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I am an associate professor in the Department of Kinesiology at Michigan State University (MSU). I am also a nationally certified athletic trainer (ATC) and fellow in the National Association of Athletic Trainers (FNATA). My responsibilities are almost equally weighted between research (33%) and service (30%), followed by teaching (25%) and advising (12%). I direct both the Sport-Related Concussion Laboratory and the Commission on Accreditation of Athletic Training Education (CAATE) Undergraduate Athletic Training Education Program. My contributions relative to each of my assigned duties follow.

RESEARCH

Sport-related concussion (SRC) remains at the center of attention in sports medicine and in the public at large. The prevalence for SRCs have increased in recent years from an estimated 300,000 SRC/year ([redacted]) to 1.6 to 3.8 million [redacted]). Consensus statements recommend that sports medicine professionals use a multi-faceted approach for the assessment of SRC ([redacted] This approach includes measures of neurocognition, balance, vestibular/ocular, symptoms, and a thorough clinical exam ([redacted]). Many of these assessments are prospectively administered, which allows for the comparison of post-injury scores to pre-injury (i.e., baseline) scores to track improvement or deterioration in the days and weeks following injury. This repeated measures approach also provides important data on the recovery from SRC, which informs targeted management and treatment strategies. My overall research mission is to improve the standard of care for athletes who sustain an SRC. My research focuses on three primary themes:

1) Epidemiology of sport-related concussion
2) Sex differences and concussion outcomes
3) Risk factors associated with concussion outcomes

Epidemiology of Sport-Related Concussion

In collegiate and high school athletics, the participation of female athletes has increased dramatically since the implementation of Title IX. In 2015-2016, the total number of students participating in high school sports was 7,868,900, the most since the National Federation of State High School Association (NFHS) began tracking participation in the 1971-72 school year. Girls' participation recorded the highest number ever reaching 3,324,326 athletes, an increase of 36,591 athletes from the previous year. In regards to collegiate athletes, National Collegiate Athletic Association (NCAA) athletic participation increased slightly too over 460,000 athletes. Due to this increase in sport participation, it is expected that the annual incidence of SRC will continue to rise.

In 2003, I was one of the first researchers to demonstrate sex differences in SRC injury rates between male and female collegiate athletes. Recently, we published an update on SRC injury rates between male and female athletes [redacted] Our research found that female collegiate athletes participating in comparable sports have a higher injury rate than male collegiate athletes [redacted]). Specifically, female athletes participating in soccer, basketball and softball had a higher injury rate compared to male athletes. My research in this area has led to 5 publications and numerous presentations on epidemiology on SRC. Moreover, my research in this area has led to the International Consensus Statement on Concussion in Sport to suggest that females are at a greater risk for a concussion than males ([redacted]

Sex Differences and Concussion Outcomes

Sex differences in baseline symptoms (i.e., pre-injury) and cognitive function have been well documented. For instance, our research has indicated that significantly more baseline symptoms are reported by female athletes compared to male athletes ([redacted]). Moreover, female high school and collegiate athletes self-reported more cognitive, emotional, and sleep symptom clusters than male athletes prior to sustaining a concussion [redacted] As a result of these sex differences at baseline, it was imperative to examine sex differences in SRC and related outcomes.

My dissertation focused on sex differences in SRC outcomes in collegiate athletes. I initiated this research line because of the lack of evidenced based literature on female athletes and post-concussion outcomes. The majority of research prior to 2000 concentrated on male athletes and cognitive function following an SRC.

Very few researchers were exploring female athletes and post-concussion outcomes due to the limited sample size and lack of awareness of SRCs in female athletes. I was one of the first researchers to find that females had exhibited cognitive impairments following an SRC ([redacted]). Specifically, female high school and collegiate athletes have decreased visual memory [redacted]), reported more total symptoms [redacted] showed greater vestibular and ocular-motor deficits (Sufrinko et al., 2017), and suffered neurocognitive impairments ([redacted] following an SRC compared to males. There are several reasons why sex differences exist in SRC. First, sex differences exist in reporting behaviors, with female athletes more likely to report an SRC. Second, sex differences have been attributed to anatomical differences in the brain between males and females. Finally, researchers have suggested that females have higher blood flow in the brain, coupled with a higher basal rate of glucose metabolism which may exacerbate the neurometabolic cascade. As a result, concussed female athletes may exhibit longer neurocognitive impairments than male athletes. These sex differences have led to healthcare professionals suggesting an individualized approach to concussion management. In addition, sex differences in concussed athletes have also resulted in increased awareness and education towards the female population.

