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**Original Article**

# Exploring the integration of medicine and sport at macro-, meso-, and microlevels of development for high athletic performance and lifelong public health with reference to practices at the University of Northern Iowa

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**Abstract**
This study analyzes the progressive practices at University of Northern Iowa (UNI) against a global sport development model for high performance integrated with healthy lifelong mass participation. The model's macro-level embraces elements of socioeconomic, cultural, legislative, and organizational support for a sport system by all possible public and private partners and stakeholders. The meso-level includes infrastructure, personnel, and services enabling sport programs, and the micro-level consists of operations, processes, and methodologies for development of individual athletes. The innovative macro-level UNI partnerships mobilized and integrated financial and human resources of private healthcare and public education systems. This includes voluntary community resources in the state of Iowa, creating a meso-level facility, event and educational infrastructures, as well as unique job positions servicing both recovering hospital patients and high performance (HP) athletes competing for Division I National Collegiate Athletic Association (NCAA). At the micro-level, the world's best methods of clinical rehabilitation and HP science utilize natural outdoor environments, water, gym apparatus, including mobile fitness equipment, and partner resistance for a holistic fitness program with maximum variety and efficient compounded exercises. The holistic fitness program, individualized through isokinetic testing, serves the following purpose: injury prevention; accurate determination of return to play for HP athletes and hospital patients; monitoring athlete and patient progress utilizing strength benchmarks and highlighting strength standards; accurate evaluation of strength and conditioning programming to identify best practices; and the creative integration of strength and conditioning staff and their innovations to benefit the well-being and success of athletes, hospital patients, and the community.
**Key Words: integration, public health, sport performance, university.**

## Introduction

Mutual benefits of sport and medicine have been utilized from ancient times. At the macro-level, as part of strategies by national governments and large organizations; at the meso-level as part of physical infrastructures and intellectual services provided to hospitals and sport facilities; and at the micro-level as part of programs for medical patients, athletes, and military personnel (Malcolm, 2006; Smolianov & Zakus, 2009). The current global health issues related to inactivity are solved through sport and growing number of doctors across the world prescribe exercise as medicine (Berryman, 2010; Eijsvogels & Thompson, 2015; Pedersen & Saltin, 2015; Thompson et al., 2020). Examples of progressive integration practices that have been increasingly demonstrated are resistance training interventions in Parkinson's Disease patients to improve quality of life, exercise prescription to youth and adolescence to improve physical, cognitive, and psychosocial performance (Alvarez-Pitti et al., 2020), and moderate intensity exercise of any type can contribute to reduction of signs and symptoms of a non-alcoholic fatty liver (Thorp & Stine, 2020). Additionally, hypnosis has been used in mainstream medicine since the 18th century: as an alternative to anesthetic and to aid in treatment for psychiatric illnesses (Upshaw, 2006). The use of hypnosis for Australian, US, and Russian athletes dates to the 1950's. (Kornspan, 2012). Investigations into mental health literacy, including the examination of mental health disorders of elite athletes, are currently underway between sport psychology and clinical psychology experts (Gorczynski et al., 2020). This partnership with the medical establishment seeks to identify strategies and best practices across multiple levels of organized sport and ultimately generalizing to the physically active and achievement-minded populace.


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**Theoretical Framework and Methods**

This research study examines medical aspects related to structures, processes, and practices leading to demonstrated effectiveness and efficiency in the analyzed sport system. There is a particular emphasis on practices that can be used in any socio-economic conditions, following the key parameters used by comparative international sport studies at the macro-, meso-, and micro-levels outlined in the abstract and detailed further. There is no perfect model for international comparative sport analysis, even focusing on the HP sport, which has received significant research attention in attempts to assist elite sport teams achieve success effectively and efficiently (De Bosscher et al, 2010; Hiemstra et al, 2004). However, there have been recent attempts by a number of researchers in the field (Baumann, 2002; Green & Oakley, 2001; Houlihan & Green, 2016; Platonov, 2010; Ridpath & Farrey, 2018; Smith & Smolianov, 2016). Most comparative sport models focus on descriptive explanations of the selected ingredients contributing to successful performances and validated through case studies of countries that have demonstrated international sporting success. HP sport systems are dynamic, complex, and varied in design due to the fast-changing sport practices and the cultural and political environments which should be considered in a comparative research study (De Bosscher et al, 2010; Diegel, 2002).

