. I reached out to a local coach in the area and asked for help. My background was predominantly in the shot and discus. Then I had another guy that I would bounce ideas off of that was a javelin thrower. I would show him videos of my throwers and he

would give me feedback. Now, I still call a few people I trust. I'll give them the situation and talk it through with them. I have a couple of Division 1 coaches I'll reach out to if I need something.

I REACH OUT TO OTHER COACHES WHEN I'M NOT SURE OF WHAT I'M SEEING. I DON'T WANT TO CHANGE SOMETHING WITH THE KIDS I HAVE IF I DON'T HAVE TO.

Similarly, Anthony shared his thoughts of support systems when he began working with elite level throwers. He said, "I reach out to other coaches when I'm not sure of what I'm seeing. I don't want to change something with the kids I have if I don't have to. I usually reach out to a couple of people and ask them what they think". Sam was also able to recall times he reached out for assistance about technique and programming. He said, "Yeah, I have a few coaches I trust to talk to about throwing. We usually talk once a week. It's usually about technique and programming." Unlike prior research focused on structured mentorship programs (Sawiuk, et al., 2018), the coaches in this study did not specifically share thoughts about mentorship programs or having secured a mentor in the past (Hodgson & Butt, 2017). Rather, they spoke at great length about their peer support system they have been able to develop through networking throughout their coaching careers (Callary, et al., 2012). Bill spoke about asking for support when discussing the mental aspects to throwing. He said,

> So with her, she was a prime example of having tons of ability, but she didn't know how to compete. So I reached out to others who had more experience in that aspect of throwing than I did. We spent way more time on the mental than the physical side to throwing. That was new to me, but I had coaches that I could reach out to for help.

Rick spoke about learning new ways to communicate technique with his athletes. He said,

> I think I always want to get the right message across correctly. I'm a very adaptive and open person. I think I'm very high on openness. By openness, I mean that I'm always willing to hear that there's a better way to do or say something. Honestly, I think that leads into, obviously, when we learn, once you're out of school, you choose what you learn, right? I try to talk to people to learn more about better ways to share the message correctly.

DISCUSSION

The aim of this qualitative research study was to provide insight into how elite American throwing coaches have been able to continuously produce international competitive throwers over the course of their coaching careers. In total, six throwing coaches working with throwers in the United States participated in this study. Overall, the coaches in this study have coached throwers who participated in an Olympic Games, World Championships, and other international competitions beginning with the 2004 Athens Olympic Games.

To repeat, the throwing coaches who participated in this qualitative study highlighted two higher order themes that they have attributed to their success as throwing coaches. The first higher order theme was the incorporation of *Positive Coaching*. This theme included four subthemes: (a) communication skills, (b) autonomy supportive behaviours, (c) getting to know your athletes, and (d) creating an atmosphere of success. The second higher order theme was *Understanding Your Coaching Philosophy*. This theme included three subthemes: (a) an established technical model of coaching, (b) lifelong learning, and (c) a peer support system.

In their reflective journeys as throwing coaches at the collegiate and club level, the coaches discussed psychological tenets that allowed them to coach multiple throwers to competing on the international stage while representing the United States. First, the coaches spent ample time discussing the importance of being able to effectively communicate with their athletes. Law (2013) suggested that communication is one of seven social competencies that should be developed, which supports the idea that coaching is indeed a social competency in which the role of the coach is provide athletes an opportunity to attain a high level of performance by communicating expectations, cues, and experiences with their athletes (Rezania & Gurney, 2014). The coaches stressed the importance of being able to express what they needed their athletes to do in respect to working on a technical cue in practice and how to implement that cue in competition. Positively communicating with athletes is a central

theme that has been recognized as a critical factor in ensuring success of the coach-athlete dyad in respect to Olympic athletes (Jowett & Cockerill, 2003).

Similarly, the ability to positively communicate with an athlete is in tune with the overarching theme of positive coaching (McGuire, 2016). The high performing coaches in this study understood the value and critical importance of having excellent communication skills. They also understood that it was important to regularly communicate with their athletes and have an understanding of the type of communication was most important in high stress situations, such as competing at the Olympic Trials, Olympic Games, and World Championships. In line with prior research, these findings support the notion that coaching is more than a simple transmission of tactical knowledge and the simple teaching of skills (Hodgson & Butt, 2017; Olusoga, et al., 2012). Stelter (2016) sums it up best by suggesting, "the ultimate goal of coaching is to facilitate and improve leadership, communication, and cooperation" (p. 55).

Coaches in the present study advocated the importance of developing a strong interpersonal relationship with their athletes. A philosophical aspect of their coaching style was focused on the implementation of autonomy supportive behaviors (Ryan & Deci, 2002) related to the goal setting process. Autonomy supportive behaviours have been discussed in the sports and physical education literature previously (Bartholomew, et al., 2009). All the coaches who participated in this study made some reference to allowing their athletes the opportunity to contribute to the daily practice regimen, the yearly outlook, and competition strategy. All but one of the coaches that participated in this study was employed by a college/university. Sam's coaching, most of which consists of a team of post-collegiate throwers, suggested that he provides his athletes with "a lot of room when it comes to what to focus on in practice, how many throws to take, and how many meets they want to compete in."

COACHING IS MORE THAN A SIMPLE TRANSMISSION OF TACTICAL KNOWLEDGE AND THE SIMPLE TEACHING OF SKILLS

To be a successful high performing throwing coach, "coaches must have/develop a mindset characterized by openness to diversity and flexibility" (Milistetd, et al., 2018, pp. 11). In similar instances of working with post-collegiate and collegiate throwers at the same time, Bill said, "Well, I've been working with her for six years now. I think she knows what she needs to do more than I do." This distinction is important to make at the elite level of throwing, especially when working with collegiate athletes who qualify for international competitions before they graduate from college.

All the coaches who participated in this study maintained an effort to develop and maintain positive interpersonal relationships with their athletes which assisted in developing and creating an atmosphere in which the athletes could achieve their athletic goals. Like the research conducted by Nash, et al., (2011), the coaches in this study took a more holistic approach to coaching their athletes. The coaches understood that even though they have had consistent success at the highest level of individual athlete performance, not all athletes at the collegiate level will one day represent the United States at an international competition. They felt it was important to not only ensure their athletes met their athletic goals, but also ensured that their athletes knew they could talk to them about things unrelated to coaching. All of the coaches shared experiences about the importance of getting to know the individual because it would be at that point that they could then help them achieve their athletic goals. Gabby said, "It's like you are peeling back an onion. Eventually you get to where you need to go, but they need to know you care before they let you start peeling."

Bill summed it up best by suggesting that "sometimes it takes a long time before they let you in. As long as you continue to show them you care, eventually you break down those walls."

When asked about their style of coaching, each coach shared their thoughts about having an established technical model of coaching. "A coaching philosophy is believed to underpin individual coaching practice" (Nash, et al., 2008, p. 550). Four of the six coaches interviewed have coached athletes of different disciplines to international competition during their coaching careers. Having a firm background of specific technical expertise allowed them the opportunity to coach athletes who bought into programming while excelling in their chosen discipline(s) of competition. Similarly, the coaches exhibited craft knowledge as opposed to

professional knowledge in helping support the development and implementation of their coaching philosophies. Irwin, et al., (2004) defines the professional knowledge "as formal coach education" (p. 247). Craft knowledge is defined as "knowing in action—an intuitive feel…which develops with experience" (p. 247).

THEY FELT IT WAS IMPORTANT TO NOT ONLY ENSURE THEIR ATHLETES MET THEIR ATHLETIC GOALS, BUT ALSO THAT THEIR ATHLETES KNEW THEY COULD TALK TO THEM ABOUT THINGS UNRELATED TO COACHING.

As the coaches shared their professional experiences, none of the coaches referred to their formal education as a support to their knowledge and expertise as an elite level throwing coach. Rather, the coaches in this study suggested that informal opportunities of lifelong learning and the support of peers within the track & field throwing community were the backbone that aided in their coaching development over time. This is interesting to note because much of what is reported in the current literature suggests that receiving formal training (He, et al., 2018; Irwin, et al., 2004: Cushion, et al., 2003) and the support of a mentor or mentors was key in the development of elite level coaches (Nash, et al., 2011; Nash, et al., 2008; Nash & Collins, 2006). In this study, the coaches suggested that having a peer support system of other coaches and peers they trusted were important to them. Rick said, "I only attend conferences and clinics now to talk shop with my coaching friends. I haven't sat through a breakout session in years." Bill added, "I don't go to conferences any more. If I need something, I call someone I know that can help me." Similarly, Donald said, "I don't mind attending conferences, but I go for the social aspects of sharing ideas with other coaches outside of the conference."

Limitations and future research

It is important to note a few limitations to this study. First, the study consisted of track & field throwing coaches in the United States, and the results of this study cannot be generalizable to either, a) other event groups within the sport of track & field, and b) other elite level coaches from a broader scope of coaching professions either within the United States or globally. Future studies should examine how coaches from other Olympic sports within the United States define effective coaching in respect to the successes they have achieved during their professional coaching careers.

Second, five of the six coaches were male. Future studies should emphasize the perspective of elite female coaches across a horizon of sports professions within the United States and possibly across the globe. As Hodgson and Butt (2017) reported, "only 11% of the 3225 coaches at the 2012 London Olympic Games were female" (p. 27). Third, all the coaches were white. Future studies should include and examine elite level sports coaches from a more diverse population of sports coaches. Finally, four of the six coaches referenced some difficulties they experienced in the early stages of their coaching careers when supporting the mental capacity of competition their throwers lacked. Future studies should examine how the support from sport psychology practitioners can enhance athletes' capacities to prepare for and compete in high stress and anxiety causing situations, such as representing the United States on an international stage, more specifically with other teams of low team interdependence (tennis, golf and swimming and diving).

CONCLUSION

The coaches interviewed in this study show a clear understanding of how developing interpersonal skills enhances the relationships with their athletes. In turn, these positive coach-athlete relationships have provided the athletes with communities of support, belief systems, and opportunities to reach their athletic goals. The coaches interviewed in this study can be described as serial winning coaches, a term coined by Lara-Bercial and Mallett (2016). Their experiences as elite level throwing coaches "represent a powerful reference point from which to understand this very unique environment and the required skills and attitudes of coaches to succeed within it" (Lara-Bercial & Mallett, 2016, p. 43).

The coaches provided great depth and knowledge in understanding how the psychological tenets of coaching (goal setting, communication, and a belief in their athletes) added to their coaching philosophy that strengthened their preparedness to coach collegiate and post-collegiate athletes on an international stage. Findings sug-

gest that coaches would benefit from coach education programs focused on supporting the mental capacity of their athletes in regard to competing internationally. A majority of American Olympic track & field athletes only earn one opportunity to represent the United States on an international stage. Coaches, and in this case throwing coaches, would benefit greatly from education programming focused on ways they could enhance the mental skills required to better provide their throwers with the opportunity to excel on the international level.

