History of Dance Medicine

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ABSTRACT

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Despite the extensive history of dance as an artform, beginning with ballet in the 16th century, it is only in the last two decades with the founding of the International Association for Dance Medicine and Science that the medical care of dancers has become an organized subspecialty. Dance medicine is a multidisciplinary subspecialty that specializes in the treatment of the musculoskeletal injuries as well as other dance-related health needs, including mental health, of dancer patients. To better understand this young field’s trajectory, I examined the unique origins of this subspecialty. To this end, I conducted semi-structured interviews with dance medicine pioneers to get first-hand accounts of the early history of dance medicine.

The late 20th century was a period that witnessed a proliferation of medical subspecialties. This allowed sports medicine and performing arts medicine to form. Given the status of dance at the intersection between arts and sports, I am interested in dance medicine’s relationship to these fields. In the early 1970s, dancers and dance educators witnessed the benefits that athletes received from sports medicine, a field led by orthopedic surgeons, and began to seek their medical advice. Individual orthopedic surgeons observed many similarities between dancers and athletes. While some injuries are unique to dancers because of the aesthetic demands of the art form, this alone does not account for how dance medicine became a distinct entity. The key distinction emerged as healthcare providers realized that the dancers self-identified much more as artists than athletes, yet their needs were more similar to athletes than musicians and vocalists, thus could neither group them in sports medicine or performing arts medicine. Dance medicine, unlike any other medical specialty, became a distinct subspecialty driven by patients and not the medical profession.

The oral histories I obtained revealed another important component: though focused on the needs of dancers, dance medicine has yielded insights that are valuable more broadly. In particular, eating disorders and HIV are two diseases that have emerged earlier and in disproportionate prevalence in dancers, bringing them to the attention of the medical community as well as the public.

The interviews revealed that the emergence of dance medicine was a combination of fortuitous events and opportune timing. Individuals who were invested in the well-being of dancers, a small but unique population, were brought together to bring awareness to dancers’ needs and propel the advancement of better care, ultimately with a creation of a new subspecialty.
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Introduction

Forty years ago, “dance medicine” as a medical specialty was in its nascency, and the term did not yet exist. Even though dance has a long-standing history, it has only been since the 1970s that the medical care of dancers has become an organized and recognized entity. The late 20th century was a period that witnessed a proliferation of modern medical specialization. Medical specialties and subspecialties organize around different categories – organ-based anatomy, such as ophthalmology, nephrology, cardiology; technology, such as radiology; and patient populations, such as pediatrics. It was in this environmental context that dance medicine formed around a unique patient population. But also, if not more important to the emergence of dance medicine, are the stories of the individuals involved.

The history of dance medicine, despite its short history and the very specific and relatively small population it serves, intersects with the broader context of the history of medicine. Dance medicine has yielded insights that are valuable beyond just the dance population. In particular, eating disorders and HIV are two diseases in which dancers contributed to the understanding of the disease processes and advancements in research.

Dance-related injuries are common with studies reporting injury rates in different dance populations ranging from 67% to 95% of dancers sustaining injuries in a contract year with the average number of injuries ranging from 1.7 to 6.7 injuries.
per dancer.¹ Most of the injuries that dancers sustain are chronic, or overuse, injuries to the lower extremity.² Dance medicine is the subspecialty that specializes in the treatment and prevention of these dance-related injuries. But, dance medicine is not just limited to the musculoskeletal injuries that occur; it also includes the medical and psychological components, such as psychological impact of dance injuries, dancer burnout, and career transition. The field is comprised of physicians and allied health professionals with the shared goal of promoting dancers’ health. Research in dance medicine and science has focused primarily on identifying the unique needs of dancers as well as the treatment and prevention of issues specific to this population. Despite the scientific rigor and clinical applications of dance medicine and science, the “goal is not to extinguish the ‘art’ of dance”; instead, by enhancing “performance, injury prevention, and dancers’ longevity,” dancers are thus more able to accomplish their art, to “fully realize their potential with the minimum of physical hindrance.”³

There exists two historical accounts of dance medicine: one documenting important milestones in dance medicine,⁴ and the other a brief history and overview of the field.⁵ No work has been done to understand the historical and cultural context in which the dance medicine subspecialty formed. The source material for this research is drawn from personal interviews with individuals who were pioneers of dance medicine or became involved in the field during the early years. Individuals selected for interview were identified from published sources as physicians at the forefront or initiators of dance medicine-related organizations. Snowball sampling
was then used to identify additional interviewees as well as to cross-reference those who had already been identified as influential in the field. This research will be the first to highlight the pioneers of dance medicine and understand their attitudes, inspirations, barriers, and hopes that catalyzed the emergence of a new medical field. Dance medicine and science are comprised of individuals of many different backgrounds; however, this paper will focus predominantly on the formation of dance medicine from the medical doctor perspective. In addition, the history of sports medicine and performing arts medicine will be explored as they relate to the history of dance medicine.