There is also agreement among authors Bravo et al. (2012), De Bosscher et al. (2006), Digel (2005), Fetisov (2005), Platonov (2010) Smolianov and Zakus (2009) that mass sport participation and elite athletic performance should be organized systematically to support each other. This process of developing participants from recreation to HP involves macro-, meso-, and micro-levels of policy and support, all considered in this research, are adapted from scholars who focused on sport policy analysis (Gilbert, 1980). They referred to the macro-level as the social and cultural context (including consideration for GDP, population, and state-society relationship); the meso-level focused on sport policies; and the micro-level related to the individual athletes and their close environment. The model was used for an international comparison of the sports policy factors leading to international sporting success in 15 nations (De Bosscher et al., 2015). Unfortunately, it was critiqued for lack of qualitative analysis and debatable use of variables, which assumed similarities of cases and overlooked fundamental differences that may exist within sporting systems (Henry et al., 2020).

The current study's theoretical framework also incorporates models of sport development. One model defined the macro-level as socio-economic, cultural, legislative, and organizational support for a national sport system by the whole society and the state (Smolianov, Zakus, 2008). The meso-level included infrastructures, personnel, and services enabling sport programs; and the micro-level consisted of operations, processes, and methodologies for development of individual athletes. This model was used to evaluate and advance both mass and elite parts of sport systems in the USA (Smolianov et al., 2016), the Netherlands (de Zeeuw et.al, 2017), Russia (Smolianov et al., 2014), Nigeria (Kaka'an et al., 2018), and Zambia (Smolianov & Musunsa, 2018). The Zambian study assisted the country's Ministry of Youth, Sport, and Child Development with a systematic national sport development plan. In the US, the research results published in Managing Sport and Leisure International Journal were used by USA Rugby to develop a multi-million dollar plan that helped to bring rugby back to the Olympics and recognize USA Rugby as an official National Governing Body under the United States Olympic & Paralympic Committee (USOPC).

King (2009), whose concept was also used in this study's model, examined policies and governance in local communities at the "macro- and meso-" levels of sport development: such macro-level influences on policy as public attitudes towards sport, health, and education policy communities and central government, and meso-level relationships and resources for organizations in the local sport networks. Similarly, Banjade et al. (2007) conceptualized governance in the management of commons by identifying macro-level as national policies, meso-level as institutions and processes shaping the social and environmental outcomes, and micro-level as community user groups. The theoretical frameworks used by Rad et al. (2014) and Wicker et al.(2012) are based on the concept of sport participation as influenced by internal or micro-factors (associated with individual such as available time, income, ethnicity, gender) and external or macro-factors (sport spaces, parks, gyms, and programs). We used this concept to define our model's macro- (external) and micro- (internal) levels.

Our research also integrated Al Mofarreh's (2016) definitions of the three levels: macro- (governmental), meso- (school), and micro- (teachers, students, and administrators). Reflecting the variations in the use and application of the three levels, Johnson (2013) investigated only two levels of policy influence on science education reform: macro-level (federal and state) policies, which result in the creation of micro-level (district and school) policies. Similarly, Barasa et al. (2015) attempted to set healthcare priorities at the macro- (national) and meso- (decentralized health systems and health facilities) levels. In other socio-economic fields, Dunlap et al. (2010) investigated the impact of macro-level social forces, such as economic trends, employment, housing, homelessness, and effectiveness of public education on micro-level consequences such as poverty, alternate occupations, and drug dealing. Bergström and Dekker (2014) studied human resilience in the context of inter-connected health and social systems, and referred to the macro-level as societal, meso-level as organizational, and micro-level as related to processes and individual action. This perspective is also incorporated in the theoretical framework of the current study.