It is important to recognize that no two coaches interviewed in this study had similar trajectories in terms of becoming elite in the field of coaching throwers internationally. In fact, their stories all begin at different points and with diverse experiences in the early stages of their coaching careers. A large contributing factor of their successes as throwing coaches can be characterized by their early experiences as throwing coaches either at the collegiate and private sectors, their thirst for continuous improvement and life-long learning, and their expansive peer support networks. Their stories and experiences lend themselves to providing compelling accounts and familiarity into the world of high performing track & field coaches that have achieved unparalleled levels of success by coaching throwers at Olympic Games and World Championships over a successive period.

REFERENCES

Bartholomew, K. J., Ntoumanis, N., & Thogerson-Ntoumani, C. (2009). A review of controlling motivational strategies from a self-determination theory perspective: Implications for sport coaches. *International Review of Sport and Exercise Psychology,* 2(2), September 2009, 215-233.

Bartholomew, B. (2017). *Conscious Coaching: The Art & Science of Building Buy-In*. Omaha: Bartholomew Strength, LLC.

Bloom, G. A., Durand-Bush, N., & Salmela, J. H. (1997). Pre-and post-competition routines of expert coaches of team sports. *The Sport Psychologis*t, 11(2), 127-141.

Buchheit, M. (2016). Chasing the 0.2. *International Journal of Sports Physiology and Performance*, 11, 417-418.

Callary, B., Werthner, P., & Trudel, P. (2012). How meaningful episodic experiences influence the process of becoming an experienced coach. *Qualitative Research in Sport, Exercise, and Health,* 4(3), November 2012, 420-438.

Celestino, T. F., Leitao, J. C. G., Sarmento, H. B., Routen, A., & Pereira, A. A. (2015). Elite coaches views on factors contributing to excellence in orienteering. *CCD*, 11(10), 77-86.

Chambliss, D. (1989). The mundanity of excellence: An ethnographic report on stratification and Olympic swimmers. *Sociological Theory*, 7(1), 70-86.

Cross, N., & Lyle, J. (Eds.). (1999). *The coaching process; Principles and practice for sport*. Oxford: Butterworth-Heineman.

Currie, J. L., & Oates-Wilding, S. (2012). Reflections on a dream: towards an understanding of factors Olympic coaches attribute to their success. *Reflective Practice*, 13(3), 425-438.

Cushion, C. J., Armour, K. M., & Jones, R. L. (2006). Locating the coaching process in practice: Models 'for' and 'of' coaching. *Physical Education Sport Pedagogy*, 11, 83-99.

Cushion, C. J., Armour, K. M., & Jones, R. L. (2003). Coach education and continuing professional development: Experience and learning to coach. *Quest*, 2003, 55, 215-230.

Dieffenbach, K., Gould, D., & Moffett, A. (2008). How coaches molded Olympians. *Soccer Journal*, 53, 63-65.

Din, C., Paskevich, D., Gabriele, T., & Werthner, P. (2015). Olympic medal-winning leadership. *International Journal of Sports Science & Coachin*g, 10(4), 589-604.

Fletcher, D., & Hanton, S. (2003). Sources of organizational stress in elite sports performers. *The Sport Psychologist,* 17, 175-195.

Freitas, S., Dias, C., & Fonseca, A. (2013). How do elite soccer coaches prepare their players and teams psychologically? *Journal of Physical Education and Sport*, 13(3), 321-329.

Giges, B., Petipas, A. J., & Vernacchia, R. A. (2004). Helping coaches meet their own needs: Challenges for the sport psychology consultant. *Sport Psychology*, 18, 430-444.

Gould, D., Giannina, J., Krane, V., & Hodge, K. (1990). Educational needs of elite U.S. National team, Pan American, and Olympic coaches. *Journal of Teaching in Physical Education*, 9, 332-344.

Gould, D., Hodge, K., Peterson, K., & Petlichkoff, L. (1987). Psychological foundations of coaching: Similarities and differences among intercollegiate wrestling coaches. *The Sport Psychologist*, 1, 293-308.

Hanton, S., Fletcher, D., & Coughlan, G. (2005). Stress in elite sport performers: A comparative study of competitive and organizational stressors. *Journal of Sports Sciences*, October 2005; 23(10), 1129-1141.

He, C., Trudel, P., & Culver, D. M. (2018). Actual and ideal sources of coaching knowledge of elite Chinese coaches. *International Journal of Sports Science & Coaching*, 0(0), 1-12.

Hodgson, L., Butt, J., & Maynard, I. (2017). Exploring the psychological attributes underpinning elite sports coaching. *International Journal of Sports Science and Coaching*, 12(4), 439-451.

Holt, N. L., & Hogg, J. M. (2002). Perceptions of stress and coping during preparations for the 1999 women's soccer world cup finals. *The Sport Psychologist*, 16, 251-271.

Irwin, G., Hanton, S., & Kerwin, D. G. (2004). Reflective practice and the origins of elite coaching knowledge. *Reflective Practice*, 5(3), October 2004, 425-442.

Jones, R. L., Bailey, J., & Thompson, I. (2013). Ambiguity, noticing, and orchestration: Further thoughts on managing the complex coaching context. In P. Potrac, W. Gilbert, & J. Denison (Eds.), *The Routledge handbook of sports coaching* (pp. 271-283). London: Routledge.

Jones, R. L., Armour, K. M., & Potrac, P. (2003). Constructing expert knowledge: A case study of a top-level professional soccer coach. *Sport Education & Society*, 8, 213-229.

Jowett, S. (2017). Coaching effectiveness: The coach-athlete relationship at its heart. *Current Opinion in Psychology*, 16, 154-158.

Jowett, S., & Shanmugam, V. (2016). Relational coaching in sport: Its psychological underpinnings and practical effectiveness. In R. Schinke, K. R. McGannon, & B. Smith (Eds.), *Routledge International Handbook of Sport Psychology* (pp. 471-484). London: Routledge.

Jowett, S., & Carpenter, P. (2015). The concept of rules in the coach-athlete relationship. *Sports Coaching Review*, 4, 1-23.

Jowett, S. (2008b). Outgrowing the familial coach-athlete relationship. *International Journal of Sport Psychology*, 39, 20-40.

Jowett, S., & Cockerill, I. M. (2003). Olympic medallists' perspective of the athlete-coach relationship. *Psychology of Sport and Exercise*, 4, 313-331.

Kavussanu, M., Boardley, I. D., Jutkiewiez, N., et al. (2008). Coaching efficacy and coaching effectiveness: Examining their predictors and comparing coaches' and athletes' reports. *Sport Psychology,* 22, 383-404.

Kim, M., Kim, Y., & Won, D. (2018). From commanding to serving athletes: Nurturing the coach-athlete relationship. *International Journal of Sports Science & Coaching*, 0(0), 1-11.

Lara-Bercial, S., & Mallett, C. J. (2016). The practices and developmental pathways of professional and Olympic serial winning coaches. *International Sport Coaching Journal*, 3(3), 1-50.

Law, H. (2013). *The Psychology of Coaching, Mentoring and Learning* (2nd ed.). Chichester: Wiley.

Lee, S., Shaw, D. J., & Chesterfield, G. (2009). Reflections from a world champion: An interview with Sir Clive Woodward, Director of Olympic Performance, the British Olympic Association. *Reflective Practice*, 10, 295-310.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. London: Sage Publications.

Lyle, J. W. B. (1999). The coaching process: principles and practice. In N. Cross & J. Lyle (Eds.), *The Coaching Process: Principles and Practice for Sport* (pp. 1-24). Oxford: Butterworth-Heinemann.

Lyle, J. (2002). *Sports Coaching Concepts: A Framework for Coaches' Behaviour*. London: Routledge.

Marshall, C., & Rossman, G. B. (1995). *Designing qualitative research (2nd ed.)*. Sage Publications.

McGuire, R. (2016). *The power of positive coaching*. University of Missouri.

Milistetd, M., Peniza, L., Trudel, P., & Paquette, K. (2018). Nurturing high-performance sport coaches' learning and development using narrative-collaborative coaching approach. *Journal of Sport Science*, 9(1), 6-38.

Nash, C. S., Sproule, J., & Horton, P. (2011). Excellence in coaching: The art and skill of elite

practitioners. *Research Quarterly for Exercise and Spor*t, 82(2), 229-238.
Nash, C. S., Sproule, J., & Horton, P. (2008). Sport coaches' perceived role frames and philosophies. *International Journal of Sports Science & Coaching*, 3(4), 539-554.
Nash, C., & Collins, D. (2006). Tacit knowledge in expert coaching: Science or art? *Quest,* 58, 465-477.
Olusoga, P., Maynard, I., Hays, K., et al. (2012). Coaching under pressure: A study of Olympic coaches. *Journal of Sports Science*, 30, 229-239.
Patton, M. (2002). *Qualitative research & evaluation methods (3rd ed.*). Thousand Oaks: Sage Publications.
Rezania, D., & Gurney, R. (2014). Building successful student-athlete coach relationships: Examining coaching practices and commitment to the coach. *SpringerPlus*, 2, 1-11.
Ryan, R. M., & Deci, E. L. (2002). Overview of self-determination theory: An organismic dialectical perspective. In E.L. Deci, & R.M. Ryan (Eds.) *Handbook of self-determination research* (pp. 3-33). Rochester NY: University of Rochester Press.
Salmela, J. (1995). Learning from the development of expert coaches. *Coaching and Sport Science Journal,* 2(2), 3-13.
Sawiuk, R., Taylor, W. G., & Groom, R. (2018). Exploring formalized elite coach mentoring programmes in the UK: 'We've had to play the game'. *Sport, Education, and Society*, 23(6), 619-631.
Schempp, P. G., & McCullick, B. (2010). Coaches' expertise. In Lyle, J., & Cushion, C. (Eds.). *Sports Coaching, Professionalism and Practice.* London: Churchill Livingstone Elsevier, (pp. 221-231).
Stelter, R. (2016). The coach as a fellow-human companion. In: L. van Zyl, A. Oddendal, & M. Stander (Eds.), *Meta-theoretical Perspectives and Applications for Multi-cultural Contexts of Coaching Psychology* (pp. 47-66). New York: Springer.
Trudel, P., Culver, D., & Richard, J-P. (2016). Peter Jarvis: Lifelong coach learning. In L. Nelson, R. Groom, & P. Potrac, P. (Eds.), *Learning in Sports Coaching: Theory and Application*, (pp. 202-214). New York: Routledge.
Van Mullen, P. V., & Dahlin, S. (2017). Five perspectives on pursuing mastery in coaching. *International Sport Coaching Journa*l, 4, 246-253.
Watts, D. W., & Cushion, C. J. (2017). Coaching journeys: Longitudinal experiences from professional football in Great Britain. *Sports Coaching Review,* 6(1), 76-93.
Woodman, L. (1993). Coaching: A science, an art, an emerging profession. *Sport Science Review*, 2(2), 1-13.