The Beginnings of Dance Medicine and The Pioneers

Dance has long been an important part of human culture, existing in various forms, as ritual, ceremony, celebration, healing, entertainment, and expression. Formalized dance, or concert dance, can be traced back to the beginnings of ballet in the 16th century. Dance medicine, on the other hand, as a medical subspecialty has a relatively short history. However, injuries secondary to dance are not a new phenomena. Due to the unique aesthetics of dance, such as extreme plantar flexion of the ankles, external rotation of the hips, and flexion of the back, dancers place repetitive forces of stress on various body parts that become vulnerable to injury. In Dr. Allan’s “Early History of Dance Medicine,” he found the first mention of injuries particular to dancers to be dated to 1935. However, there are earlier mentions, which is not surprising given the long history of dance. In a letter to the editor in
response to this review article, two readers report on a book they had found published in France in 1898, *La Danseuse: Considérations sur Quelques Accidents professionnels de ses Tendons et Ligaments du Pied [The Ballerina: Considerations Upon Some Professional Accidents of the Tendons and Ligaments of the Foot]*, written by George Blanchard, a physician. Indeed, in the research of this paper, there was a discovery of an even earlier mention of a dance-specific injury in the *Boston Medical and Surgical Journal*, now *The New England Journal of Medicine*, from April 15, 1875. In the published medical note of a Society of Physicians’ meeting in Vienna, a physician “described a new form of disease which hitherto he had observed only in ballet-girls,” a “cramp of the muscles of the calf of the leg” that occurred “chiefly amongst those who were in the habit of performing on the points of the toes”. The muscle described is the flexor hallucis longus, and “this muscular cramp was relieved in all cases by faradization”, the application of induced electric current. Even by 1901, textbooks are describing “dancer’s bones” alongside “rider’s bones” and “drill-bone” under the topic of traumatic myositis ossificans. To name a type of injury after a specific patient population suggests that it is unique to and relatively common within that patient population. Moreover, the recognition that there are circumstances or issues unique to a particular patient population is a necessary impetus for a subspecialty to emerge.

Dance may have been brought to greater medical attention in the late 19th century due to several changing factors in ballet. By the late 19th century, female ballet dancers were consistently dancing full evening-length ballets en pointe, or on the
toes. Ballet choreography was moving towards greater focus on technique with longer periods of time and more technical footwork en pointe; increasing degrees of turnout, the standing and moving in external hip rotation; and increasing flexibility. This change was reflected by the costumes, where full-length skirts were shortened to reveal the ankles, then the calves, and then became ever shorter until it was the stiff, classical tutus that extended out from the waist, revealing the entirety of the legs from the thighs down. The popularity of ballet was also growing in Europe and Russia. This corresponded to an increase in the number of ballet companies, and in turn, the number of hired professional dancers. The late 19th century was also a prolific time for the creation of classic ballets. The original Swan Lake was choreographed by Julius Reisigner in 1877, but it was Marius Petipa’s 1895 interpretation that made Swan Lake the masterpiece that is still popular today. Marius Petipa’s The Nutcracker premiered in 1892, again another success. Another famous ballet created during this period was Sleeping Beauty that is still performed today.

It was not until the latter half of the 20th century that there was a drastic shift in the medical care of dancers. In the early 1970s, individual physicians with no background in dance took up a strong commitment to the care of dancers in a more sustained approach with partnerships to large dance institutions. Several niduses of similar nature and origins were forming across the United States around the same time period.
In 1970, Dr. William Hamilton, an orthopedic surgeon in New York City, who happened to be working in close proximity to Lincoln Center, just two blocks away, started to see individual dancers present themselves to his clinic. The New York City Ballet had just established its home at Lincoln Center in 1964 with the opening of the New York State Theater, renamed the David H. Koch Theater in 2008. One of the dancer patients, who recognized the positive benefits of the medical care, approached George Balanchine, the founder and artistic director of New York City Ballet at the time, for this orthopedist to become the company doctor. They both agreed, and in 1972, New York City Ballet had its first orthopedic company physician.9

In Seattle, Dr. James Garrick, also an orthopedic surgeon, was working at the University of Washington in 1973. Within a year of working in the Sports Medicine Division, a woman on crutches came into his office. The woman was Ruthanna Boris, the founding director of the Dance Department at the University of Washington and a retired ballet dancer with the Ballet Russe de Monte Carlo and with George Balanchine. She was concerned about her students and wanted them to have a physician they could trust. Dr. Garrick responded that he was not the right person because he did not know anything about dance. Ms. Boris was not fazed and insisted that he come watch the ballet classes she was teaching. With Ms. Boris’s persistence as well as patience in teaching him about dance, Dr. Garrick started taking care of her college student dancers.10
In Boston, another beginning was taking place. In 1974, Dr. Lyle Micheli, an orthopedic surgeon, was a founding member of the Sports Medicine program of the Department of Orthopedic Surgery at Boston Children’s Hospital. Soon after, individual dancers from Boston Ballet started to make appointments at the clinic. One of the dancer patients, fortuitously, was the union representative for Boston Ballet and word of the excellent care was passed on to the company, who then formally invited Dr. Micheli to be their first company physician in 1977.\textsuperscript{11} Neither of these physicians had any dance training.

In Cleveland, Ohio, Cleveland Ballet, a newly formed ballet company, had its first performance in 1976. The founding executive director of Cleveland Ballet, a retired dancer of Boston Ballet, had learned of Boston Ballet’s newly acquired company physician. The executive director contacted Dr. Lyle Micheli, Boston Ballet’s new company physician, and asked if there was anyone local in Cleveland who would be able to provide similar consultations for their newly founded ballet company. Dr. Micheli recalled his days as a rugby player and recommended a friend at Cleveland Clinic, Dr. John Bergfeld, who he had played rugby with in the past. Dr. Bergfeld, also an orthopedic surgeon, was head of the Sports Medicine Department at Cleveland Clinic and team physician for several professional sports teams, including the football and basketball teams, the Cleveland Browns and Cleveland Cavaliers. He had absolutely no dance experience, and in a panic, turned to a physician friend whom he thought had more of a connection with dance.\textsuperscript{12} Dr. Leonard Calabrese, a rheumatologist and immunologist, himself had no dance experience, but his wife
was a nurse with previous dance training and had continued to dance non-
professionally at a high-level.\textsuperscript{13} They both agreed to be company physicians of
Cleveland Ballet.