Our framework borrowed from business researchers Kim et al. (2016) who analyzed entrepreneurship mechanisms embedded within complex social structures through macro-institutional and micro-individual characteristics as well as meso-level social structures. At these intermediate levels, social groups, associations, and other collectives operate between the two ends of the institutional spectrum. This is based on a concept from five other studies, which linked country-level (macro) characteristics with individual-level (micro) outcomes of entrepreneurial actions. Jeurissen (1997) studied business ethics at macro-level institutions, the market, government, cultural traditions, etc.; meso-level of the organization, its structure and culture; and the micro-level of the individual in the organization. As all known comparative models have strengths and limitations while serving various research purposes, the authors of this study combined the above described models to develop a new hybrid for better understanding and comparison in elite athlete education. The new proposed model attempts to provide a balanced, even focus among the macro-, meso-, and micro-levels. The De Bosscher et al. (2015) model focuses on the meso-level, but most sport organizations aim to develop participants at the micro-level. Sotiriadou and De Bosscher (2013) stressed that in order for athletes to thrive, managers, coaches, and sport scientists should work together, and that more multidisciplinary synergies in HP sport and supporting research are needed if we are to reach solutions based on a new understanding of complex situations. This is particularly important for our research of integrated medical and sport structures and practices connected and depended on systems of education, healthcare, and community services. Following the recommendations by Sotiriadou and De Bosscher (2013), the current study is analyzing the useful experiences of integrating medicine and sport from the athlete perspective of our comparative model. As mentioned, our model stresses interconnections among the levels, such as macro-level policies used to impact healthy behaviors through regulations of advertising and marketing, school provisions, retail offerings, and taxes and levies (Swinburn, 2008), which directly and indirectly influence sport development at meso- and micro-levels. When the performance and health of athletes and general population are advanced in integration, this can ultimately help reach goals of many supporting agencies and contribute to macro-level socio-economic success. Good national health and fitness increases general effectiveness and productivity, with positive results for social capital, community development, and commercial objectives, as well as success in mass and elite competitions.

HP elements overlap at different levels (De Bosscher, 2006). The interdependency, magnitude, and hierarchical relationship of sport and society are expressed by the positions and sizes of the circles of our theoretical model depicted in Figure 1. The model's macro-level refers to socio-economic relationships and support from all possible collaborates contributing to sport and healthcare development. Meso-level refers to infrastructures, while micro-level refers to operations and processes related to individuals. The micro-level requires identifying talent and gradually developing participants into high performers who should be trained and educated for long, healthy athletic careers and productive lives after elite competition contributing to health and wellness of general population (Eganov et al., 2021; Fyodorov et al., 2019). The hierarchical pools of HP athletes demand access to sophisticated and scientifically based multidisciplinary performance, career, and lifestyle support, including medical, anthropometric, prophylactic, and holistic fitness services in addition to education that build upon sport skills and allow athletes to give back to community after their formal sport career is over. Effective functioning of the micro-level requires policies on such meso-level infrastructure to be easily accessible with conveniently connected facilities as well as coaching and medical services specific to each age and level of participation (Park et al., 2020). A key meso-level policy area relates to a system of incrementally intensified competitions to seamlessly prepare athletes for major events under nurturing medical testing and supervision. Our theoretical model also implies that policies and practices related to education, scientific, medical, philosophical, and promotional support of sport programs are developed at each level of participation.

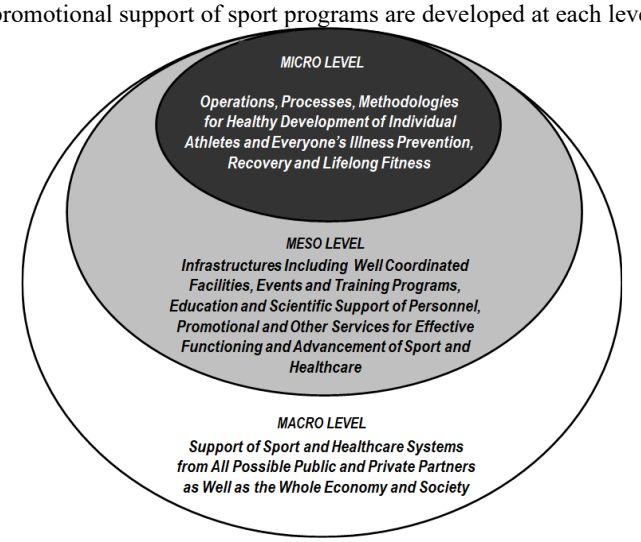


Figure 1. Proposed model for analysis of integrated sport and medicine

Effective meso-level infrastructures result from multiple partnerships in order to obtain sufficient resources, exchange expertise, and achieve common goals to influence the environment of mass and elite sport and health, particularly mass media, sponsorship from businesses, as well as direct and indirect support from the state or government and from overall society. For an efficient, long-term functioning of all these elements, funding, and structures of mass and elite sport and healthcare systems must be balanced and integrated. This relies on legislative, ideological, and government inputs (Dolmatova et al., 2020).