Charles J. Infurna, Ed.D. was a four-year competitor in the hamer throw at SUNY Fredonia. As a coach he has coached two Division III national championships in weight throwing, as well as one HS national champion. He is a USAW Level 2 certified coach. Infurna is currently the throws coach at Alfred State College.

CONTINUED FROM PAGE 7611

The Physiology Of Marathon Running
Just What Does Running A Marathon Do To Your Body?

Nieman, D.C., D.A. Henson, S.R. McAnulty, L. McAnulty, N.S. Swick, A.C. Utter, D.M. Vinci, S.J. Opiela, and J.S. Morrow. 2002b. Influence of vitamin C supplementation on oxidative and immune changes after an ultramarathon. *Journal of Applied Physiology* 92:1970-1977.
Nieman, D.C., D.A. Henson, L.L. Smith, A.C. Utter, D.M. Vinci, J.M. Davis, D.E. Kaminsky, and M. Shute. 2001. Cytokine changes after a marathon race. *Journal of Applied Physiology* 91:109-114.
Nieman, D.C., L.M. Johanssen, and J.W. Lee. 1990. Infectious episodes in runners before and after a road race. *The Journal of Sports Medicine and Physical Fitness* 29(3):289-296.
Noakes, T., B. Adams, K. Myburgh, C. Greeff, T. Lotz, and M. Nathan. 1988. The danger of an inadequate water intake during prolonged exercise. *European Journal of Applied Physiology* 52:210-219.
Noakes, T.D. 2003. *The Lore of Running*. Champaign, Illinois: Human Kinetics.
Noakes, T.D. 1987. Heart disease in marathon runners: A review. *Medicine and Science in Sports and Exercise* 19(3):187-194.
Noakes, T.D., K.H. Myburgh, J. Du Plessis, L. Lang, M. Lambert, C. Van Der Riet, and R. Schall. 1991. Metabolic rate, not percent dehydration, predicts rectal temperature in marathon runners. *Medicine and Science in Sports and Exercise* 23(4):443-449.
Noakes, T., L. Opie, W. Beck, J. McKechnie, A. Benchimol, and K. Desser. 1977. Coronary heart disease in marathon runners. *Annals of the New York Academy of Sciences* 301:593-619.
Nybo, L. 2003. CNS fatigue and prolonged exercise: Effect of glucose supplementation. *Medicine and Science in Sports and Exercise* 35(4):589-594.
O'Conner, A.M., D.F. Johnston, K.D. Buchanan, C. Boreham, C. Trinick, and C.J. Ridoch. 1995. Circulating gastrointestinal hormone changes in marathon running. *International Journal of Sports Medicine* 16(5):283-287.
Pedersen, B.K., and L. Hoffman-Goetz. 2000. Exercise and the immune system: Regulation, integration, and adaptation. *Physiological Reviews* 80(3):1055-1081.
Pedersen, B.K., and Toft, A.D. 2000. Effects of exercise on lymphocytes and cytokines. *British Journal of Sports Medicine* 34:246-251.
Pedoe, D.T. 2000. Sudden cardiac death in sport-Spectre or preventable risk? *British Journal of Sports Medicine* 34:137-140.
Peters, E.M., and E.D. Bateman. 1983. Ultramarathon running and upper respiratory tract infections: An epidemiological survey. *South African Medical Journal* 64(15):582-584.
Peters, E.M., J.M. Goetzche, B. Grobbelaar, and T.D. Noakes. 1993. Vitamin C supplementation reduces the incidence of postrace symptoms of upper-respiratory-tract infection in ultramarathoners. *American Journal of Clinical Nutrition* 57(2):170-174.
Plymire, D.C. 2002. Running, heart disease, and the ironic death of Jim Fixx. *Research Quarterly for Exercise and Sport* 73(1):38-46.
Ratliff, N.B., K.M. Harris, S.A. Smith, M. Tankh-Johnson, C.C. Gornick, and B.J. Maron. 2002. Cardiac arrest in a young marathon runner. *Lancet* 360(9332):542.
Ridley, S.A., P.N. Rogers, and I.H. Wright. 1990. Glasgow marathons 1982-1987: A review of medical problems. *The Scottish Medical Journal* 35:11-14.
Roberts, W., and B. Maron. 2005. Evidence for decreasing occurrence of sudden cardiac death associated with the marathon. *Journal of the American College of Cardiology* 46(7):1373-1374.
Roberts, W. O. 2000. A 12-yr profile of medical injury and illness for the Twin Cities Marathon. *Medicine and Science in Sports and Exercise* 32(9):1549-1555.
Satterthwaite, P., P. Larmer, J. Gardiner, and R. Norton. 1996. Incidence of injuries and other health problems in the Auckland Citibank marathon, 1993. *British Journal of Sports Medicine* 30:324-326.
Satterthwaite, P., R. Norton, P. Larmer, and E. Robinson. 1999. Risk factors for injuries and other health problems sustained in a marathon. *British Journal of Sports Medicine* 33:22-26.
Schwellnus, M., E. Derman, and T. Noakes. 1997. Aetiology and skeletal muscle "cramps" during exercise: A novel hypothesis. *Journal of Sports Sciences* 15(3): 277-285.
Shephard, R.J., and P.N. Shek. 1999. Exercise, immunity and susceptibility to infection. *The Physician and Sportsmedicine* 27(6):47-71.
Sherman, W.M., D.L. Costill, and J.M. Miller. 1981. Effect of exercise-diet manipulation on muscle glycogen and its subsequent utilization during performance. *International Journal of Sports Medicine* 2:114-118.
Siegel, A.J., M. Sholar, J. Yang, E. Dhanak, and K.B. Lewandrowski. 1997. Elevated serum cardiac markers in asymptomatic marathon runners after competition: Is the myocardium stunned? Cardiology 88:487-491.
Siscovick, D., N. Weiss, R. Fletcher, and T. Lasky. 1984. The incidence of primary cardiac arrest during vigorous exercise. *The New England Journal of Medicine* 311(14):874-877.
Smetanka, R.D., G.P. Lambert, R. Murray, D. Eddy, M. Horn, and C.V. Gisolfi. 1999. Intestinal permeability in runners in the 1996 Chicago Marathon. *International Journal of Sports Medicine 9(4):426-433*.
Thompson, P.D., E.J. Funk, R.A. Carleton, and W.Q. Sturner. 1982. Incidence of death during jogging in Rhode Island from 1975 through 1980. *Journal of the American Medical Association* 247(18):2535-2538.
Tsintzas, K., and C. Williams. 1998. Human glycogen metabolism during exercise: Effect of carbohydrate supplementation. *Sports Medicine* 25(1):7-23.
Tsintzas, K., C. Williams, R. Singh, W. Wilson, and J. Burrin. 1995. Influence of carbohydrate-electrolyte drinks on marathon running performance. *European Journal of Applied Physiology and Occupational Physiology* 70:154-160.
Warhol, M.J., A.J. Siegal, W.J. Evans, and L.M. Silverman. 1985. Skeletal muscle injury and repair in marathon runners after competition. *American Journal of Pathology* 118(2):331-339.
Williams, D., J. Brewer, and M. Walker. 1992. The effect of a high carbohydrate diet on running performance during a 30-km treadmill time trial. *European Journal of Applied Physiology and Occupational Physiology* 65:18-24.

JUST WHAT DOES RUNNING A MARATHON DO TO YOUR BODY?

This article, reprinted here with permission from the author, originally appreared online: www.marathonhandbook.com. It is an in-depth look at the research on what happens physiologically in running a marathon.

BY JAKE EMMETT, PH.D.

Running a marathon has been viewed, and still is by many, as too extreme to be healthy.

Certainly, the physical stress of running a marathon played some role in not holding a women's Olympic marathon race until 1984.

On the flip side, casual runners think that if a pampered celebrity can run a marathon, it can't be all that strenuous.

While marathon running is far from damaging, it should be respected for the physiological stress inflicted over its 26.2 miles.

For example, running a five-minute-per-mile marathon requires a 15-fold increase in energy production for over two hours.

Even runners who finish in over four hours maintain a 10-fold increase in their metabolism.

Such extended energy demands require the cardiorespiratory, endocrine, and neuromuscular systems to operate at an elevated level for an inordinate length of time.

It is no wonder then that the story of Pheidippides and his marathon run to Athens easily grew into a tragic tale about how running a marathon killed the first person to do so.

Fortunately, scientists have researched the physiological stresses of running a marathon.

The findings from such studies can help potential marathon runners better appreciate what they will be up against and remind seasoned marathon runners just how amazing the human body is.

SUDDEN DEATH

The physiology on marathon running starts with Pheidippides, who reputedly ran from the plains of Marathon to the city of Athens to report the victory of the Athenian army over the Persians.

Upon his arrival, Pheidippides exclaimed, "Rejoice, we conquer" and dropped dead—or did he?

The accuracy of this account has been questioned by modern scholars (Martin and Gynn 2000); however, the unfortunate outcome of Pheidippides is manifested in a few marathon runners every year.

Just how stressful to the human body is running a marathon?

This and other questions regarding marathon running were addressed at *The Marathon: Physiological, Medical, Epidemiological, and Psychological Studies* conference in 1976. The boldest theory regarding marathon running was made by Dr. Tom Bassler (1977), who suggested that the stress of running a marathon built immunity to the development of fatty deposits within coronary arteries.

In other words, running a marathon prevents coronary artery disease (CAD).

Bassler compared marathon runners to the heart-disease-free Masai warriors and Tarahumara Indians in that they all maintain active lifestyles, eat healthy diets, and have enlarged and wide-bore coronary arteries.

After reviewing the cause of death in marathon runners from the previous 10 years, Bassler claimed that "there have been no reports of fatal, histologically proven, [CAD] deaths among 42K men."

While he noted that some runners have died while running marathons, he concluded that these deaths were due to other factors such as nonatherosclerotic heart diseases (such as myocarditis or coronary spasms), congenital abnormalities, hyperthermia, or undertraining.

To his credit, Bassler also acknowledged that a low-fat diet and abstention from smoking play important roles in developing immunity to heart disease. Bassler concluded that whether running a marathon offered absolute protection from CAD would be proven within the following 10 years.

THE MOST DAMNING EVIDENCE AGAINST BASSLER'S THEORY, HOWEVER, CAME FROM ONE UNFORTUNATE CASE STUDY.

At the same conference, Bassler's claim was refuted with four documented cases of marathon runners who had died from CAD (Noakes et al. 1977).