Another dance educator, Martha Myers, who was Dean of the prestigious American
Dance Festival, had a personal interest in the health and career longevity of dancers.
When the annual dance festival moved to Durham, North Carolina on the Duke
University campus in 1977, she seized upon the opportunity to connect with the
medical campus. She literally went door-to-door of the doctors’ office at Duke
University Hospital, and Dr. William Hardaker, an orthopedic surgeon, agreed to
become the orthopedic specialist for the annual summer dance festival, beginning in
1978.\textsuperscript{14}

These are just a few of the stories of how individuals first became involved with the
care of dancers. None of these men had any dance experience themselves nor
expertise in the care of dancers. Despite this, they were interested and agreed to be
the physicians of these dance institutions, thus starting their paths to becoming
pioneers of dance medicine. These dance pioneers were in the right place at the
right time. However, it was not fortuity alone that made these individual physicians
pioneers. It was their strong interest and passion that drove them to go above and
beyond. They took the initiative to step outside of the clinic, on their own time, to
learn about the profession of their patients and to learn first-hand what dance
entails. Dr. Donald Rose, a former high-level competitive rower and a recreational
tennis player, stated that he was first drawn to dance because of his admiration from an athletic perspective – the strength, balance, and memory – but compared to football players who just have to get the ball across the line, dancers have to do all the above while having to still look great and appear effortless in the movement. It was only later as he learned more about dance and his patients that his artistic appreciation grew. Many of the physicians took it upon themselves to observe as many classes, rehearsals, and performances as possible to watch the dancers in their environment and witness the demands that these dancers placed on their bodies.

These pioneers also went above and beyond financially. Dancers had a great need for good quality medical care, but little access. Many dancers did not have health insurance and had minimal financial means due to the nature of a dance career with low-paying and fluctuating, sometimes part-time work. Dr. Donald Rose, one of the physicians in New York City, realized that the dancers he was seeing were unable to afford the care and saw them pro bono in his private clinic. Because of the increased costs of seeing physicians, many dancers sought other healthcare professionals instead, utilizing complementary and alternative medicine practitioners, such as chiropractors, massage therapists, and physical therapists, who were more affordable.

Even though the physicians could not draw on personal dance experience, many of them had a sports medicine background and some even covered various sports
teams.\textsuperscript{9–12,14,15} They relied on their sports medicine knowledge and training to apply the same principles to the dance companies. They considered themselves to be the equivalent of a “team physician,”\textsuperscript{12} providing treatment for acute and chronic injuries on-site as well as administering screenings, or physicals, of the company dancers at the beginning of each performance season. They were on-call at performances and were able to provide continuity of care during rehearsal periods. This approach seemed to be effective to the pioneers and brought a new systemized approach to the medical care of dancers that did not exist previously.

They also turned to literature and read all that was available, though in the early days, there was very little science, mostly anecdotal, about dance medicine. \textit{Dancing without Danger: The Prevention and Treatment of Ballet Dancing Injuries}, was one such book, the first one written specifically about dance medicine. It was written in 1970 by Dr. Donald F. Featherstone, a British surgeon, and Rena Allen, a dance teacher, with four main components: The Human Body, Prevention of Injury, Vital Areas of the Body, and Treatment of Injuries.\textsuperscript{4} But these physicians did not limit themselves to just medical literature. They also read about dance technique and learned names for dance steps. These terms helped to develop a shared vocabulary with dancers, a step towards developing a stronger alliance with dancers, crucial for their care, as true for establishing a strong patient-physician relationship with any other patient population.\textsuperscript{15} Many of the physicians also credit the physical therapists they worked with to be a tremendous source of information. Physical therapists are often the forgotten heroes of dance medicine. Many of them were former dancers
and were able to help provide the dance background knowledge to the physicians and crucial to the rehabilitation of the dancers.

As many of the dance medicine pioneers admit, there was a lot of passion, but very little science at the beginning. For a specialty to emerge, there must be a body of knowledge in which to draw on for clinical practice. Conversely, the development of a specialty also generates more knowledge. Specialized books, journal articles, and textbooks serve as a marker for this. These publications serve as a means for knowledge to coalesce, develop an audience for readers, and encourage further research. The early books were written with different audiences in mind – physicians and medical practitioners, teachers, and dancers. In many ways, the medical field of dance medicine follows the trend of other specialties. To establish scientific knowledge of treatment of a dance injury relies on first understanding the frequency of particular injuries, characteristics of the activity in which the injury occurs, and utilizing this knowledge to prevent recurrence. Occupational or industrial medicine had taken on this approach, with early writings, such as “Diseases of the Workers”.