Successful sport and healthcare systems receive significant macro-level social support for effective meso-level programs and facilities for the general public and for HP athletes. These are developed through integration of national, regional and local healthcare services of government and private providers, the Olympic Committees, National Governing Bodies (NGBs), training centers, clubs, and communities. Other needs include:

- PE, sport, and healthcare integrated at childcare facilities, schools, and universities,
- a pyramidal system of sport clubs for each participation level with a dual goal of maximizing healthy participation and developing excellence,
- progressive participant and coach rewards for healthy fitness and elite performance,
- a high number of dedicated professional coaches who are well-trained in health at all levels, and
- subsidies and incentives for health-oriented recreational and elite sport ensuring diversity and access to a full spectrum of sport activities prioritized by health benefits funded for both recreation and excellence in all appropriate age groups at meso- and micro-levels.

The above summary of the theoretical model developed for this study is based on the desired three level practices exemplified by a number of researchers (De Bosscher et al., 2010; Gilbert, 1980; Matveev, 2008; Pedersen & Saltin, 2015; Putney, 2020; Ridpath, Smolianov, Komova, et al., 2019; Riordan, 1978; 1980; Shneidman, 1979; Smolianov, Bravo, Vozniak, Komova, 2014; To, Smolianov, Semotiuk, 2013). It reflects international best practices of systematic sport development and its integration with medicine. Taking into account suggestions by Henry et al. (2020) about usefulness of research methods driven by qualitative approaches in analyzing complex sport systems, this study qualitatively investigates the integration of sport and health services at University of Northern Iowa using the developed conceptual framework for the identification of practices in a systematic and actionable way thereby validating, specifying and advancing the developed theoretical construct. The study method was used to detail the unique practical approach with the needed depth as well as to describe the broad environment and influencing conditions, therefore trying to understand the important factors underpinning this exemplar.

**Discussion - Micro-level**

UNI conducted the following analysis looking for optimal tests of fitness and health before choosing the isokinetic testing method. Evolutions in the sports sciences and greater financial incentives have created more physically advanced athletes with increasingly optimized physical morphology, trending towards heavier and taller athletes (Norton & Olds, 2001). Injury rates have amplified as well, such as knees, ankles, hamstrings, shoulders, and the head injuries in football (Lawrence et al., 2016); knee injuries (Agel et al., 2016; de Loes et al., 2000), shoulder injuries in many sports (Mannava, Frangiamore, Murphy, et al. 2018), and particularly spinal disorders which are also common for general population (Nourbakhsh & Arab, 2002; Okada et al., 2007; Tumanian, 2006; Van Hilst et al., 2015).

During the 2009-10 through 2013-14 academic years, The National Collegiate Athletic Association Injury Surveillance Program (NCAA-ISP) reported 1,053,370 injuries were estimated to have occurred during an estimated 176.7 million athlete-exposures to potential injury (i.e., one athlete's participation in one competition or one practice (Kerr et al., 2015). One of the most well-known assessments is the Functional Movement Screen (FMS) (Chang, Hsueh, Lo, 2018). The testing involves a subjective interpretation by the tester of seven different bodyweight exercises or movements. Although widely used, the subjective nature of the test leaves results open to interpretation of the tester. The test can over utilize resources by placing staff members into corrective exercise routines while not preventing injury, in turn yielding valuable developmental time of the athlete practicing movements not guaranteed to better athletic performance or reduce the athlete's risk of injury (Warren et al., 2018).

Other less known tests, the Star Excursion Balance Test (SEBT) and the Y-Balance Test assess single leg balance while reaching with the non-support leg to point in different directions. The overall reliability of these two tests are improved over the FMS, due to the fact the test is measuring normalized reach distances based on limb lengths. There are limited studies, but there may be some potential for predicting non-external force related ACL injuries with the anterior reach asymmetry test (Chimera & Warren, 2016).