Noakes (1987) bolstered his opposition with a follow-up report on a total of 36 documented cases of heart attacks or sudden death in marathon runners prior to 1984.

Angiography, autopsy, or electrocardiographic results were available for 27 of the runners, 25 of whom had some degree of CAD. Sudden death occurred in 22 of the 36 runners, with 19 of those deaths occurring during, immediately after, or within 24 hours after running a marathon or a long training run.

While this report clearly showed that marathon running alone does not guarantee a life free of CAD, it should be noted that the contributing factors of smoking and diet mentioned by Bassler were not addressed.

The most damning evidence against Bassler's theory, however, came from one unfortunate case study.

Jim Fixx was an overweight, overstressed smoker whose father suffered a heart attack at the age of 35 and died eight years later.

Rehabilitation of a tennis injury motivated Fixx to start running to the point that he completed several marathons and wrote the bestseller *The Complete Book of Running.*

Because of Fixx's positive family history for heart disease and his passion for running, he understandably agreed with Bassler's theory. His faith in Bassler's theory may be why Fixx ignored chest pains while he ran, hoping they would eventually go away if he kept on running (Plymire 2002).

Unfortunately, his passion for running came to an end along a Vermont road in 1984 when, in the middle of a run, **Jim Fixx died of a heart attack.**

An autopsy found a complete blockage in one coronary artery, an 80 percent blockage in another, and signs of previous heart attacks.

The death of Jim Fixx convinced the world not only that running a marathon couldn't prevent CAD but that running could result in sudden death.

While true, the risk for sudden death is greater in marathon runners who, similar to Fixx, have a positive family history, elevated cholesterol, and warning signs such as angina, nausea, and epigastric discomfort (Noakes 1987).

This was confirmed by Maron et al. (1996), who quantified the risk of marathon running with data from the 1976 to 1994 Marine Corp marathons and from the 1982 to 1994 Twin Cities marathons. Out of 215,413 runners, there were four deaths, three men and one woman.

One of the men experienced chest pains at mile 20 and died 15 minutes after finishing, while the other three runners died on the course.

All three men died of heart attacks, while the woman's death was attributed to an abnormal origin of the left main coronary artery on the aorta resulting in inadequate blood supply to the heart.

Two of the men had significant blockage (greater than 50 percent) in three arteries, and the other had significant blockage in two arteries.

Roberts and Maron (2005) published an updated report with data through 2004 for the same two marathons. There was one additional death in nearly the same number of finishers as in their first study. Combining the data, there were five deaths and four successful resuscitations that occurred in 8 men and one woman.

The updated risk of sudden death improved to 1 in 220,000 finishers. The authors point out that the decreased risk is likely due to the availability of external defibrillators due to three nonfatal heart attacks in their recent study compared to only one in their original study.

Another study identified eight cases of sudden death in over 840,000 runners, or a nearly one in 100,000 ratio, during 19 years of the London and New York City marathons (Pedoe 2000).

Determining an exact risk of sudden death from marathon running would require accounting for the degree of preexisting heart disease, the quality of medical treatment at the marathon, and gathering much more data.

However, it is noteworthy that these estimated sudden death risk ratios from marathon running are better than the estimated one death in 15,000 for jogging (Thompson et al. 1982) or one death in 18,000 for general exercise (Siscovick et al. 1984).

THERE ARE DOCUMENTED CASES OF INDIVIDUALS WHO EXPERIENCE CARDIAC ARREST DESPITE NO EVIDENCE OF CAD.

A few studies have looked for signs of heart damage immediately following and for hours after completing a marathon (Kratz et al. 2002; Siegel et al. 1997; Lucia et al. 1999).

The levels of proteins typically used to diagnose cardiac damage were slightly elevated, indicating a mild stress to the heart, but none of the levels approach those seen following a heart attack.

However, there are documented cases of individuals who experience cardiac arrest despite no evidence of CAD. Green et al. (1976) found extensive damage to the heart, but no CAD, in a 44-year-old marathon runner who collapsed after 24 miles of a marathon and later died.

Ratliff et al. (2002) reported normal coronary arteries in a 22-year-old runner who collapsed from cardiac arrest at the finish line. The runner survived, but because of acute kidney failure from dehydration and nonsteroidal anti-inflammatory drug (NSAID) use, he developed gangrene in his lower right leg, which had to be amputated.

The ability of the heart to effectively fill and pump blood has been researched in postmarathon runners.

For example, Neilan et al. (2006) found mildly impaired heart function that persisted for one month. Therefore, any person considering running a marathon, particularly those over the age of 45, should check with a doctor before starting to train.

HYPERTHERMIA

Besides supplying oxygen-rich blood to the body, the heart helps control body temperature by pumping warm blood to the skin where body heat is lost through the evaporation of sweat.

During a marathon, heat loss and production can increase over 10-fold.

High humidity and dehydration can make heat loss more difficult. High humidity levels reduce evaporation, while dehydration impairs the ability to transfer heat from the muscles to the skin.

Either situation will increase body temperature and the risk for heat problems. Muscle weakness and disorientation can develop with body temperatures of 105-106 degrees Fahrenheit, and a loss of consciousness can occur with body temperatures near 107 degrees

Fahrenheit.

Without the ability to lose heat through evaporation, body temperature would rise fast enough to cause heat problems after only 15 to 20 minutes of running. Even with the ability to sweat, it is not uncommon for marathon runners to finish the 26.2 miles with body temperatures of 105 degrees Fahrenheit.

However, heat problems can occur in much milder conditions.

For example, in the 2001 Chicago Marathon, a 22-year-old man collapsed within 300 yards of the finish line as he neared the three-hour mark.

Despite quick medical attention, he later died with a body temperature of 107 degrees Fahrenheit despite temperatures in the 50s at the time of his collapse (Nevala 2001).

According to Cheuvront and Haymes (2001), an elevated body temperature, or hyperthermia, during marathon running can be due to the climate, dehydration, a relatively high metabolic rate from running a faster-than-usual pace, or a combination of factors.

Also, marathon runners may overdress or not remove layers or clothing as the air temperature rises over the course of the marathon. Even though runners can't control the climate, there are other things they can do to prevent hyperthermia.

Since dehydration reduces the amount of blood available for heat removal, one way to prevent hyperthermia would be to drink as much water as is lost through the sweat. The average sweat rate for runners is 1.2 liters per hour. However, most runners either can't tolerate drinking that much or choose not to drink that much liquid.

Typically, runners drink as little as 200 milliliters per hour but rarely more than 1 liter per hour. Therefore, it is not uncommon for runners to lose 2 to 10 percent of their body weight through sweating.

Studies have shown that dehydration of only 3 percent of body weight can decrease a runner's performance (Cheuvront and Haymes 2001). But dehydration is not the only factor that will increase body temperature.

SLOWER RUNNERS ARE AT A GREATER RISK SIMPLY BECAUSE THEY HAVE MORE TIME DURING A MARATHON TO DRINK TOO MUCH WATER.

There is evidence that a high energy production, or metabolic rate, while running may have a stronger influence. Thirty runners had their dehydration level measured and their metabolic rate estimated during the 1987 Cape Peninsula Marathon (Noakes et al. 1991).

These values were then compared to their core body temperatures measured within two to five minutes after the marathon. The results showed it was not the degree of dehydration but the metabolic rate during the last four miles of the race that had the strongest correlation to body temperature.

Toward the end of a marathon, when the speed and effort of running increase, the body becomes less efficient at using energy, which produces more excess heat, which in turn drives the body temperature even higher.

Cheuvront and Haymes (2001) compiled data from 12 studies looking at dehydration in runners. Their results also showed a significant correlation between running speed and core temperature but not between dehydration and core temperature.

HYPONATREMIA

Could it be that dehydration during marathon running has been overemphasized? Perhaps so, especially with the increase in cases of water intoxication, or hyponatremia, reported in recent marathons.

The major cause of hyponatremia, or low blood-sodium levels, is drinking too much water, which dilutes sodium levels in the blood. Low sodium levels cause swelling or edema in the brain, which can be fatal.

Davis et al. (2001) found 26 cases of hyponatremia in over 34,000 runners from the 1998 and 1999 San Diego Rock 'n' Roll Marathon. They found that hyponatremia was greater in women, slower runners (those who finish in over four hours), and in people who took over-the-counter nonsteroidal anti-inflammatory drugs (NSAIDs).

Similarly, Hew et al. (2003) reported 21 cases of hyponatremia at the 2000 Houston Marathon. There was a similar number of cases in men and women, but hyponatremia was more common in slower runners and those who used NSAIDs.

Women may be at greater risk because less water can dilute sodium

levels in smaller bodies; additionally, estrogen can further contribute to brain swelling once it starts.

Slower runners are at a greater risk simply because they have more time during a marathon to drink too much water. For example, Hew et al. (2003) found that runners who developed hyponatremia drank about twice that of other runners and were on the course one to two hours longer.

In addition, NSAIDs can increase the effect of antidiuretic hormones, which increases water retention. Hyponatremia can develop after completion of a marathon when hormonal changes cause increases in absorption of water combined with sodium lost in the urine.

Hyponatremia is rare, occurring in less than 0.3 percent of marathon runners, but the number of cases increased from 1993 to 2000 (Hew et al. 2003). This increase has been countered by a similar increase in education about the risk of overdrinking from the media and race directors.

On the other hand, drinking water or sports drinks during a marathon should not be avoided.

While studies have shown that increases in body temperature are related more to running speed than to dehydration, these studies did not look at the effect of dehydration on actual performance.

Even though dehydration may not be related to increases in body temperature, drinking fluids during a marathon maintains adequate blood flow to the muscles to support the high-energy demands of running a marathon. In addition, sports drinks contain electrolytes that help prevent hyponatremia as well as sugars for additional fuel.

The best advice is to drink in moderation before and during a marathon. Common recommendations for marathon runners are to drink 20 ounces of fluid two to three hours before the race and another 8 ounces 30 minutes before.

During the marathon, runners should drink 8 to 10 ounces of water or a sports drink every 10 to 20 minutes and afterward drink as much as they comfortably can.

HYPOTHERMIA

Sometimes hypothermia, rather than hyperthermia, can be the main environmental concern for marathon runners. Between 1982 and 1987, the Glasgow Marathon was run in temperatures ranging from 39.5 to 59.3 degrees Fahrenheit (Ridley et al. 1990).

The 1983 Bostonfest Marathon had 11.5 percent of runners request medical treatment, with hypothermia being the most common diagnosis (Jones et al. 1985). Obviously, the risk for hypothermia is greater in cold, windy, or wet weather; however, the American College of Sports Medicine (1996) cites other factors that may reduce body temperature.

For example, if the second half of the marathon is run slower than the first half, not enough heat may be generated to maintain body temperature. Also, any sweat that builds up can saturate clothing, which will draw additional heat away from the body.

Hypothermia can also occur after the race when heat radiates from a warm body to the cooler air temperature.