The development of knowledge also requires bringing together individuals to exchange ideas and information. One of the earliest public gathering of individuals interested in dance medicine, though the term “dance medicine” was not used at this time, was in 1973, at the symposium, “Orthopedic Aspects of Dance and the Dancer’s Environment”. This was organized by Dr. Ernest Washington, an orthopedic
surgeon by training and a dancer himself, based in Los Angeles. From this first symposium, greater momentum was gained as this symposium started having annual conferences in multiple cities, which were then joined by the hosting of other conferences across the nation.

By the mid-to late 1970s, there were several articles in high profile, broad-audience based journals calling for attention to the needs of dancers. In 1975, in the article, “A new consideration in athletic injuries: The classical ballet dancer,” there was a call to orthopedic surgeons to recognize that a professional ballet dancer “presents all the problems of any vigorous athlete”, but it did not produce a large amount of interest among orthopedic surgeons. In 1978, in The American Journal of Sports Medicine, this call was expanded from not just classical ballet dancers, but to encompass all forms of stage, or theatrical, dancers. In the same year, in the Journal of the American Medical Association, there was further advocacy for a specialized field, “that ballet and other stage dancers should be considered as a separate professional group exposed to specific hazards of orthopedic-occupational injury, and that this group’s therapeutic and diagnostic problems should be given special, undivided attention.” But there is no mention of “dance medicine” in any of these articles.

The 1970s may have been a pivotal time for the beginnings of dance medicine as a specialty because of the growing popularity of sports medicine. There were dancers and dance educators who witnessed the benefits that athletes received from sports
medicine physicians, who understood and were interested in the needs of these athletic patients. This led them to seek the medical advice of sports medicine physicians, who were mostly orthopedic surgeons at that time, hoping that this same care practice could be translated to dancers. Individual dancers and dance educators were essential to the establishment of dance medicine because they brought themselves to the attention of these physicians and trusted their care. This may seem trivial, but in a profession where physical pain is accepted as inevitable, ignoring pain is strength, and pain is regarded as a sign of improvement, seeking medical attention runs counter to the “culture of injury and pain.” Dancers were also initially skeptical of physicians, often due to prior negative experiences. Many dancers had previously encountered physicians who dismissed their concern with comments such as, if the pain is caused by dancing, stop dancing. For the physicians who made a connection with dancers, word-of-mouth became a powerful means in which many of the physicians started to gain a dancer-patient following. The early dance medicine pioneers played a very important role in changing how the medical world was perceived by dancers.

Dance medicine is a field driven forward by the patients. If not for the dancers, dance educators, and dance companies that sought out these physicians, these physicians would never have pursued their path of caring for dancers. A trend that becomes apparent among these physicians is that their formative years of dance medicine were through an affiliation with a dance company, many of which are also associated with a dance school, or another dance institution. The dance schools are
much larger than the dance companies and enroll students of all ages, including young children. These organized institutions provided the perfect opportunity for deep immersion with a large number of dancers to see numerous cases and gain exposure quickly. Because many of these physicians were on-site, the dancers now had immediate access to addressing acute injuries, that previously may have been delayed. They were also able to intervene on chronic injuries earlier in the process, rather than later when they become worse and are more difficult to treat. In addition, these organized institutions provided a consistent study population in which to gather more information. As they learned more, the physicians could also provide education and implement preventative medicine.

The end of the 1970s culminated with the first use of the term “dance medicine” in 1979 by Dr. Ernest Washington. At that time, he was director of the First Annual Symposium on Orthopedic and General Medical Aspects of Dance and titled a talk to be presented at the conference, “Dance Medicine – A New Challenge to the American Physician.” In the interim between annual conferences, he was editor of Dance Medicine Health Newsletter, which had a quarterly distribution beginning in 1983. Internationally, other symposia were being established as well, such as by the Spanish Association for Dance Medicine starting in 1986.

As dance medicine continued to evolve, dance clinics started to form around the country. Many dance companies and choreographers hired freelance dancers either part-time or on a per project basis. Unless you were in a large dance company or a
student at an established dance academy, you did not have access to a company physician. In New York City, the Harkness Center for Dance Injuries was founded in 1989 by Dr. Donald Rose, an orthopedic surgeon. The initial impetus for starting a dance clinic stemmed from a strong desire to help dancers, while also recognizing the reality that it was not sustainable to continue seeing the increasing number of dancer patients all pro bono in his private clinic. As he was seeking financial investment, he made an opportune connection. One of the board members of the Harkness Foundation for Dance, a large private grant-making foundation dedicated to supporting the dance art form in New York City, was also on the board of the Hospital for Joint Diseases at NYU Langone Medical Center. This has been a productive partnership that continues to this day. There was also the hope to create a center in which dancers could receive different aspects of dance medicine care in one location, which was why physical therapists were integral to the program from the very beginning. More importantly, it was a clinic that provided an environment in which the patient can look around the waiting room, see other dancers, and feel like they fit in and were in the right place. The physical therapy facility room also provided this sense of community, where a dancer would be receiving treatment right next to another fellow dancer. In addition, this was an opportunity to be a center of knowledge, bringing together a multi-pronged approach, integrating clinical, educational and research aspects of dance medicine and science.