Different jumping and landing assessments have been developed and used to predict possible injuries in athletes. The Drop Jump Screening Test (DJST), the Landing Error Scoring System (LESS), and the Tuck Jump Assessment (TJA), are all tests that digitize markers on the body, identifying visual discrepancies between hip height, knee separation, ankle separation, valgus, etc. These tests all have contradicting results as to their validity in their ability to predict injury (Chimera & Warren, 2016).

Another type of testing that can help with athlete return to play is isokinetic testing. Isokinetic testing is done using a computer-assisted dynamometer that measures power output of agonist muscle groups compared to antagonist muscle groups in an isokinetic manner. To do this, isokinetic muscle testing uses the concentric or eccentric muscle contraction performed at a constant speed of angular motion but with variable resistance for a prescribed number of repetitions. Isokinetic dynamometers have been shown to produce relatively reliable strength data when testing simple uniaxial joints, such as the knee, in flexion and extension (Zvijac et al., 2014).

Though roughly 2000 research articles published throughout the 1990's supported the use of isokinetic testing, many clinicians stopped the implementation and practice of the testing (Davies, Reimann, Ellenbecker, 2018). Isokinetic testing is one of the most applied methods for the assessment and monitoring of the quadriceps and hamstrings strength after ACLR (Knezevic et al., 2014). There also have been studies looking at the ratio between quadriceps and hamstring strength in healthy individuals to look at how muscle strength imbalances can lead to injury. Nunes et al. (2018). discovered strength imbalances in Brazilian elite football/soccer players during the preseason had a correlation with hamstring injuries in season. Dauty et al. (2019) found isokinetic ratios can be used as an effective predictor of hamstring injuries for professional soccer players during in-season play. Hadzic et al. (2014) recommend using isokinetic testing to identify possible risks of future injuries in volleyball players.

Beischer et al. (2018) claim most young athletes return to knee strenuous sport too early without the recuperating the proper muscle function following their ACL reconstruction surgery. It has been stated some athletes may not fully recover for over 12 months. Through isokinetic testing, areas of weakness can be identified and logical training protocols put in place, determining the level and effectiveness of the rehabilitation, as well as the readiness of the athlete to safely reenter competition (Bernardo, 2018).

With the objective data from isokinetic testing, coaches, athletic trainers, therapists, and orthopedic specialists can know exactly where the patient is in the rehabilitation process. This allows for alterations in rehabilitation and treatment where needed, expediting the process more proficiently (Davies, Reimann, Ellenbecker, 2018). Physicians have used isokinetic testing to look at benchmarks knee post-surgery of a medial patellofemoral ligament reconstruction. This is to help determine if major strength deficits still exist six months post-surgery to make recommendations for prolonged strength training, which can lower the rate of injury recurrence (Krych et al., 2016). Isokinetic testing can also serve as a way to determine effectiveness in a strength and conditioning program, as well as show improvement in an athlete's strength, moving the athlete towards strength standards in their particular sport. Yin et al. (2018) found isokinetic testing of back and leg strength to be the most valid in determining entire body strength as compared to a multitude of other tests. The use of isokinetic testing is clinically valid and appropriate to determine core strength through back extension and flexion tests, to investigate strength methods, injury prevention methods, as well as rehabilitation methods (De Blaiser et al., 2018). Furthermore, a correlation was found between the average power in the quadriceps using isokinetic testing and the vertical jump of an athlete, suggesting proper in-season strength training protocols maintain and increase jump height (Ebert, Leigh & Konz, 2018).

Since 2001, the National Football League (NFL) uses isokinetic testing during the NFL Combine to determine: 1) previous injuries and physical problems and 2) if the athlete has muscle strength values in the upper ranges according to the position and duties. These two factors can potentially affect possible draft status and value of the athlete. Isokinetic testing of future NFL players can identify hamstring to quadriceps imbalances as well as bilateral asymmetries in strength, and injury prevention protocols to balance strength ratios can be implemented (Severo-Silveira et al., 2017).