The best defense against hypothermia is to dress in layers with an outer layer that protects from wind and water. Layers should be removed as air temperature increases to avoid hyperthermia, and any wet layers should be replaced.

THE BEST ADVICE IS TO DRINK IN MODERATION BEFORE AND DURING A MARATHON.

While not as common as hyperthermia, the number of hypothermia cases could increase along with the popularity of trail and adventure marathons. Hypothermia can produce more than just cold limbs or noses.

Irregular and life-threatening heart rhythms can develop, so it should not be treated any less seriously than hyperthermia.

GLYCOGEN DEPLETION

Carb-loading dinners have become a staple of the modern marathon prerace events.

And why not?

When the facts are linked together, carbohydrate loading makes sense. For instance, carbohydrates provide energy to the muscles faster than fats and are required for optimal aerobic performances.

Inside the body, carbohydrates are found as glycogen in the muscles and liver and as glucose in the blood.

During a marathon, the muscle gains energy from the glycogen within its

cells and from blood glucose. As the amount of glucose in the blood is used up, the liver converts its glycogen into glucose and releases it into the bloodstream to maintain a constant supply of glucose to the muscles.

During prolonged exercise, glycogen levels become depleted, leaving the muscles with little of the high-performance fuel and forced to operate on slower-burning fats.

This shift in fuel sources does not go unnoticed. Marathon runners describe it as like running into a wall or "bonking." It is also known that a diet high in carbohydrates can increase the amount of glycogen stored inside the muscles and liver.

Therefore, if glycogen depletion leads to a decrease in running speed and a high-carbohydrate diet can increase glycogen stores, then carbohydrate loading should prevent or delay hitting The Wall.

When carbohydrate-loading studies from all endurance sports were reviewed, Hawley et al. (1997) found that carbohydrate loading did improve performance in endurance sports lasting longer than 90 minutes.

However, none of the studies used a full marathon as the performance distance. The closest are studies that looked at the effects of carbohydrate loading on 30K race times. Karlsson and Saltin (1971) found that carbohydrate loading improved 30K race times by an average of nearly eight minutes (143.0 to 135.3 minutes).

The faster times were the result of not having to slow down rather than being able to run faster. Similarly, six men cut an average of 3.6 minutes (131.0 to 127.4 minutes) off their 30K time after increasing carbohydrate consumption by 200 grams the week before the race (Williams et al. 1992).

Other studies looked at whether carbohydrate loading could prolong the time to exhaustion. Overall, subjects were able to run 10 to 66 percent longer at 70 to 75 percent of maximal effort after having carbohydrate loaded (Brewer et al. 1988; Chryssanthopoulos et al. 2002; Galbo et al. 1967; Lamb et al. 1991).

HYPOGLYCEMIA REDUCES THE STRENGTH OF STIMULATION FROM THE BRAIN TO THE MUSCLES, RESULTING IN WEAKER MUSCLE CONTRACTION AND SLOWER RUNNING SPEEDS.

On the other hand, a study by Sherman et al. (1981) found that eating a diet of 70 percent carbohydrate for three days elevated muscle glycogen levels but failed to improve 20.9K times compared with a diet of 50 percent carbohydrate.

Also, in a second part of the study by Lamb et al. (1991), the run time to exhaustion was 16 minutes longer but not statistically better than the group that did not carbohydrate load.

While carbohydrate loading does appear to be effective for most runners, it does have its drawbacks. Consuming too many calories in the name of carbohydrate loading can add extra body weight, which will increase the energy demands of running a marathon.

Also, for every gram of glycogen stored, almost 3 grams of water are stored with it. This can leave a runner with a bloated or heavy feeling. Besides, it may be that hypoglycemia, not muscle glycogen depletion, is a greater concern.

If a runner does not consume carbohydrates during a marathon, liver glycogen depletion can occur around two hours, leading to hypoglycemia. Even though muscle glycogen depletion may take longer to develop, hypoglycemia resulting from liver glycogen depletion can reduce running speed from inadequate neural stimulation (Noakes 2003).

The problem is that the brain prefers glucose as its fuel, and hypoglycemia impairs brain functions, one of which is stimulation of the muscles.

So despite glycogen remaining inside the muscles, hypoglycemia reduces the strength of stimulation from the brain to the muscles, resulting in weaker muscle contraction and slower running speeds (Nybo 2003).

Some experts feel that consuming carbohydrates during a marathon is just as important, if not more so, as carbohydrate loading (Ivy 1999). In fact, many studies have shown that carbohydrate ingestion during exercise helps prevent hypoglycemia and improves performance (Tsintzas and Williams 1998; Jacobs and Sherman 1999).

For example, subjects ran two 30K races with either a high-carbohydrate meal before the race and water during the race or a no-

carbohydrate solution before the race and a carbohydrate sports drink during the race.

Race times were the same regardless of whether carbohydrates were emphasized before or during the race (Chryssanthopoulos et al. 1994). In a study by the same group of researchers, a prerun carbohydrate meal improved run times to exhaustion by about 10 percent, but combining the carbohydrate meal with a carbohydrate sports drink during the run increased performance an additional 10 percent (Chryssanthopoulos et al. 2002).

In the marathon study, subjects ran three 42.2K treadmill time trials consuming only water, or a 5.5 percent carbohydrate sports drink, or a 6.9 percent carbohydrate sports drink. Race times were significantly faster (190 minutes) with the 5.5 percent solution compared with either water (193.9 minutes) or the 6.9 percent solution (192.4 minutes) (Tsintzas et al. 1995).

Collectively, these studies show the importance of carbohydrate as a fuel source during prolonged running, but the issue of when and how much carbohydrate should be consumed seems to be an individual matter.

Ivy (1999) suggests that both carbohydrate loading before and carbohydrate consumption during an event are needed for those who run between 60 and 70 percent of their VO_2max.

But, for faster runners, carbohydrate consumption during exercise is not beneficial because glucose uptake into the muscles cannot occur fast enough to be useful.

More research is needed to determine whether these conclusions pertain to marathon runners, but there is little doubt that increasing carbohydrate intake before and/or consuming carbohydrate during a marathon is critical for optimal performance.

The original version of carbohydrate loading starts with three days of a low- carbohydrate diet followed by intense exercise to deplete glycogen stores.

EVERY TIME THE FOOT HITS THE GROUND, A STRESS THREE TO FOUR TIMES BODY WEIGHT IS ABSORBED BY THE ANKLES, KNEES, HIPS, AND LOWER BACK.

This is followed by three days of a high-carbohydrate diet where glycogen levels are supercompensated from a normal value of 100 millimoles per kilogram to 220 millimoles per kilogram. Sherman et al. (1981) found that a gradual increase in dietary carbohydrate along with tapering training resulted in just slightly less glycogen (205 millimoles per kilogram) but with much less stress to the individual.

Sherman et al.'s modified version of carbohydrate loading has since been the recommended technique of carbohydrate loading for most endurance athletes.

Consuming carbohydrates during a marathon should be done at a rate of 30 to 60 grams (120 to 180 calories) per hour and 30 to 40 minutes prior to fatigue.

The amount and timing are based on the fact that glucose is absorbed into the bloodstream at a rate of 1.0 to 1.2 grams per minute (Ivy 1999). Various types of carbohydrate (glucose, a glucose polymer, or fructose) seem to be equally effective in maintaining blood glucose levels (Noakes 1988).

Therefore, it is up to the individual to determine whether sport drinks, energy gels, bananas, flat cola drinks, or some other type of carbohydrate works best.

INJURY

As if hitting The Wall wasn't worry enough, running a marathon can be a musculoskeletal nightmare as well. It takes between 30,000 and 50,000 steps to run a marathon.

Every time the foot hits the ground, a stress three to four times body weight is absorbed by the ankles, knees, hips, and lower back. Also, with each stride, some muscles contract to propel the body forward while others control the degree of movement by being lengthened. The lengthening or eccentric contractions are notorious for damaging the muscle's infrastructure.

As a result, muscle damage and inflammation can remain for seven days after having run a marathon (Hikida et al. 1983), while repair of muscle fibers can take three to 12 weeks (Warhol et al. 1985). It's not surprising then that postmarathon data have found "stiffness or pain" in 65 to 92 percent of marathon runners (Satterthwaite et al. 1996; Kretsch et al. 1984; Nicholl and Williams 1982).

Fortunately, only a relatively few marathon runners have experienced injuries while running a marathon that caused them to seek medical

attention.

A survey of runners who completed the 1980 Melbourne Marathon found that 3 percent of runners reported serious injuries, with the most common being knee pain, hamstring problems, dehydration, blisters, and quadriceps pain or cramps (Kretsch et al. 1984).

Similarly, the injury rate from 12 years of the Twin Cities Marathon was 2.1 percent of all runners (21.15 per 1,000 entrants), with the top five injuries being exercise-associated collapse (59.4 percent), blisters (19.9 percent), muscle strain (14.3 percent), muscle cramps (6.1 percent), and skin abrasions (1.9 percent) (Roberts 2000).

The 1993 Auckland Marathon medical staff reported a nearly three times higher injury rate of 6.2 percent, with cramps, exhaustion, hematomas, blisters, and lightheadedness being the most common problem (Satterthwaite et al. 1996.)

One study that looked at muscle cramping in marathon runners determined that dehydration and electrolyte imbalances may not be responsible (Maughan 1986).

It could be that fatigue from running farther or faster than accustomed and irregular stretching may play a stronger role in producing muscle cramps during a marathon (Schwellnus et al. 1997), while other experts feel dehydration and electrolyte imbalances may play a role, especially in hot conditions (Eichner 1998).

While muscle soreness is the major health issue for the average marathon runner, elite runners have additional concerns.

Data from the 1986 Wonderful Copenhagen Marathon found the most common problem in elite runners was gastrointestinal (GI) distress (26 percent) followed by back or joint pain (20 percent), muscle cramps (16 percent), and blisters and other skin lesions (16 percent each) (Holmich et al. 1988).

It has been speculated that elite runners who suffer from GI distress secrete higher levels of GI hormones (O'Conner et al. 1995) or consume higher amounts of NSAIDs (Smetanka et al. 1999).

Some of the factors that increase the risk for injury while running a marathon are running a first marathon, participation in other sports, illness during the two weeks prior, current use of medication, and training mileage (Kretsch et al. 1984; Satterthwaite et al. 1999). Runners who train less than 60 kilometers per week were more likely to become injured while running a marathon (Kretsch et al. 1984).

Higher levels of training have been shown to decrease the risk for knee injuries but increase the risk of injury to the quadriceps and hamstrings during a marathon (Satterthwaite et al. 1999).