Dance medicine formed the first, and only association – the International Association for Dance Medicine and Science (IADMS) – on June 19, 1990. The
formation of an international organization is significant because it suggests the growing traction of the field in multiple locations. The establishment of an international association allows for greater collaboration on a larger scale for the exchange of ideas, data, research, and knowledge, critical for a subspecialty that is still relatively small currently. IADMS hosted its first annual conference in 1991. It just held its 27th annual conference in 2017 in Houston, Texas. To serve their international membership, the conference is held biannually in a location outside of the United States. In its first year, IADMS had 48 members and now has over 900 members from over 35 different countries. The organization has grown rapidly and now even has dedicated “Special Interest” days for different practitioners, such as teachers and medics. Over the course of a decade between the 2nd and 12th annual conference, the number of presentations increased three-fold, reflecting the membership growth. The presenters had a wide range of backgrounds, including doctoral researchers, medical doctors, medical specialists (ie. physical therapist), terminal arts degrees (ie. MFA), and non-medical masters, as well as representing 11 different countries. The diversity of professionals presenting at these conferences reveals the interdisciplinary nature of dance medicine and science. The range of topics presented at the conferences also reveals that dance medicine is not just limited to musculoskeletal dance injuries, as one might assume from first glance. From the analysis of the IADMS conference presentations, the field encompasses topics from injury prevention, treatment, and screening; psychological and social issues; specialized approaches to training and somatics; biomechanics and physiology.
Critical in an age of evidence-based medicine is good quality research and dissemination of this information. Recognizing the need to gather all the various pockets of information in the ever-expanding realm of literature, IADMS published the first volume of its official journal, *The Journal of Dance Medicine & Science* in 1997. The goal of the journal, as described by Karen S. Clippinger and Scott E. Brown, the founding co-editor-in-chiefs, is an “outlet for scholarly, scientifically oriented research in the field,” recognizing that dance medicine is “a young field, still formulating and coalescing a meaningful scientific database upon which clinical practice and dance training can be based.” A specialty interest journal limits the size of the audience with whom innovations are shared, but it also makes it more likely that these innovations will be shared with the targeted, smaller community. Moreover, an editorial board and peer reviewers all with dance medicine and science expertise helps to elevate the quality of research and papers.

*The Journal of Dance Medicine & Science* publishes quarterly issues, providing a comprehensive source of literature, including original articles, editorials, position statements, case reports, abstracts from the current literature, and book reviews. The contributors of the articles come from diverse backgrounds and degrees, including ATC (Certified Athletic Trainer), BA, BS, CSCS (Certified Strength and Conditioning Specialist), DO, DPM (Doctor of Podiatric Medicine), DPT (Doctor of Physical Therapy), EdM, FRCPC (Fellow of the College of Physicians of Canada), FRCSC (Fellow of the Royal College of Surgeons of Canada), MA, MFA (Master of Fine
Arts), MD, MPT, MS, MSPH (Master of Science in Public Health), OCS (Orthopedic Clinical Specialist, administered by the American Board of Physical Therapy Specialists), PhD, PT, RD (Registered Dietitian), and SCS (Sports Certified Specialist, administered by the American Board of Physical Therapy Specialists). The journal also seeks to highlight important topics with the publishing of special issues. Topics that have been chosen thus far include “Psychological Issues in Dance Medicine,” “Fitness for Dance,” “Dance and Development in Children and Adolescents,” “The Complexities of Dancers’ Pain,” “Motor Learning and Motor Control in Dance,” “Turnout,” and “Biomechanics in Dance.”

**Relationship to Sports Medicine and Performing Arts Medicine**

As dance medicine emerged in the 1970s, it faced an identity question: would it ally itself with sports medicine, more established but traditionally focused on athletes, or performing arts medicine, which was newly emerging, but initially not interested in dance. This was a fraught question because physicians and dancers had differing opinions. The dance medicine pioneers initially saw the dancers as more similar to athletes than instrumental and vocal musicians or visual artists. Dancers self-identify as artists – athletic artists that perform with great physicality, but not just an athlete, and dance is not a sport. Dancers thus could not be clearly grouped with either sports medicine or performing arts medicine. Ultimately, dance medicine formed its own entity, but historically has closer ties with sports medicine.
because the majority of the medical dance medicine pioneers already had an affiliation with sports medicine.

The first use of the term “sports medicine” was in February 1928, during the Second Winter Olympic Games, with the establishment of a committee to plan for the First International Congress of Sports Medicine. In the United States, there was a growing interest in exercise and health as well as the development of methods to measure physical fitness and military research in physical training and rehabilitation of soldiers. These factors contributed to the founding of The American College of Sports Medicine in 1954. The organization now has more than 50,000 members. Sports medicine is comprised of individuals with diverse backgrounds, including orthopedic surgery, family medicine, internal medicine, pediatrics, emergency medicine, and physical medicine and rehabilitation. Orthopedic surgeons were leading the field of sports medicine and The American Orthopaedic Society for Sports Medicine was established in 1972. There was very little mention of dance in sports medicine literature, and if there was, only superficially. The Olympic Scientific Congress, which convenes in conjunction with the summer Olympic Games and brings together physicians, trainers, physical therapists, and others, included dance in the program for the first time in 1984.