A retrospective review of previously collected CRT data from 2016 to 2019. The data were collected through a partnership between Cedar Valley Medical Specialists, PC and the University of Northern Iowa. Student-athletes at the University of Northern Iowa and surrounding colleges have routinely been undergoing diagnostic evaluation of the knee flexors and extensors post-ACLR surgery. Six student-athletes (aged 17-21 years) had complete data sets for analyses (some student-athletes did not have data collected at six, seven, and eight months post-ACLR surgery). Demographic data were also collected for each student-athlete consisting of gender, height, weight, sport, playing position, and injured lower extremity side. The subjects were soccer (two), wrestling (one), swimming (one), basketball (one) and football (one). There were no specific inclusion or exclusion criteria. All student-athletes signed a consent form before participating in the test allowing use of their data for research purposes. This study was approved by the University of Northern Iowa Institutional Review Board. Concentric quadriceps and hamstring measurements were made using CRT ET2000 (Cost Reduction Technologies, Dubuque, IA, USA) dynamometer. Student-athletes had the opportunity to warm-up by riding a stationary bike in addition to completing a given specific dynamic stretching routine. After a short practice session on the dynamometer consisting of eight repetitions with increasing level of exertion, staff tested participants at 60° per second, with five repetitions recorded at that speed. Peak torque was measured with isokinetic concentric/concentric testing with five repetitions at an angular velocity of 60/60° per second. At low speeds (i.e., 60°/s), peak force reflects pure muscle strength (Willigenburg, et al., 2015). Willigenburg et al. (2015) indicated quadriceps asymmetry at the low speeds also tended to show quadriceps asymmetry at the high speeds eliminating the need to subjects at multiple speeds for this study.

**Discussion - Meso-level**

The University of Northern Iowa through a partnership with Cedar Valley Medical Specialists, a physician owned and operated healthcare provider, has added a specialty position in the strength and conditioning department. The University of Northern Iowa has embraced the high performance model of sport management, enhancing the resources surrounding the athlete to create a better experience for the athlete and move surrounding resources towards best practice. The partnership has created a full-time strength and conditioning professional, working with multiple sports, who assists in the day-to-day development of football athletes, and the physical progress for the women's basketball team and the women's swimming and diving teams. The primary coaching responsibility of this added position ultimately is to design and implement the training protocols for the injured athletes on all sports teams. This position is responsible for isokinetic testing both for the University of Northern Iowa, and Cedar Valley Medical Specialists. Through Cedar Valley Medical Specialists, an isokinetic testing machine (Cost Reduction Technologies, Dubuque, IA, USA) is provided and housed in the University of Northern Iowa strength and conditioning center.

The specialized strength and conditioning coach, who is compensated with a full-time salary and benefits through the healthcare provider, is responsible for a multitude of tasks related to isokinetic testing. First, their responsibility is to gather baseline data of the knee, shoulder, and trunk for strength, endurance, and range of motion. Second, they are to build a database of Division I athletes and analyze the data in the database with Cedar Valley Medical Specialist staff and athletic training staff to determine potential deficiencies and imbalances in student athletes. Third, the specialized strength and conditioning coach is to prevent potential injuries by designing strength training protocols to address these deficiencies and imbalances or make referrals for the athlete to medical specialists to address underlying injuries and, provide the proper medical attention needed to allow the athlete to compete at their best possible levels of play. Fourth, the strength coach is to evaluate mainstream strength and conditioning protocols for the team to determine if imbalances or deficiencies could be occurring due to strength training programming or sport coach practice protocols. Fifth, the specialized strength coach collaborates with medical staff and athletic training to modify or individualize team-training sessions to accommodate an injured athlete. The goal is to keep the injured athletes participating in the weight room during team training sessions, while performing as much of the regular lift as possible and modifying certain exercises to accommodate their injury status. Finally, once an injured athlete reaches final stages of rehabilitation, the specialized coach, working with the athletic training staff, helps to determine optimal timing for return to play for the athlete, ultimately trying to bring the athlete back to baseline strength levels equivalent to pre-injury status.

Throughout these stages, as well as through the athlete's career, innovative methodologies have been implemented and applied to not only help counter imbalances, but also offer preventative maintenance solutions for athletes to strengthen the spine, allow for decompression of joints, aid in joint mobility, as well as add general physical preparation for sport and health. Spine strengthening protocols have been borrowed from the Dikul Center (2020) and have been adapted for use with resistance training implements and machines, as well as the pioneering equivalent stretching and strength exercises prescribed by Dr. Dikul. These protocols use less cumbersome and more mobile tools, such as suspension trainers and resistance bands, both of which can be easily transported for travel. Hydrotherapy protocols have also been applied allowing for athletes to using facility pools for stretching, inflammation relief, cardiorespiratory health, and basic general physical training.