With the large number of training miles required to prepare for running a marathon, it is not surprising that 29 to 43 percent of runners develop injuries during training. In fact, the number of injuries from running a marathon is five to 10 times less than while training for a marathon (Chorly et al. 2002; Holmich et al. 1988; Holmich et al. 1989; Kretsch et al. 1984).

The premarathon injury rate increases with the number of training miles run per week (Holmich et al. 1989), with most injuries occurring to the feet and knees, followed by the shins and hips (Chorly et al. 2002).

IMMUNE SYSTEM

Microscopic damage to the muscles from running a marathon can cause more than soreness. As part of the repair process, cytokines are released from the injured area to promote the influx of white blood cells from the immune system.

In particular, neutrophils, monocytes, and lymphocytes are elevated after prolonged endurance events such as a marathon (Nieman 2000; Pedersen and Hoffman-Goetz 2000). However, other markers of immune function are lower after running a marathon. For example, nasal and salivary immunoglobulin A (IgA) (Nieman et al. 2002a) is reduced for several hours after a marathon, while postmarathon levels of natural killer cells can be suppressed for at least one week (Berk et al. 1990).

There is strong evidence that cortisol, a stress hormone typically released during prolonged exercise, is at least partially responsible for the decrease in natural killer cells.

The muscle damage incurred from running a marathon can divert some immune cells for muscle repair and weaken others, leaving the immune system less able to protect against upper respiratory tract infections (Nehlsen-Cannarella et al. 1997; Nieman 1997).

While there is no direct evidence that those runners with the most weakened immune system are those who develop upper respiratory tract infections (URTI), there is evidence

of a higher rate of URTI in marathon runners compared with nonrunners.

Peters and Bateman (1983) found that 33 percent of the runners who completed the 56-kilometer Two Oceans Marathon developed URTI compared with 15.3 percent in people who did not participate.

Also, there was a higher rate (47 percent) in runners who finished under four hours compared with 19 percent in runners finishing over 5.5 hours. Similarly, Nieman et al. (1990) found 12.9 percent of the finishers of the Los Angeles Marathon developed URTI in the following week compared with 2.2 percent in a similar group of nonparticipants.

However, Ekblom et al. (2006) found runners reported a similar number of infectious episodes in the three weeks before the 2000 Stockholm Marathon as they did in the three weeks afterward.

The increased number of postmarathon URTI led to the development of the "open window" hypothesis, which says that running a marathon depresses the immune system for three to 72 hours and thus increases the susceptibility to URTI (Pedersen and Toft 2000).

Just the possibility of such a relationship has led researchers to investigate whether nutritional supplementation can attenuate the negative effects of marathon running on the immune system.

For example, consuming a 6 percent carbohydrate solution during actual and simulated marathons decreased the inflammatory response measured following the runs (Nehlsen-Cannarella et al. 1997; Nieman et al. 2001; Nieman et al. 2003).

The glucose solutions helped to maintain blood glucose levels, reducing the release of cortisol, which is thought to weaken the immune system.

Glucose consumption during a marathon did not, however, prevent a decrease in salivary immunoglobulin A (IgA), which is one of the first lines of defense against URTI-causing microorganisms (Nieman et al. 2002a).

DURING A MARATHON, GLUTAMINE LEVELS DROP, WHICH COULD CONTRIBUTE TO A WEAKENING OF THE IMMUNE SYSTEM.

Free radicals, byproducts of aerobic metabolism, also appear to play a role in promoting the muscle-damage-induced inflammatory response.

There is evidence that antioxidants like vitamin C combat free radicals and may help prevent a postmarathon weakening of the immune system. One study found fewer postrace URTI in ultramarathon runners who consumed 600 milligrams per day of vitamin C for three weeks prior to the ultramarathon (Peters et al. 1993).

However, glucose intake was not controlled for, and as noted previously, consuming glucose can reduce the amount of stress placed on the immune system following a marathon.

In studies where glucose was controlled for, consuming high doses of vitamin C (500 to 1,500 milligrams per day) for seven to 14 days before a marathon or ultramarathon provided no additional benefit to the immune system or in preventing URTI (Nieman et al. 2002b).

Glutamine is an amino acid that provides energy to the cells of the immune system. During a marathon, glutamine levels drop, which could contribute to a weakening of the immune system.

One study found that supplementation with glutamine after a marathon resulted in fewer postrace URTI (Castell and Newsholme 1997). However, more research is needed to confirm whether glutamine supplementation has a direct effect on strengthening the immune system (Pedersen and Hoffman-Goetz 2000).

Running a marathon temporarily suppresses the immune system, but is the suppression great enough to increase the risk for developing URTI? While there are findings that suggest such a connection, it has yet to be proven that other factors are not responsible.

For example, it is possible that high and turbulent airflow rates, cooling and drying of airways, exposure to unfamiliar microorganisms at unique marathon locations, changes in nutrition, muscle microtrauma, travel influences such as sleep deprivation and time-zone shifts, and psychological stress could also lead to an increase in postmarathon URTI (Shephard and Shek 1999).

Regardless, it is not unreasonable for marathon runners to follow the guidelines presented by Nieman (2000):

- Keep other life stresses to a

minimum.

- Eat a well-balanced diet.
- Obtain adequate sleep.
- Avoid putting hands to eyes and nose.
- Avoid sick people and large crowds.
- Avoid overtraining and rapid weight loss.
- Use carbohydrate beverages before, during, and after marathon races and long training runs.

OTHER PHYSIOLOGICAL BENEFITS

It could very well be that no other sport is so popular yet as potentially harmful as marathon running. Studies on marathon runners indicate that the physiological stresses of running a marathon far outweigh the physiological benefits.

At best, a successful marathon runner will have a few thousand fewer calories to carry around and, once the recovery process is complete, stronger bones, heart, and muscles. The other benefits either come from the miles of premarathon training or are more psychological or emotional in nature.

Despite the fact that running a marathon is hard on the body, even deadly, from an exercise physiologist's standpoint, every runner who crosses the finish has personally validated the miracle that is the human body.

REFERENCES

American College of Sports Medicine. 1996. Heat and cold illnesses during distance running. *Medicine and Science in Sports and Exercise* 28(12):i-x.

Bassler, T.J. 1977. Marathon running and immunity to atherosclerosis. *Annals of the New York Academy of Sciences* 301:579-592.

Berk, L.S., D.C. Nieman, W.Y. Youngberg, K. Arabatzis, J. Simpson-Westerberg, J.W. Lee, S.A. Tan, and W.C. Eby. 1990. The effect of long endurance running on natural killer cells in marathoners. *Medicine and Science in Sports and Exercise* 22(2):207-212.

Brewer, J., C. Williams, and A. Patton. 1988. The influence of high carbohydrate diets on endurance running performance. *European Journal of Applied Physiology and Occupational Physiology* 57:698-706.

Castell, L.M., and E. Newsholme. 1997. The effect of oral glutamine supplementation on athletes after prolonged exhaustive exercise. *Nutrition* 13:738-742.

Cheuvront, S.N., and E.M. Haymes. 2001. Thermoregulation and marathon running: Biological and environmental influences. *Sports Medicine* 31(10):743-762.

Chorley, J.N., J.C. Cianca, J.G. Divine, and T.D. Hew. 2002. Baseline injury risk factors for runners starting a marathon training program. *Clinical Journal of Sports Medicine* 12:18-23.

Chryssanthopoulos, C., C. Williams, W. Wilson, L. Asher, and L. Hearne. 1994. Comparison between carbohydrate feedings before and during exercise on running performance during a 30-km treadmill time trial. *International Journal of Sport Nutrition* 4:374-386.

Chryssanthopoulos, C., C. Williams, A. Nowitz, C. Kotsiopoulou, and V. Vleck. 2002. The effect of a high carbohydrate meal on endurance running capacity. *International Journal of Sport Nutrition* and Exercise Metabolism 12:157-171.

Davis, D.P., J.S. Videen, A. Mario, G.M. Vilke, J.V. Dunford, S.P. Van Camp, and L.G. Mararam. 2001. Exercise-associated hyponatremia in marathon runners: A two-year experience. *The Journal of Emergency Medicine* 21(1):47-57.

Eichner, R. 1998. Treatment of suspected heat illness. *International Journal of Sports Medicine* 19(2):S150-S153.

Ekblom, B., O. Ekblom, and C. Malm. 2006. Infectious episodes before and after a marathon race. *Scandinavian Journal of Medicine and Science in Sports* 16(4): 287-293.

Galbo, H., J. Holst, and N.J. Christensen. 1967. The effect of different diets and of insulin on the hormonal response to prolonged exercise. *Acta Physiologica Scandinavica* 107:19-32.

Green, L.H., S.I. Cohen, and G. Kurland. 1976. Fatal myocardial infarction in marathon racing. *Annals of Internal Medicine* 84(6):704-706.

Hawley, J.A., E.J. Schabort, T.D. Noakes, and S.C. Dennis. 1997. Carbohydrate-loading and exercise performance: An update. *Sports Medicine* 24(2):73-81.

Hew, T.D., J.N. Chorley, J.C. Cianca, and J.G. Divine. 2003. The incidence, risk factors, and clinical manifestations of hyponatremia in marathon runners. *Clinical Journal of Sport Medicine* 13:41-47.

Hikida, R.S., R.S. Staron, F.C. Hagerman, W.M. Sherman, and D.M. Costill. 1983. Muscle fiber necrosis associated with human marathon runners. *Journal of the Neurological Sciences* 59:185-203.

Holmich, P., S.W. Christensen, E. Darre, F. Jahnsen, and T. Hartvig. 1989. Non-elite marathon runners: Health, training and injuries. *British Journal of Sports Medicine* 23:177-178.

Holmich, P., E. Darre, F. Jahnsen, and T. Hartvig-Jensen. 1988. The elite marathon runner: Problems during and after competition. *British Journal of Sports Medicine* 22(1):19-21.

Ivy, J.L. 1999. Role of carbohydrate in physical activity. *Clinics in Sports Medicine* 18(3):469-484.

Jacobs, K.A., and W.M. Sherman. 1999. The efficacy of carbohydrate supplementation and chronic high-carbohydrate diets for improving endurance performance. *International Journal of Sport Nutrition* and Exercise Metabolism 9:92-115.

Jones, B.H., P.B. Rock, L.S. Smith, M.A. Teves, J.K. Casey, K. Eddings, L.H. Malkin, and W.T. Matthews. 1985. Medical complaints after a marathon run in cool weather. *The Physician and Sportsmedicine* 13(10):103-110.

Karlsson, J., and B. Saltin. 1971. Diet, muscle glycogen, and endurance performance. *Journal of Applied Physiology* 31(2):203-206.

Kratz, A., K.B. Lewandrowski, A.J. Siegel, K.Y. Chun, J.G. Flood, E.M. Van Cott, and E. Lee-Lewandrowski. 2002. Effect of marathon running on hematologic and biochemical laboratory parameters, including cardiac markers. *American Journal of Clinical Pathology* 118:856-863.