My research has contributed to the Institute of Medicine's (IOM) suggestion to examine sex differences in 3 of their 6 recommendations made in the 2013 published IOM report titled: *Sports-related concussions in youth: Improving the science, changing the culture* (Institute of Medicine (IOM) and National Research Council (NRC), 2013). My research team and I have produced 15 publications on sex related differences in high school and collegiate athletes based on this research. Moreover this research has resulted in my being invited to speak at the National Institute of Health (NIH) Pediatric Concussion Workshop, American Medical Society for Sports Medicine, Department of Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury **(**DCoE**),** National Summit on Sports Concussion, and the Big Ten/Ivy League Concussion Summit.

Risk Factors Associated with Concussion Outcomes

Identifying athletes who are at risk for SRC and/or prolonged recovery is important for informing prevention efforts and management approaches. In addition, clinicians who are aware of factors that influence SRC risk and recovery are more informed and better prepared to discuss prognosis and expectations for recovery with the injured athlete.

There are two risk factor classifications described in the SRC literature – primary and secondary risk factors. Primary risk factors are associated with an increased risk of sustaining an SRC (e.g., sex, concussion history), and secondary risk factors place an athlete at an increased risk for protracted recovery and/or poor outcomes (e.g., age, post-traumatic migraine, mood disturbance). Researchers have suggested that the association between SRC history and future risk of injury may represent a decreased resiliency of the brain to sustain additional impact ([redacted]). My research has suggested that athletes who sustain multiple concussions are at a greater risk for a protracted recovery ([redacted]). In addition to concussion history, our research has also reported that high school-aged athletes demonstrated worse SRC recovery outcomes than older college-aged athletes [redacted]. These data, along with other studies, ([redacted]) suggest younger athletes are at risk for prolonged SRC recovery outcomes, which is likely due to the on-going development of the brain during youth and adolescent years.

Finally, mood disturbances have been suggested to be a potential modifying factor for concussed athletes ([redacted] Through our funded National Operating Committee on Standards for Athletic Equipment (NOCSAE) grant, we have documented depression in high school athletes up to 14 days post-injury [redacted] and anxiety in collegiate athletes ([redacted] Recently, we have reported almost 20% of concussed athletes experienced symptoms of depression and 34% reported experiencing anxiety. Baseline depression was the strongest predictor of post-concussion depression and anxiety. Our results call for programs to effectively address both psychological predictors and consequences of SRCs. The College of Education at MSU maintains the enhancement of health and well-being as a priority area, my research in these issues contributes to that priority. Overall our research in risk factors associated with SRC outcomes has led to 6 publications on history of SRC, 6 publications on mood disturbances, 4 publications on other risk factors and 2 publications on age differences in SRC.

Overall Research Productivity

During my time at MSU, I have obtained $1,577,151 in external grant funding and $54,903 in internal grant funding. I received multiple BrainScope (a medical neuro-technology company) grants for both the high school and collegiate populations. BrainScope developing a next generation portable, simple-to-use, non-invasive instrument to detect mild Traumatic Brain Injury at the initial point of care. The purpose of our BrainScope grants were to determine if this electroencephalogram (EEG) device could detect an SRC. We compared EEG to a concussed and healthy athletes' cognitive, balance, and resting state functional magnetic resonance imaging (fMRI) in high school and collegiate athletes. This grant required a tremendous effort to coordinate as we had 9 high schools and 5 universities/colleges that were involved in data collection. BrainScope funding also included 30% indirect cost for the high school grant and 36% indirect cost for the college grant. My previously funded NOCSAE grant examined changes in depression symptoms and neurocognitive impairments among male and female concussed high school and collegiate athletes. The purpose of this grant was to determine if athletes who incur a concussion also exhibit symptoms of depression as a results of their SRC. This was also a multi-study grant that involved 4 states and 21 high schools and universities. Finally, I am currently completing our Grant from the Joe D. Pentecost Foundation that examines neurocognitive function, vestibular and ocular motor impairments, and symptom reporting in youth and high school athletes with SRC. To date we have collected over 400 baseline SRC tests on youth athletes under the age of 13 years and numerous post-concussion tests. This research should help contribute to a much needed area of research on an at-risk population. While most of these grants are still on-going, we have produced 14 publications as a result of external and internal grants.

Overall I have over 87 publications that include 27 as first author, 7 book chapters, 14 international presentations, and 116 national presentations (see google profile below). My international reputation has led to invited presentations in South Korea, Canada and Germany. In addition, I have published in numerous reputable international journals such as the British Journal of Sports Medicine and the Clinical Journal of Sport Medicine. Moreover, my research productivity has increased over the past four years (see Table 1). My h-index is 30 and i10-index is 50, with almost all of my citations occurring since 2012 (N=2748). I strongly believe my research productivity has exceeded expectations for promotion to full professor even with a reduced research load (average yearly~33%) and increased service load as a CAATE Program Director (average yearly load ~30%).

