The medical community is in the midst of transformational change that is driven by health care reform. The cost of medicine is drowning our economy and requires a solution that will reduce the rising costs of health care. The need to create a system of medicine that creates value innovation (lower cost and higher quality) in medicine is needed. We believe a large part of fulfilling this paradigm is to transform medicine from a disease-oriented, reactive system of patient care, toward a wellness-oriented proactive approach. The Patient Protection and Affordable Care Act of 2010 (i.e., the health care reform law) further facilitates this transition by promoting care coordination and performance-based payments through the use of accountable care organizations (ACO). ACOs will require not only a systems-based approach to care coordination throughout different health care systems and medical specialties, but it will also require individuals in the community to actively participate in the health care system. By systems-based approach, we mean an approach that explores and identifies the basic structure and dynamic network properties that occur at systems levels (individual, community, national, and global). From a systems perspective, phenotypic (i.e., what an organism looks like as a result of genotype and environment) elements leading to individual health are the product of genes, environment, behavior, and physical make-up. Successful implementation of the ACO model will necessitate a shift in medicine that is not only cost effective, but also demonstrates quality improvement to the prevention and management of disease.

As we will demonstrate in the following pages, it is our belief that these trends are relevant to, and hold much promise for, sports medicine clinicians of all backgrounds, including athletic trainers and therapists. One concept we think is especially relevant is P4 medicine, which is aimed at creating organizational environments to improve the entire health care system community, based on the four Ps of P4 medicine: predictive, preventive, personalized, and participatory.

What Is P4 Medicine?

Dr. Leroy Hood initially coined the phrase *P4 medicine* in 2004 to describe a systems medicine approach toward prevention of disease.¹ The foundation of P4 medicine is a systems/biology/medicine approach that combines genetic markers, environmental information, behavioral systems, and physical components to create a strategic plan of health for each person. In this way, P4 medicine combines personalized and population-focused medicine to create a systematic approach to the promotion of disease treatment and wellness that brings the right treatment to the right patient at the
right time throughout the health care system. A good analogy that justifies a systems approach to medicine is the saying, “one cannot study the forests simply by evaluating the trees individually.” In sports medicine, the absences of a systems approach would be studying an ankle sprain solely by focusing on each individual component (e.g., amount of inflammation, ligamentous tissue damage, and degree of laxity) as opposed to evaluating the entire system (e.g., disability implications, functional performance capabilities, and athletic task demands). Simply focusing on each individual component will aid the clinician in identifying critical factors to address in rehabilitation, but it does not account for the health and wellness of the entire individual suffering with the ankle sprain (e.g., cardiovascular fitness, socio-emotional team connection, financial incentive loss). We identify and explain each of the four Ps in the following paragraphs.

**Predictive Medicine**

Omniscience would be an ideal skill for a sports medicine clinician. Unfortunately, that skill is not humanly possible; however, predictive medicine aims to assist clinicians in their ability to predict those at-risk for disease and injury. Advances in genomics, molecular biomarkers, and diagnostic tools allow clinicians to more accurately determine individual responses to disease treatments, which allow for tailored approaches per individual for optimal intervention. Using sports-related concussion as an example of predictive medicine, advances in genetic marker analysis have demonstrated some evidence of apolipoprotein alleles, acting as possible markers for concussion occurrence or factors predictive of delayed recovery due to a concussive episode. Future research may bring the day when the probability of a concussion, or the likelihood of recovery following a concussion, can be predicted through a genetic marker test for a given athlete.

**Preventive Medicine**

Preventive medicine is about developing health-management tools and therapies to proactively avert disease before it occurs. Consider the prevention possibilities for a traumatic musculoskeletal problem such as anterior cruciate ligament injury (ACL). Numerous studies report a significant difference in the rates of adolescent female ACL injuries compared to their male counterparts, yet efforts are underway to reduce this female biased injury. Numerous preventative medicine efforts are aimed at identifying injury prevention programs that can help to mitigate this problem. Future prevention approaches utilizing predictive tools (such as family heritability, genetic signatures, and personalized movement pattern assessments) will change the programs from generalized whole group activities to targeted prevention programs specific to each individual’s unique ACL injury risk characteristics.

**Personalized Medicine**

Current approaches to preventative medicine focus on each individual patient’s responses to drug and other forms of therapies. Personalized medicine requires that all information about the individual’s genetic profile, behavioral responses, environment influences, and physical abilities be captured, as they are all paramount to providing personalized care. Consider a recreational adult runner suffering from low back pain. Personalized evaluation of spine mobility, pain level, and muscle activation patterns is the typical approach to assessment and the development of an individual treatment plan. Further consideration of previous history of low back pain is also considered a gold standard factor for evaluation of low back pain occurrence. Personalized medicine reminds us that clinicians must also consider genetic heritability and environmental factors as a standard component of their evaluation. Williams et al. have shown a potential genetic heritable link to lumbar disc degeneration, meanwhile El-Metwally et al. and Dai et al. have shown a stronger correlation to environmental influences for low back pain and surgical outcomes. Personalized medicine is more than an individualized treatment approach per patient. Instead, it should utilize various methodological approaches to assess the cause of the injury/illness and then identify personalized, focused treatments based on information that is specific to each individual patient.

**Participatory Medicine**

Efforts to transform passive patients into informed, engaged consumers, who take ownership of their health and work with medical providers to actively plan, manage, and achieve their health objectives, are at the heart of participatory medicine. By harnessing the power of information, social networking, and the