Kretsch, A., R. Grogan, P. Duras, F. Allen, J. Sumner, and I. Gillam. 1984. 1980 Melbourne Marathon study. *The Medical Journal of Australia* 22:809-814.

Lamb, D.R., A.C. Snyder, and T.S. Baur. 1991. Muscle glycogen loading with a liquid carbohydrate supplement. *International Journal of Sport Nutrition and Exercise Metabolism* 1:52-60.

Lucia, A., L. Serratosa, A. Saborido, J. Pardo, A. Boraita, M. Moran, F. Banders, A. Megias, and J.L. Chicharro. 1999. Short-term effects of marathon running: No evidence of cardiac dysfunction. *Medicine and Science in Sports and Exercise* 31(10):1414-1421.

Maron, B.J., L.C. Poliac, and W.O. Roberts. 1996. Risk for sudden death associated with marathon running. *Journal of the American College of Cardiology* 28(2): 428-431.

Martin, D.E., and R.W.H. Gynn. 2000. *The Olympic Marathon: The History and Drama of Sport's Most Challenging Event.* Champaign, Illinois: Human Kinetics.

Maughan, R.J. 1986. Exercise-induced muscle cramp: A prospective biochemical study in marathon runners. *Journal of Sports Sciences* 4(1):31-34.

Nehlsen-Cannarella, S.L., O.R. Fagoaga, D.C. Nieman, D.A. Henson, D.E. Butterworth, R.L. Schmitt, E.M. Bailey, B.J. Warren, A. Utter, and J.M. Davis. 1997. Carbohydrate and the cytokine response to 2.5 h of running. *Journal of Applied Physiology* 82(5):1662-1667.

Neilan, T., D. Yoerger, P. Douglas, J. Marshall, E. Halpern, D. Lawlor, M. Picard, and M. Wood. 2006. Persistent and reversible cardiac dysfunction among amateur marathon runners. *European Heart Journal* 27(9):1079-1084.

Nevala, *A.E. 2001. Runner who died had been very fit. Chicago Tribune.* October 9.

Nicholl, J.P., and B.T. Williams. 1982. Medical problems before and after a popular marathon. *British Medical Journal* 285:1465-1466.

Nieman, D.C. 1997. Immune response to heavy exertion. *Journal of Applied Physiology* 82(5):1385-1394.

Nieman, D.C. 2000. Exercise effects on systemic immunity. *Immunology and Cell Biology* 78:496-501.

Nieman, D.C., J.M. Davis, D.A. Henson, J. Walberg-Ranking, M. Shute, C.L. Dumke, A.C. Utter, D.M. Vinci, J.A. Carson, A. Brown, W.J. Lee, S.R. McAnulty, and L.S. McAnulty. 2003. Carbohydrate ingestion influences skeletal muscle cytokine mRNA and plasma cytokine levels after a 3-h run. *Journal of Applied Physiology* 94:1917-1925.

Nieman, D.C., D.A. Henson, O.R. Fagoaga, A.C. Utter, D.M. Vinci, J.M. Davis, and S.L. Nehlsen-Cannarella. 2002a. Change in salivary IgA following a competitive marathon race. *International Journal of Sports Medicine* 23:69-75.

(Continued on p7601)

LETTER FROM KENYA

This is the first of a planned series of "Letters From Kenya"
by Jason Karp who is currently living, coaching and training in Kenya.

BY JASON R. KARP, PHD, MBA

Dear Coach,

Hello from Kenya! I'm writing to you from Iten Club, a quaint café and restaurant just outside the gate of the famous High Altitude Training Center in Iten, Kenya. I just met with Emmanuel Kipruto, one of the many Kenyan runners; he has run 28:02 for 10K and 1:01:22 for half-marathon, both at altitude in Kenya.

"I ran 30 kilometers this morning," he said in his Kenyan accent, as we sat down at 10 a.m. at Iten Club for some Kenyan chai tea.

There are hundreds of runners here like Kipruto, all literally running for their lives, training to run fast enough to attract an agent or a manager to help them get sponsored to race in the U.S. and Europe so they can have a chance to earn some money and escape poverty.

To get faster and chase their dreams, the Kenyan runners have specific habits that can benefit your athletes. Here are five of them.

1. Train in a Group

Like a pack of wolves traversing the wilderness together, Kenyan runners train in groups. While pack life for wolves ensures the care and feeding of the young and enables them to defend their common territory, group running for Kenyans ensures competition to push the pace for the more seasoned runners, while providing careful training and motivation for the lower-level runners, who practice holding on to the group pace.

Have your athletes train in groups of runners of similar abilities, with one of the runners designated as the leader who controls the pace. In each of the groups, include one or two runners who are not quite as fast, who will be pushed by the faster runners and give them a goal to work toward.

2. Control the Pace

A senior member of the Kenyan running group dictates the pace of the run. No one is allowed to pick up the pace on his or her own. Everything is controlled.

This is a difficult concept for many U.S. runners to understand. When I was in college, there was a guy on the cross country team who always had to be in front. He would push

the pace all the time because he had to always finish each run ahead of everyone else. That's immature, and shows ignorance of how to train properly. Most runners run much faster than they need to meet the purpose of the workout. I have seen this countless times over my coaching career.

Your athletes shouldn't do workouts to practice running faster; they should do workouts to improve the physiological characteristics that will enable them to run faster in the future. To do that, they should run only as fast as they need to meet the purpose of the workout.

For example, if the purpose of an interval workout is to train VO_2max, your athletes should run at VO_2max pace, no faster. If an athlete's VO_2max pace is 6:00 per mile, he/she should run his/her reps at 6:00 pace, no faster. Running at 5:50 pace or 5:40 pace is not better than running at 6:00 pace when 6:00 pace achieves the purpose of the workout.

For a distance runner, it's better to run more volume (distance or time) at the correct pace than less volume at faster than the correct pace. So make workouts harder by adding more volume (more reps or longer reps) or less recovery time between reps.

When your athletes deeply understand the purpose of each run and each workout, it becomes easy to control the pace because that deep understanding governs the runner's actions. Ingrain that deep understanding in them. Like the Kenyans, coach your athletes to control the pace.

3. Run by Feel

Most of the Kenyan runners don't run with a GPS watch on their wrists; only the top runners can afford one. Instead, they run by feel. Every run, every fartlek, every interval workout not done on a track is done by feel. Through months and years of practice running with others in groups, the Kenyan runners have learned what different paces feel like, and they become masters of the pace and of the effort it takes to run a specific pace.

When your athletes become a master of the pace and of the effort, they become masters of themselves, and they won't make mistakes like starting every workout or every race too fast, only to slow down in the second half. Instead, they start at the pace they know they can hold the entire workout or race because they have become expert judges of the pace, and then are in a position to run faster toward the end. Tell your athletes to leave their GPS watches at home and coach them to run by feel.

4**. Run High Mileage**

Not only do the best Kenyan runners run high mileage; they all do. Most of the marathon runners run upwards of 115 miles per week, while the shorter distance runners run slightly less. Even the runner ranked 5,865th in Kenya runs high mileage. Running 100 miles per week is nothing special in Kenya. This training approach is in contrast to many U.S. high school and college cross country and track programs, which focus on speed work to prepare for many races throughout the school year. The Kenyans race infrequently, and instead focus on developing their aerobic systems to their highest potential through high mileage, running 11 times per week.

Although volume has a significant impact on nearly every runner's success, high school and college runners need to increase their mileage slowly and methodically, matching the training to what they can handle each year. Injuries like shin splints (medial tibial stress syndrome) and stress fractures are common among young runners, who are subjecting their bones to a new stress. From their current starting point, whether zero, 20, or 50 miles per week, slowly increase your athletes' mileage until it's time to back off to taper prior to the most important end-of-season races. Don't back off the mileage for every race every weekend; all that does is retard their aerobic development.

Don't feel pressure to rush into speed work because of a hectic race schedule that begins at the beginning of the school year and doesn't end until the end. Explain to your athletes the training process and the patience that goes into that process, and get them to buy into it. Although throwing many interval workouts and races at runners can improve fitness quickly, long-term progress should not be subordinated to short-term results.

In the developmental years, training intensity needs to be carefully controlled, with the major increase in training from year to year coming from volume, sprinkling in just enough intensity at the right times to get the job done and keep the athletes interested and motivated. The more aerobically fit runners are, the more they will ultimately get from their subsequent speed work. And since your athletes likely did not grow up walking and run-

ning to school like the Kenyan kids, they need to make up for lost time.

5. Run Fartleks

Every Thursday at 9 a.m. in Iten, about 200 Kenyan runners (and a few visiting Caucasian runners, referred to as *mzungu* by the locals) collect at a trailhead at the side of the road for the famous Iten Fartlek. It is a special event and impressive to watch. The fartlek is 5K to 10K on rolling dirt, rocky trails.

Jason Karp and friends.

A combination of two Swedish words that, when put together, translate to "speed-play," fartlek running dates back to 1937, when it was developed by Swedish coach Gösta Holmér, who used it as part of Sweden's military training. Many of the Kenyan runners in Iten don't have transportation or the financial means to use the few available tracks, so they rely on fartleks for their quality workouts. Fartleks allow your athletes to play with changes in speed and to have fun while doing quality workouts determined by effort.

The Iten Fartlek rotates three workouts: 5K to 10K of either alternating 1 minute fast/1 minute slow, 2 minutes fast/1 minute slow, or 3 minutes fast/1 minute slow, repeating those three workouts every three weeks. Some runners stop at 5K and then jog home, while senior members of the group make a right turn at the fork in the trail to extend the fartlek to 10K. The runners usually start the fartlek conservatively, with the second half of the workout run faster. The slow parts are run very slow, which enables them to run the fast parts fast.

Coach, I hope you'll find these tips useful so that your athletes can run like the Kenyans!

Mpaka wakati ujao (Until next time),
Coach Jason

Dr. Jason Karp is an American distance running coach living and coaching in Kenya. He is founder and CEO of the women's-specialty run coaching company Kyniska Running. The passion for running Jason found as a kid placed him on a yellow brick road that he still follows as a coach, exercise physiologist, speaker, and best-selling author of 12 books and more than 400 articles. He is the 2011 IDEA Personal Trainer of the Year and two-time recipient of the President's Council on Sports, Fitness & Nutrition Community Leadership award. His REVO$_2$LUTION RUNNING™ certification has been obtained by coaches and fitness professionals in 25 countries.