Table 1. Publication Citations

Citation indices	All	Since 2012
Citations	3390	2875
h-index	31	30
i10-index	51	49

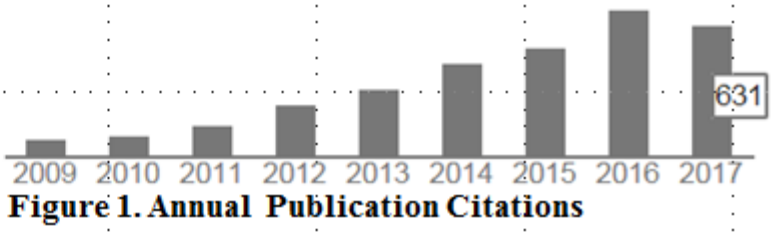

Figure 1. Annual Publication Citations

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I believe students have the potential to succeed and it is my duty to establish an educational foundation that students can build upon as they progress through their education and career as an athletic trainer. My philosophical approach to teaching is to develop students' faculty of reason and critical thinking skills, all of which are necessary for success as a future clinician. I prefer to act as a guide for students to create and discover new ideas. This philosophy assumes that students possess innate qualities of reason, self-determination, intellectual honesty and curiosity. My objective is to encourage academic and professional growth through a positive, but challenging, learning environment. Finally, my beliefs form an instructional framework which values the strengths that all individuals bring to the classroom; promotes an open and non-threatening classroom environment; acknowledges diverse ways of thinking; and recognizes the importance of context, dialogue, and meaning in the learning process. These are the ideals for which I strive to reach as a teacher of future certified athletic trainers.

I expect my students to become competent clinicians in the field of athletic training. I encourage students to become leaders in their field by helping them to evaluate accepted clinical practice, conduct scientific inquiries, disseminate and clinically apply new knowledge from research that enhances proficiency in

sports injury prevention, treatment, and rehabilitation of physically active populations. To achieve this end, educational attempts are made to provide new information in a hierarchical order of complexity so that the acquisition of facts can be synthesized with students' existing knowledge and experiences.

Students are encouraged to question assumptions, which is paramount to developing critical thinking skills. Athletic training professionals need to be able to make rapid on field decisions, and thus, need to develop these skills in active classrooms. I encourage students to think outside the box and challenge themselves. I encourage them to build a foundation for evidenced-based approaches to clinical practice. This is taught by integrating the best research evidence with clinical expertise and patient values to facilitate clinical decision making. As a result, I believe in having my students learn through evidence-based practice.

I use technology to maintain a rich visual and tactile (hands-on) experience. All my PowerPoint notes are easily accessed by students on D2L. In addition, I have incorporated the use of iPADs into the classroom. Students are encouraged to use their iPADs for anatomical landmarks, special tests and to bring them into their clinical rotations. I communicate short and long term specific aims early in the students' class experiences, and often re-state these relative to the broader context of their education. Examples of this method are when I teach all the special assessments for detecting knee injury/functioning, and then instruct my students to integrate the various assessments and perform an entire knee evaluation. In general, the students have responded very well to this approach and do assimilate basic concepts in a more thorough manner than they would if they were simply assigned readings or presented with lecture material.

I take pride in being an effective teacher which can be seen in my student instruction rating system (SIRS) scores which range from 1.11-1.69 (excellent category on a scale from 1-5). When I arrived at MSU, our athletic training program's Board of Certification (BOC) first time pass rate was 10%. I made significant modifications to all athletic training courses, implemented a general medical course and a BOC prep course, and revised all clinical integrated proficiencies to encourage learning over time. In 2016 we finally graduated our first athletic training class with a 100% (n=25/25) first time pass rate. As a result, my effectiveness in teaching can now be seen in our athletic training program's three year aggregate first time BOC pass rate of 94% (n=61/65).

Since I was awarded tenure, I have supervised students who have completed 39 independent studies and numerous honors options. Our PhD athletic training concentration only has 9 graduate credits (students are required to complete 12 credits in their concentration), thus, I always do a 3-credit independent study with my doctoral students in order for them to fulfill the academic requirements for their PhD program. I typically meet with my doctoral students every week to discuss CAATE standards, policy and procedures, and roles of a program director and clinical education director. Due to being the CAATE program director and having only one other colleague as part of the athletic training faculty, I am also instructor of record for 13 athletic training courses between the Fall and Spring semesters. I mentor both graduate and undergraduate students. During my time at MSU, I have supervised10 PhD students, 29 MS students, and typically have 3 Professorial Assistants, and 8-12 undergraduate students yearly. We meet as a group twice a month to discuss upcoming projects, research studies, and data collection. I am very proud that my graduate students have been awarded grants from the Blue Cross Blue Shields Foundation, National Athletic Trainers' Association (NATA) Research and Education Foundation, and the NATA Ethnic Diversity Advisory Committee.

