PATIENT CORNER

Patient perspective: Lessons doctors can learn from coaches and athletes to improve patient outcomes using digital technologies

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Athletes and coaches have been incorporating digital technologies to collect data to improve athletic performance for many years. Innovation in mobile apps, wearable devices, and sensors has converged to provide a technology ecosystem that produces predictive health insights for improving athletic performance. Digital technologies allow for the application of metrics to measure an athlete’s physical performance, physiological status, and biochemical composition. These insights are used to reduce the risks of overtraining injuries and enable coaches to develop precision athlete-centered training programs. It is essential to understand the roles of both the coach and the athlete and how they work together to set goals, align expectations, and measure performance success.

I was 6 years old when I started playing sports at a competitive level. I started with swimming and added soccer, tennis, high school track, and cross country running over the years, eventually competing at elite levels in World Cup Windsurfing events, ultimately making the USA National Freestyle Skiing team. I had been an athlete long before I was diagnosed with irregular junctional tachycardia (Figure 1) and elected to have an electrode catheter ablation of the atrioventricular junction rather than continue drug therapy in 1983 (I am patient #1 in the paper by Ruder and colleagues2). Based on my history as an athlete, I intuitively applied goal setting and developing a training program to improve my performance to my approach of recovery from my many heart procedures and surgeries. My experience using digital tools to collect data to improve performance and monitor my heart began in 1998 with a Polar Heart Rate monitor and cycling computer. I was able to identify anomalies in pacemaker function and heart rate both during and after exercise. Initially, my physicians did not think I could interpret the data from the device in this way. So we replicated the scenarios in the lab and confirmed the results. The study paper “Comparison of Polar 810s and an ambulatory ECG system for RR interval measurement during progressive exercise,” published in 2005,3 provided validation that digital tools athletes used to collaborate with coaches could be helpful in a healthcare setting.

As a heart patient and athlete, I saw many opportunities to use data to collaborate with my doctors the same way that I worked with my sports coaches. However, traditional healthcare systems have not made it easy to adopt patient-generated solutions and consumer wearables in a meaningful way. This lack of industry adoption has not stopped many heart patients from creating their digital disease management solutions. Today there are sophisticated devices and mobile apps that deliver detailed data insights to the athlete and coach. These tools help create a personalized experience for the athlete in a scalable and cost-effective way for the coach. Access to data to develop custom training programs and metrics to measure performance improvement has proven to be the key to accomplishing my goals. After almost 40 years of using these methods with outstanding results, my goals as an athlete are not limited by my heart condition (Figures 2–5d).

When doctors think like coaches: Athlete-centered outcomes reimagined as patient-centered outcomes

The goals and measures of quality coaching are how well the athlete develops and performs—that is, athlete-centered outcomes. Quality coaching leads to more than just capable participants and competitors: Quality coaching is driven by a quest for holistic athlete development, making better people while also making better athletes. These desired athlete outcomes generally fit into 4 areas, referred to as the Four C’s of athlete development:

1. **Competence**: sport-specific technical, tactical, and performance skills; improved health and fitness; and healthy training habits
2. **Confidence**: self-belief, resilience, mental toughness, and sense of positive self-worth
3. **Connection**: positive bonds and social relationships with people inside and outside of sport
4. **Character**: respect for the sport, ethical and morally responsible behavior, integrity, and empathy

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Figure 1  The 12-lead electrocardiogram and rhythm strip (lead II) during tachycardia for patient 1. The tachycardia is irregular (rate averages 160 beats/min), with rate-related aberrancy, atrioventricular dissociation, and captured complexes. Rhythm strips during tachycardia were diagnosed as bouts of atrial fibrillation or multifocal atrial tachycardia.

Figure 2  Strava dashboard.
Figure 3  Strava metrics.

Heidi Dohse  
Date of Birth: Jan 23, 1964 (Age 57)  
Recorded on Aug 11, 2020 at 9:48 PM

Heart Rate Over 120 — 160 BPM  
Average
This ECG was not checked for AFib because your heart rate was over 120 BPM.
If you repeatedly get this result, or you're not feeling well, you should talk to your doctor.