USATF COACHING EDUCATION

USATF CALENDAR OF SCHOOLS

https://www.usatf.org/programs/coaches/calendar-of-schools

Jan 7-10	Level 1 – Zoom #2022-1 (Central Time)
Jan 14-17	Level 1 – Zoom #2022-2 (Pacific Time)
Jan 21-24	Level 1 – Zoom #2022-3 (Central Time)
Jan 28-31	Level 1 – Zoom #2022-4 (Eastern Time)
Feb 4-7	Level 1 – Zoom #2022-5 (Pacific Time)
Feb 18-20*	Level 1 – Zoom #2022-7 (Eastern Time)
Feb 25-28	Level 1 – Zoom #2022-8 (Central Time)
March 4-7	Level 1 – Zoom #2022-9 (Mountain Time)
March 11-14	Level 1 – Zoom #2022-10 (Pacific Time)
March 18-20*	Level 1 – Zoom #2022-11 (Eastern Time)
March 25-28	Level 1 – Zoom #2022-12 (Pacific Time)

**Indicates Level 1 School offered in a special three-day format*

Watch the Calendar of Schools for preliminary information on the summer 2022 USATF Level 2 School and the popular USATF Cross Country Specialist Course.

USATF

BOBBY KERSEE NAMED 2021 USATF NIKE COACH OF THE YEAR

Bobby Kersee is the 2021 Nike Coach of the Year, earning recognition for the third time in his storied career.

Kersee, the 2005 and 2015 award winner, guided Sydney McLaughlin to two gold medals in Tokyo and a pair of world records this season in the women's 400m hurdles. Allyson Felix, who has been coached by Kersee since late 2004, took bronze in the 400m at Tokyo and joined with McLaughlin to help Team USATF to gold in the 4x400m relay to become the most decorated Olympic track and field athlete in American history.

McLaughlin joined Kersee's training group in the summer of 2020 and the change brought dramatic results. Undefeated this year in the 400H, McLaughlin set her first world record with a 51.90 at the Olympic Trials, beating Dalilah Muhammad, the former record-holder, by more than a half-second and taking .33 off her own lifetime best. At the Olympic Games, McLaughlin sliced even more off the WR,

stopping the clock at 51.46 to break the global record by the largest margin in almost 40 years. The 22-year-old also lowered her personal best in the 100H by more than half a second to 12.65.

The 35-year-old Felix ran her second-fastest time ever with a 49.46 to medal in the 400m, and she picked up her fourth 4x400m relay gold to bring her tally to 11 career medals at the Games to overtake Carl Lewis as the most bemedaled U.S. Olympic track and field athlete.

The Coach of the Year Award was established in 1998 to recognize the outstanding achievements by coaches in our sport.

2021 USATF COACHING EDUCATION AWARDS

Joe Vigil Sports Science Award: Denise Wood, Ed.D, Huntington University of Health Sciences

This award recognizes a coach who is very active in the area of scholarship, and contributes to the coaching literature through presentations and publications. This award identifies a coach who utilizes scientific techniques as an integral part of his/her coaching methods, or has created innovative ways to use sport science.

Ron Buss Service Award: Andrew Allden, University of South Carolina

This award recognizes a coach that has a distinguished record of service to the profession in leadership roles, teaching, strengthening curricula and advising and mentoring coaches. This person is a leader, whose counsel others seek, and who selflessly gives his/her time and talent.
Fred Wilt/Educator of the Year Award: Richie Mercado, St. Johns School
This award recognizes a coach that has a distinguished record, which includes sustained, exceptional performance. This award is presented annually to recognize one individual who has exemplified passion and leadership nationally for the promotion of USATF Coaching Education.

Vern Gambetta/Young Professional Award: Joel Pearson, University of Arkansas-Little Rock

This award recognizes a young coach in the first 10 years of his/her career that has shown an exceptional level of passion and initiative in Coaching Education. This award is presented annually to recognize one individual who has exemplified passion and leadership nationally for the promotion of USATF Coaching Education.

Terry Crawford/Distinguished Female in Coaching Award: Kathy Butler, Run Boulder AC

This award recognizes a female coach that has shown an exceptional level of accomplishment, passion and initiative in Coaching Education. This award is presented annually to recognize one female coach who has exemplified passion and leadership nationally for the promotion of USATF Coaching Education.

Kevin McGill/Legacy Award: Terry Crawford, USATF Director of Coaching (retired)

This award recognizes a veteran coach with 25+ years of involvement that has shown an exceptional level of passion an initiative in Coaching Education. This award is presented annually to recognize one individual who has exemplified passion and leadership nationally for the promotion of USATF Coaching Education.

Level 2 Coaches/Rising Star Award: Shareese Hicks, University of Texas Rio Grande Valley

This award recognizes a coach that has utilized the USATF level 2 CE program to make an impact on their coaching that includes sustained, exceptional performance. This award is presented annually to recognize one individual who has recently completed the level 2 school and it has helped to make an impact on their coaching. This award winner exemplifies the impact of the USATF Coaching Education program.

USATF COACHING EDUCATION INSTRUCTOR SPOTLIGHT

An interview with Kathy Butler, OLY, Chair, USATF Coaching Education Committee

Kathy Butler is a two-time Olympian (1996, 5000m, Canada and 2004, 10,000m, Great Britain), multiple World Cross Country Championship medalist, and five-time NCAA Champion at the University of Wisconsin. Butler served as the Women's Coach at the 2019 Great Stirling Cross Country for Team USATF, is a USATF Level 1 and 2 instructor and holds a USATF Level 3/World Athletics Academy certificate in Endurance. Butler was awarded the 2017 USATF Level 2 Coaches / Rising Star and 2021 USATF Terry Crawford/Distinguished Female in Coaching Awards.

MR: You have been involved with USATF for a number of years through coaching education and various committees. How did you get started and what interested you in USA Track & Field?

KB: I had been coaching for a while, but was interested in continuing to improve so I started with a Level 1 in Denver. Having former Wisconsin teammate Jeremy Fisher on the staff was extra incentive to catch up with him. I quickly went on to take Level 2 Endurance the next summer and managed to have a quick chat with Terry Crawford in between lectures. She encouraged me to get more involved with the Colorado Association and to look at taking the Instructor Training Course. Between her encouragement and the rapport of Dave Mills, Troy Engle and Mike Smith as instructors I wanted to stay as involved and learn as much as I could.

MR: You just completed your first year as Chair of the USATF Coaching Education Committee. What are some of the highlights from the past year and what is the committee looking forward to in 2022?

KB: A big highlight for this year has been seeing everyone come together and work so well. The executive committee has a varied and diverse background resulting in some great opinions and expertise. I'm really excited to start to see the results of lots of hard work in 2022, hopefully returning to some in-person courses, new courses and improving our live zoom options, watch this space!!!

MR: Despite having competed at the highest levels of the sport, and training under UW and USTFCCCA Hall of Fame Coach Peter Tegen, and former World Marathon record holder Steve Jones, you have placed a great emphasis on coaching education. What inspired you and how did coaching education help your transition from elite athlete to coach?

KB: I have a science background with a double major in Kinesiology (Exercise Physiology) and Biology, so I've always enjoyed the scientific approach. I like reading new research studies that are relevant to coaching and running which means that continuing to learn as much about coaching as I could was a

priority for me. I started coaching while I was still an elite athlete and it was something I always wanted to do. Seeing athletes progress is even more rewarding than when I was an athlete and often, I get just as nervous for them as I did myself!

MR: You have been a Division I volunteer coach and coached state champions at Nederland High School, numerous U.S. Olympic Marathon Trials qualifiers through Run Boulder AC and served as a USATF international team coach. How have these experiences molded you as a coach and your definition of success?

KB: I love the puzzles of coaching. Figuring out what makes a person perform at their best, this could be a great training plan, fitting together their life with their sport, but it is also finding out their "why". At all levels there are many different kinds of "why" and if you know that you know what success is for the athlete. If the athlete is successful, then I feel successful. It is cliché now to say that it is about the process, but with a coach-athlete relationship this is so true. Success could be taking an athlete who hasn't been healthy for years before they work with you and getting them to a start line, it could be developing a love for running that lasts a lifetime or it could be Olympic finals.

MR: And lastly, what is your favorite USATF course to instruct and why?

KB: The Level 2 endurance is my favorite. There are so many chances to truly get to know the students and everyone is so interesting. When we are in-person one of my favorite things is the walk to the dining hall and meal times chatting with students, fellow instructors and of course you Matt!

MR: Thank you Kathy. You're too kind. I appreciate you being a part of our first instructor profile and giving our readers some insight into your career and passion for not only the sport, but coaching education.

VERIFY YOUR STANDING ON THE USATF COACHES REGISTRY FOR THE NEW YEAR

USATF members are encouraged to start 2022 off by verifying their compliance with USATF Coaches Registry requirements. Don't be caught off-guard at 2022 USATF Championships with a lapsed requirement. Members must be current with all USATF Coaches Registry requirements to receive a coach credential at USATF Championships. Members may verify their status by querying the public list with their name. Members' whose name is not listed on the public Coaches Registry List should login to their membership profile on USATF Connect. A green, current status must be displayed under each individual requirement (Membership, Center for SafeSport Training, Background Screening and Coach Certifications). All requirements must be current through the last date of competition to qualify for a registered coach credential. In addition, members must be listed on the club profile and/or designated by declared athlete during the specified USATF Championship. Please be advised US Center for SafeSport Training is now an every 365-day requirement and NCSI background screens are valid for two years from date of acceptance.

If you have not logged into your membership profile since USATF Connect launched (May 2020), you must first recover your account (click Recover Account button) on the login page to begin the process.

Public Coaches Registry List

https://usatf.sport80.com/public/widget/3

USATF.ORG

TRACK & FIELD NEWS

www.trackandfieldnews.com

SERVING THE TRACK & FIELD

COMMUNITY SINCE 1948

TRACK & FIELD NEWS

T&FN is the standard of accuracy and completeness for reporting of U.S. and worldwide track and field athletics. Published monthly. Call 1-800-GET-TRAK (1-800-438-8725) to subscribe or subscribe online: www.trackandfieldnews.com/subscribe.

Annual Subscription Rates:	USA	Canada	Foreign
Digital only	$79	$79	$79
Print only	$79	$127	$177
Digital + Print	$109	$157	$207
Premium Archive Digital Only	$128	$128	$128
Premium Archive Digital + Print	$158	$206	$256

Print subscriptions include 12 monthly print issues. Etrack weekly results newsletter is included with all digital subscriptions.

TRACK COACH (Digital Only) *1 yr subscription — $19.95*

The official technical quarterly of USA Track & Field, *Track Coach* (formerly *Track Technique*) has been the sport's major technical publication since 1960. TC became a digital-only publication in January 2015.

TOURS

Popular sports tours since 1952. Write for information about tours to the Olympics, Olympic Trials, World Championships, etc.

TRACK & FIELD NEWS
2570 W. El Camino Real • Suite 220 • Mountain View, CA 94040 • USA
Phone (650) 948-8188 • Fax (650) 948-9445
http://www.trackandfieldnews.com • email: subs@trackandfieldnews.com