SERVICE

To serve our community in line with the College of Education's priority on health and well-being, I try to improve the betterments of our youth athletes through sitting on committees that are paramount to keeping this at-risk population safe from further injury. I was invited to President Obama's Healthy Kids and Safe Sports Concussion Summit at the White House to raise awareness and increase efforts to decrease concussions. I was honored to be appointed to the important IOM committee on *Sports-related concussions in youth: Improving the science, changing the culture.* This committee consisted of 17 members as well as staff from the IOM. The committee was responsible for reviewing the available literature on SRC including the neuroscience, biomechanics and risk of SRC in the developing brain, the effectiveness of protective devices and equipment, diagnosis, treatment and management of SRC, consequences of repetitive head impacts and multiple concussions, and their long-term consequences. This IOM report was published and cited 66 times to date.

This past year I was included as an observational member (invited to attend the writing day for the consensus statement, but not allowed to communicate directly in the writing) on the 5th Consensus Statement on Concussion in Sport held in Berlin, Germany. In addition, the committee asked me to present at the 5th International Concussion in Sport Conference and was a co-author on one of the 12 research systematic reviews that influenced the development of the 5th Consensus Statement on Concussion in Sport.

I am a member of the NATA's Research and Education Foundation committee, as well as the Athletic Training Strategic Research Committee. I am an Editorial Board Member for *Frontiers in Neuroscience, Journal of Athletic Training,* and the *Developmental Neuropsychology* journal and a reviewer for 23 journals. I am a CAATE site visitor and have completed numerous External Reviews for Promotion and Tenure. I have also been on the Executive Board for our State athletic training organization (i.e., Treasurer for the Michigan Athletic Training Society organization).

The majority of my service is to our national accrediting body CAATE. As the Program Director I am responsible for ~45 undergraduate athletic training students and ~100 pre-athletic training students. My responsibilities include directing and coordinating all aspects of the athletic training education program to ensure maintenance of all CAATE standards and guidelines. The following is a further breakdown of my Program Director responsibilities: (1) Collecting all CAATE paperwork including but not limited to students CPR/AED card, physical examination paperwork, immunization form, ORCBS, liability paperwork, LiveScan Fingerprints, and transcript from the following semester; (2) Tracking students' CGPA each semester to make sure they stay above our minimum CGPA; (3) Collecting all potential new undergraduate athletic training student applications and interviewing ~ 60 pre-athletic training students yearly; (4) Developing and implementing our comprehensive assessment plan and outcomes. This comprehensive plan includes making yearly reports for every preceptor (n~25) and clinical sites (n~20), as well as senior exit surveys; (5) Coordinating 14 off-campus Affiliation Agreements; (6) Completing and submitting the annual CAATE report; (7) Maintaining a 70% three-year aggregate first time pass rate on the Board of Certification (BOC) exam.

In regards to service to MSU, I have served on numerous University committees such as Academic and Faculty Council, Student Affairs and Athletic Council. I served on the College of Education Faculty Advisory Committee, Reappointment, Promotion and Tenure committee, and Curriculum committee. I have chaired numerous Kinesiology search committees, Kinesiology Faculty Advisory Committee, and Personnel committee. I am also the Chair of the Athletic Training Education Endowment Committee.

SUMMARY

Overall, I believe that, through my activities over the past decade, I have established myself as a national leader in the field, and a good citizen to MSU and the scientific community. As one of the first researchers to examine female athletes and SRC outcomes, my research has shed a spotlight on this at-risk population. We now know that it just isn't a football, ice hockey and boxing injury, that female athletes in comparable sports are at a greater risk for a SRC than male athletes in similar sports. In addition, through our research dissemination efforts we have educated healthcare professionals, athletes, parents and administrators on the signs and symptoms of SRC, return to play protocols, and dangers of continuing to participate with a SRC. I have secured external funding from both the Federal and foundation levels, as well published my research findings in leading journals in the fields of Sports Medicine/Kinesiology/Neuroscience. MSU's mission is to advance knowledge and transform lives by "Providing outstanding undergraduate, graduate, and professional education to promising, qualified students in order to prepare them to contribute fully to society as globally engage citizen leaders." I believe I have achieved this through the accomplishments of my athletic training undergraduate and graduate students. My students have gone on to become Head Athletic Trainers for Division I athletics, athletic trainers for professional sports ([redacted]), and good citizens of the athletic training community. Finally, I was honored to be awarded with the Fellow status from the NATA, my appointment to the IOM committee on *Sports-related concussions in youth: Improving the science, changing the culture,* being an invited to speak at the NIH Pediatric Concussion Workshop, American Medical Society for Sports Medicine, DCoE, and the 5th International Consensus in Sport Conference.

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