The University of Northern Iowa specialized strength and conditioning coach is a unique and invaluable position for a high performance model, bringing a synergistic connection between a sport coaching staff, a medical staff, a physical therapy staff, an athletic training staff, and a strength and conditioning staff. The addition of this position serves the best interest of the athlete as well as a sporting organization, ultimately reducing potential time and money to the athlete, team, and all resources surrounding the athlete.

**Discussion - Macro-level**

While the University of Northern Iowa is a public institution subsidized by the state government through Iowa's taxes, the university attracts significant private donations and corporate contributions. Relationships have been built over the last two decades, not only with the medical entity in the community, Cedar Valley Medical Specialists, but also with city government, starting with the city mayor and city officials. These individuals have helped facilitate partnerships with local businesses such as Mudd Advertising, Doerfer Companies, Martin Brothers, Martinson Construction, US Bank, CBE Group, Scheels All Sports, Home Depot, Hy-Vee, Deery Brothers Motors, Rydell Motors, Levi Architecture, Power-Lift, Benton Construction, as well as other businesses and generous individuals who see the value of having successful collegiate sports in their community. Accomplished collegiate sport teams influence all levels of athletics in the university's surrounding area, supporting positive health and well-being, and sparking greater participation in youth athletic endeavors by eliciting greater community involvement. Examples of this can been seen at UNI as collegiate athletes have initiated community projects for health in well-being. In 2017, UNI football players spearheaded a project to build a state of the art playground in the community to allow surrounding youth a safe and exciting new space to gather and play in exercise (Jamison, 2020). UNI football athletes have also partnered with the Waterloo Police

Department, creating youth football after school training opportunities for at risk youth in a program entitled the "Hail Mary Project", where collegiate football players mentor and coach small groups of young men identified by local police to help reduce recidivism (Hail Mary Project, 2020).

With the practice of utilizing evolving methodologies at the micro-level with elite athletes at the collegiate level, replication of these methods extend to grass root levels, allowing for better athlete experiences, aptitudes, and potentials. Programming principles, techniques, and coaching concepts have been brought from the university to youth training facilities in partnership in the surrounding community. The creation of XL Sports Acceleration, a youth sports and youth physical development training center, in partnership with UNI, utilizes the objectives of disseminating best practices being studied and applied by the university to enhance youth sport participation, physical fitness levels, and sport proficiencies.

Utilizing its strength and conditioning professionals and expertise in the field, the University of Northern Iowa's strength and conditioning department partnered with local government officials, Mayor Jon Crews, and a local equipment manufacturing company, Power-Lift, to create outdoor fitness equipment to be utilized by community members strategically placed in city parks, along running and biking trails, and near businesses. These multi-use, body weight stations can be easily accessed and used by community members regardless of level of fitness. Countless exercises can be performed on these innovative outdoor exercise devices, which are placed in a way where individuals can bike, run, or walk from one apparatus to the next to perform infinite physical training protocols (Hinz, 2020). The novelty of this equipment was very timely as the state of Iowa was embarking on a statewide initiative, led by Governor Terry Branstad, called the "Iowa Blue Zones Project", with the objective of increasing physical and mental health and wellness. Governor Branstad unveiled this "Blue Zones Rack" to the community, as well as introduced it to cities throughout the state, as the initiative was spread to other municipalities (Dimitriva, 2020).

**Conclusions**

Contributing pragmatically to the industry, the exemplified practices could be useful for sport, medicine, business and governmental leaders in their attempts to better integrate sport and medicine and capitalize on the interconnecting relationship of the micro-, meso-, and macro-levels surrounding this integration. Contributing to the theory of organizing, managing and developing sport and medicine, this study further validated the micro-, meso-, and macro-level model depicting practices relevant to each level and providing additional evidence of how these levels could better benefit from collaboration, communication, and partnership with each for advancing both sport and medicine.

**Conflict of interest**

The authors declare there is no conflict of interest.

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