Performing arts medicine was coalescing at around the same time as dance medicine. Some have cited that performing arts medicine was established in 1977 with the publication of “Music and the Brain: Studies in the Neurology of Music,”
which includes topics such as neurological illness in performing musicians and occupational palsies. The first Symposium on the Medical Problems of Musicians in 1983 was the impetus for the founding of the Performing Arts Medicine Association (PAMA) in 1989. The early dance medicine pioneers viewed performing arts medicine to be dominated by those who were passionate about instrumental and vocal musicians. Some common injuries of musicians include temporomandibular disorders, focal dystonias of the hand, tenosynovitis in the shoulders and wrists, carpal tunnel syndrome, and thoracic outlet syndrome. Vocal cords are a common source of injury for vocal musicians with conditions such as vocal cord hemorrhage and vocal cord polyps. These conditions attracted neurologists, otolaryngologists, and hand surgeons, who were less suited to treat the lower extremity musculoskeletal injuries of dancers. To the early dance medicine pioneers, the medical problems of dancers had more in common with athletes than musicians.

This division between performing arts medicine and dance medicine appears to have changed over time with the establishment of specialty clinics that incorporate care for all performing artists as well as increased dance-focused leadership and medicine content in PAMA. PAMA's mission today is commitment to the highest quality of care for all performing artists, including instrumental and vocal musicians, dancers, and actors.

As dance medicine developed, physicians recognized that even if dancers have the same injuries as athletes, many of the existing treatment approaches that may be
adequate for an athlete does not suffice for a dancer. For example, the surgical reconstruction of a complete anterior cruciate ligament (ACL) rupture may result in some decreased range of motion in the knees, oftentimes a worth-while trade-off for athletes for increased stability. A loss of 5° range of motion in the knee for a football player does not have a significant impact on their athletic performance; however, for a dancer, this range of motion deficit could be career ending. In dance, both extreme knee flexion and hyperextension are not just aesthetically desirable, but necessary to accomplish certain choreography. In addition, some forms of dance require kneeling and other forms of knee-work with direct contact of the anterior knee on the ground. There is no consensus in the literature as to the most ideal ACL reconstruction. How you weigh the risks and benefits of a bone-patellar tendon-bone versus a four-strand hamstring tendon autograft will result in varying conclusions as to the best method of ACL reconstruction, depending on the parameters used to measure outcome, such as failure rate, functional assessment, patient quality of life, pain, range of motion, strength, or stability. For a dancer to have the best outcome and return to performance, it is crucial to appropriately weigh the risks and benefits of each of the autograft approaches from the perspective of the priorities of dance. Typically, the hamstring tendon graft is more ideal for a dancer, even though it has been shown to have less static stability compared to the patellar tendon graft, because it has less knee extension deficits, though somewhat more knee flexion deficits, and also avoids the kneeling and anterior knee pain of patellar tendon grafts. If a surgeon was not familiar with these demands of a patient’s profession, they may not only compromise their
patient’s livelihood, but potentially damage the patient-physician relationship for not just this individual patient, but dancer patients as a group.

There are some injuries that are seen most commonly in dancers, and less commonly in the athletic or other patient populations. Flexor hallucis longus tenosynovitis is a chronic, overuse injury seen almost exclusively in dancers.\textsuperscript{32,33}

The os trigonum, a common accessory bone of the ankle found in 15% of the population, causes symptoms of posterior ankle impingement, rarely in soccer players, and most in commonly female ballet dancers dancing en pointe, where they are dancing on their toes with specialized footwear with stiff platforms to support the toes in this position.\textsuperscript{32,33,34} An oblique spiral shaft fracture of the fifth metatarsal, most often secondary to an ankle inversion twisting injury, is so common in dancers that it is considered the “dancer’s fracture”.\textsuperscript{33,35,36} Identifying and recognizing the high incidence of iliopsoas syndrome, otherwise known as snapping hip or “dancer’s hip”,\textsuperscript{37} which has symptoms very similar to a hip labral tear, has resulted in a decrease in unnecessary hip arthroscopy procedures. The research and surgical advancements developed as a result of these injuries in dancers are then be applied to those cases in the general population that might not have been studied otherwise due to their rarity. This is one of the advantages that result from having a dance medicine subspecialty.

\textbf{Contribution of Dance Medicine to Other Fields of Medicine}
Despite the focus on musculoskeletal injuries in the formation of dance medicine, dance medicine encompasses other aspects of medicine as well. The field of dance medicine and science has made important contributions to the broader understanding of diseases that are also seen in the general patient population, such as eating disorders and body image, AIDS and HIV, and smoking.

To the general public, eating disorders are the health problem that is most associated with dancers, particularly ballet dancers. This notion is not just a stereotype made popular by sensationalist news media or movies, but historically based, stemming back to some of the early studies drawing connections between restricted caloric intake, amenorrhea, and impaired bone health. Many of these studies were inspired by and conducted on ballet dancers.

As Dr. Leonard Calabrese, one of the two company physicians of the Cleveland Ballet, was conducting preseason physicals of the dancers, he observed that many of the dancers had no menstrual cycles. With a background in rheumatology and immunology, he was able to bring more of an internist and primary care perspective. He was startled that 40-50% of the female dancers of the company had primary or secondary amenorrhea. He spoke with numerous endocrinologists, who suggested that there was a vague notion that low body fat may be related to amenorrhea, but this was not a known medical fact at that time in the late 1970s. Not satisfied with the answers he received, he decided to collaborate with a well-established exercise physiologist to conduct further research. Body fat had never
before been measured in dancers. Because he had already established a trust with the dancers, they were willing to partake in the study. They were the first group to study in dancers the relationship between amenorrhea, nutritional habits, and body fat, using an underwater weighing method, which was state of the art at the time, before the development of bioelectrical impedance plethysmography.