Figure 4  Apple Watch electrocardiogram (ECG): during workout.
In my experience, the coach and athlete relationship typically begins with a question: *What is your goal?* Once the athlete has stated their vision, the coach probes to learn more about where the athlete is currently to determine the scope of the training plan to co-develop with the athlete. The coach guides and provides knowledge and wisdom to the athlete to facilitate setting realistic milestones as they work together to reach the goal. In collaboration, they agree on how to measure success and what metrics to use. The coach supports the athlete on their journey, but the coach can’t do the work. Only the individual can put in the training to reap the rewards. Successful working relationships are

![Figure 5](image)

**Figure 5**  Garmin Mobile App. **a:** Heart rate, 12-month trend. **b:** Pulse oximetry. **c, d:** Training trends: VO2 max (c) and load (d).

Figure 6  Exercise improves cardiovascular health by inducing changes in oxygen delivery, vasculature, peripheral tissues, and inflammation. **A:** Exercise improves oxygen delivery throughout the body through the promotion of vasodilation and angiogenesis. **B:** Exercise increases mitochondrial biogenesis in adipocytes, skeletal muscle myotubes, and cardiomyocytes. **C:** Exercise causes a long-term anti-inflammatory effect (which is inversely related to the increased inflammation typically seen in cardiovascular disease and obesity. Myokines released from skeletal muscle during physical exercise partially mediate these anti-inflammatory effects, and promote inter-tissue cross-talk to mediate further cardiovascular benefits.5
built on communication, listening, trust, and respect. Imagine if the healthcare system was designed to engage patients in this way and enable physicians to approach relationships similarly.

Heart patients as athletes: Exercise training improves cardiovascular health
Cardiovascular disease (CVD) is the leading cause of death in the United States and is responsible for 17% of national health expenditures. As the population ages, these costs are expected to increase substantially. By 2030, it is estimated that >40% of US adults, or 116 million people, will have 1 or more forms of CVD. Recent studies using the Coronary Heart Disease Policy Model forecast that current overweight adolescents will increase future adult obesity by 5%–15% by 2035, resulting in >100,000 excess prevalent cases of CHD.

The expected increase in younger people living with CVD highlights the need to transform how we motivate patients to own their outcomes and “think like an athlete.” A person diagnosed with CVD frequently reduces their activity owing to fear and the uncertainty of their physical capabilities. The concern for becoming sedentary for long periods is more significant for patients recovering from a cardiovascular procedure or surgery. The results can become a vicious circle of the
diagnosis or treatment, causing severe heart issues through lack of activity based on fear. Several risk factors lead to the development and progression of CVD, but one of the most prominent is a sedentary lifestyle. A sedentary lifestyle can be characterized by both obesity and consistently low levels of physical activity. Thus, lifestyle interventions that aim to increase physical activity and decrease obesity are attractive therapeutic methods to combat most noncongenital types of CVD. Exercise is also an essential treatment for patients with CVD, further demonstrating exercise’s protective and medicinal properties. In patients with CVD, exercise improved endothelium-dependent vasodilatation, increased ejection fraction and exercise tolerance, improved quality of life, and reduced CVD-related mortality. A greater appreciation and understanding of the specific and quantifiable benefits of exercise on cardiac structure and function has emerged over the last decade. Physical activity and reversal of sedentary behavior clearly benefit mortality risk, attributable primarily to reducing death from CVD. Much of the work in this area has focused on the adaptations of the heart to exercise training (Figure 6).

Conclusion
The merger of best practices from multiple disciplines and a willingness to think outside the traditional healthcare system will facilitate innovation and improved patient experiences. When I coach people with heart issues, the goal most often stated is “the desire to engage in a lifestyle they are excited to wake up to each day.” The training plan covers the journey from being a fearful heart patient to their vision of a happy person not limited in how big they can dream (Figure 7). Successful outcomes include empowering the individual to have the information and insights they need based on where they are in their program. Like an athlete training for a new sport, they just need to learn the basic mechanics when they begin. As they master each task and reach milestones, the coach provides the next level of information. The process is repeated until the athlete has achieved their goal level in that sport. When doctors think like coaches and treat people as more than patients, they can provide guidance on the use of digital health tools and inspire patients to choose to improve their health, wellness, and outcomes.

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