Around the same time in the late 1970s, a young radiology resident, Dr. Lawrence Vincent, who started dancing in medical school, took notice of all the thin female dancers that surrounded him in class. These young dancers would take great lengths to diet, striving to achieve the aesthetic ideal of the ballet world. Some of the dancers had what would be diagnosed as “classical” anorexia nervosa; however, many restricted their eating not due to body dysmorphia but to be competitive in a career and art form in which the body is perpetually scrutinized. Many did not have menstrual cycles, but it was so commonplace that it did not raise any concern among the dancers, nor did they feel it had a negative impact on their dancing – if anything, it was more convenient. All of this was normalized within this subculture. He detailed these observations in a book written for the non-medical audience and published in 1979, *Competing with the Sylph: Dancers and the Pursuit of the Ideal Body Form*. After publishing his book, he came across an article written by Rose Frisch, PhD, demonstrating a necessary minimal weight for a particular height in order for the onset or maintenance of menstrual cycles and showing that the thresholds corresponded to a minimal percentage of fatness necessary for ovulation and menstruation. None of the orthopedic surgeons seemed to be paying any
attention to this issue at that time. Dr. Vincent got in touch with Dr. Frisch, recommending that she study these female dancers that he was seeing in class and in clinic.\textsuperscript{39} Their collaboration resulted in the first published paper associating secondary amenorrhea and irregular menstrual cycles with increased physical training and exertion and low caloric intake.\textsuperscript{41}

A later study delved further and demonstrated the relationship between delayed menarche and amenorrhea with increased prevalence of scoliosis and stress fractures, suggesting the irreversible long-term impacts that primary and secondary amenorrhea may have on bone development.\textsuperscript{42} This study was also done on dancers. A former ballet dancer, Dr. Linda Hamilton, who became a clinical psychologist after dance retirement, was crucial to making the connection between the endocrinologists and scientists with the dancers for the study. These findings started to bring to medical attention not just classic eating disorders of anorexia nervosa and bulimia, but also disordered eating.\textsuperscript{22} The concept and theories of body imagery were also forming around this period. Moreover, these studies laid the foundation for later development of the diagnosis of the female athlete triad in 1992 by a panel of experts of the American College of Sports Medicine.\textsuperscript{43} The current understanding of the female athlete triad is the interrelationship of menstrual dysfunction (with or without amenorrhea), low energy availability (with or without an eating disorder), and decreased bone mineral density (with or without osteoporosis).\textsuperscript{44} Dancers as patients and study subjects provided valuable information to advancements in this field of research. All of these early studies
focused on the female dancer, though male dancers also are susceptible to disordered eating.

Anorexia nervosa and bulimia gained more public attention with the death of a young dancer, Heidi Guenther, in 1997. There was much speculation that her death was due to complications of an eating disorder. Newspaper articles with sensationalized titles like “Pursuing Perfection, Dancing with Death: Eating Disorders Haunt Ballerinas” and “a Cult of Secrecy” could be found all over the country. There was so much controversy over this that even two years after her death, there was still media coverage. This death sparked much discussion about disordered eating and eating disorders, the complicity of the dance world, and the role of the physician.

Dr. Leonard Calabrese, one of the physicians of Cleveland Ballet, is also an immunologist. He did not imagine that this aspect of his medical training would become directly pertinent to the care of dancers. However, in the early 1980s, gay, male dancers, in the prime of their careers started falling ill, developing a rare pneumonia that was only previously seen in immunocompromised individuals, and dying. This was the beginning of the AIDS and HIV epidemic. The disease affected dancers and teachers, and he took care of them the best he could at a time when there were limited interventions before the development of anti-retroviral medications. While other aspects of dance medicine, such as musculoskeletal, psychological, and nutritional issues, were gaining more support, attention to AIDS
was largely ignored. He became an advocate for these dancers and recognized some of the unique psychosocial challenges faced by performing artists, such as fear of public notoriety, given their public presence and the significant societal stigma. The dancer’s body was revealed on stage, and often the physical impact of the illness could not be hidden. In addition, he provided preventative education as scientific research revealed more information about HIV.13

The dance world was significantly impacted by AIDS: “One segment granted no emotional respite and seemingly suffering disproportionately to many other professions is the field of performing arts” and “no area of the arts, including dance, has been spared the devastation and loss inflicted by the disease.”48 On the other hand, the performing arts were also some of the strongest advocates for patients with AIDS, raising large sums of money to support education, research, and care of patients.49 Dancers Responding to AIDS, founded in 1991, is one such organization, the first organized effort of the dance community. The organization was founded by Denise Roberts Hurlin and Hernando Cortez, both dancers with the Paul Taylor Dance Company at that time. Having watched too many fellow company dancers and other friends and colleagues in the dance field suffer and die of AIDS, they were tired of feeling hopeless and helpless. They created an organization to raise awareness and money to directly help those living with AIDS that still continues this mission today.50
Despite individual artists raising public awareness of AIDS and HIV, the dance workplace was less proactive. Many other industries and businesses had developed policies for affected employees and educational programs to reduce stigma as well as establishing protocols to reduce HIV transmission in the workplace. One of the concerns raised was HIV transmission given the intense physical nature of dance and close contact of dancers, particularly during partnering choreography. Before it was known, and even after established scientific evidence, there was fear that HIV could be transmitted through sweat, the bodily fluid most routinely exchanged among dancers. There is an occasional bleeding risk associated with dance from abrasions, lacerations, and fissures. Many dance companies did not have formal policies for those who develop AIDS or HIV, resulting in much uncertainty. In addition, there were financial concerns for a field where health insurance was not ubiquitous.

Without the development of dance medicine, there would not have been the joint effort or collaboration that led to some of the research that pushed forward the understanding of these diseases. Understanding of these disease process in dancers helped the medical community as well as the public by bringing attention to and providing an increased proportion of incidence for study.

**Challenges for the Future as Seen by the Pioneers**

In the eyes of the early pioneers, the field of dance medicine has grown steadily and much has been accomplished. There is of course more room to grow. There were
several shared concerns of the interviewed physicians as to what they see as the challenges that the field faces today.

Unlike sports, there are no overarching governing bodies.\textsuperscript{12,15,39} There is no dance equivalent of the National Football League or International Olympic Committee to be able to implement change on a large scale. For example, it is known that performance enhancing drugs have detrimental health effects, yet some athletes continue to use them to gain a competitive edge. For dancers, engaging in disordered eating is known to have negative health impacts, yet some dancers continue to do so to gain a competitive edge to achieve the perceived ideal body. Sports governing bodies enforce random drug tests and disqualify athletes from competition, but dancers are not taken out of performances for disordered eating or maintaining an energy deficit. The International Olympic Committee has the authority to penalize a country that enables athletes to use performance enhancing drugs from competition, as seen during the 2018 Winter Olympics in Pyeongchang, South Korea with the barring of Russia’s Olympic team. For dancers, there is no governing authority that can prevent or disincentivize companies from having a weigh-in every season or perpetuating an unrealistic body ideal for all dancers. There are some teachers who have taken on this responsibility, but it is sporadic with no uniform approach. This could be a unique opportunity for company physicians to bring about great change. But like smoking, knowing the medicine and science is not sufficient. As stated in the special issue on eating behavior of \textit{The Journal of Dance Medicine and Science}, the field has made “scant progress in this
regard. The reason [...] is our failure to confront the root of the problem, because it a
cultural and aesthetic, not a scientific or medical one.”

Despite more awareness and utilization of dance medicine, the patient population is
still relatively small, and a physician would not be able to have dancers as an
exclusive patient population. Even for a physician in New York City, a city with a
significant number of dancers, dancer patients do not make up more than 20% of
their total patients seen in clinic. In addition, the small population makes research
funding more difficult to obtain. Again using sports as a comparison, dance, and
the arts in general in the United States, does not have the same deep financial
resources of large for-profit organizations in sports.

There is no board certification in dance medicine currently. In some ways, the field
still relies on the passing on of expertise from one individual to another. Physicians
who are interested in learning more about dance medicine will often choose a
sports medicine fellowship at a program that has individual physicians who are
experts in dance medicine. This has become easier as the field of dance medicine has
grown with more experts and practitioners in the field. An argument for the field to
become a board-certified medical specialty is the need and desire for dance
medicine to be standardized across the nation. On the other hand, one could argue
that since the field is still relatively small, this could still be achieved without board
certification. Subspecialty board certification is a tedious process. Application for
subspecialty board certification of orthopedic sports medicine, a substantially larger
group than dance medicine, began in 1988, and it was not until 2003 that it was approved by the American Board of Medical Specialties. However, recognition alone by the Board of Medical Specialties is not sufficient. There is a great need for other medical practitioners to know the existence and importance of having such a subspecialty and the expertise that it can bring to their patients. Even if they themselves do not have the knowledge to care for the dancer patient, they can direct these patients to the right resources and make referrals to appropriate dance medicine specialists.

There are some medical training programs that are trying to address this need in their curriculum. All trainees are provided exposure to dance medicine, even those without a prior special interest. The NYU Langone Hospital for Joint Diseases Sports Medicine Fellowship Program and the NYU Orthopaedic Surgery Residency Program have established a relationship with the Harkness Center for Dance Injuries, affiliated with NYU, for all residents and fellows to have a required rotation in dance clinic, including being on-call for dance performances. Even if these trainees do not continue with their own practice in dance medicine, they will know that this type of specialty care exists and know to send a referral or consult for more information.

**Looking to the Future**

Dance medicine and science has grown tremendously in the past 40 years. These innovations have allowed dancers to obtain better treatment and rehabilitation, potentially extending their careers. Some areas in which the field can still advance
are in the implementation of scientific research and clinical knowledge in dance training as well as preventative medicine. The translation of scientific and clinical knowledge will require more collaboration between medical professionals and those who have authority in the art form, such as dance educators, artistic directors, and choreographers. The possibilities are endless as to what new developments can be achieved by bringing together these different individuals. New training methods can be developed that will incorporate the science of biomechanics, allowing for dance educators to have the knowledge and resources to help each dancer achieve their full potential and improve within their limitations of their body. Safer and more productive rehearsal schedules could be made based on implementing known clinical knowledge of how fatigue affects injury rates. Clinical knowledge of rehabilitation and healing could be applied for a safer protocol to return dancers to performance after injury. Theaters could be evaluated to provide a safer environment for dancers, taking into consideration the types of surfaces and materials used floors.

The pursuit of a dance career is driven by immense passion and dedication. The pioneers of dance medicine held this same passion and desire to help, inspiring the drive, as one pioneer stated “to achieve beyond the ordinary excellence of care and commitment.” May this sentiment be carried forth by the next generation of dance medicine and science.
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