THE CORRELATION BETWEEN TIME LOSS DUE TO INJURY AND PERCEIVED HEALTH STATUS IN FEMALE COLLEGIATE DANCE STUDENTS

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ABSTRACT

Eric Nils Bengtson: The Correlation Between Time Loss Due to Injury and Perceived Health Status in Collegiate Dance Students
(Under the direction of Dr. William Prentice)

Dancers are a unique blend of artist and athlete particularly susceptible to musculoskeletal injuries and pain. When treating any athlete, it is important to consider the personal perception of health status. When considering the dancer, however, these perceptions may be especially important. One of the most widely used measures of perceived health status is the Short Form-36® (SF-36) Health Survey. Seventy-seven college dance students (aged 18-24) completed a survey containing the SF-36®, in addition to an injury history and various dance specific questions. The goal of this study was to determine the correlation between total time loss due to injury (in days) and perceived health status in collegiate dance students. No significant correlation was found when examining time loss due to injury to the Physical (N = 73, r = -.096, p = .421) and Mental (N = 72, r = .006, p = .958) SF-36® scales. However, the relationship between mental health status normative values and measured values was statistically significant (t = -2.033, df = 71, p = .046). The results from our study suggest that the SF-36® health survey may represent an accurate way to measure mental health status if administered during a pre-season injury screen creating a baseline value for individual dancers. Progress could then be observed in an objective way previously difficult to measure among this population, specifically, the progress pertaining to the mental aspect of injury rehabilitation.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
BP	Bodily Pain
GH	General Health
GHRI	General Health Rating Index
HIE	Health Insurance Experiment
MH	Mental Health
MHI-5	Five-item Mental Health Scale
PAMQ	Performing Arts Medical Questionnaire
PF	Physical Functioning
RE	Role – Emotional
RP	Role – Physical
SEM	Standard Error of Measurement
SF-36®	Short Form – 36
SF	Social Functioning
UNC-CH	The University of North Carolina at Chapel Hill
VT	Vitality

CHAPTER I

INTRODUCTION

1.1 Introduction to the Dancer

Dancers are a unique blend of artist and athlete particularly susceptible to musculoskeletal injuries and pain.[1] The health problems of dancers are deserving of study for several reasons. First, because dancers begin their training at a young age, there is potential for a great negative impact on their future health.[1] Second, the stress of dancing is significant enough to decrease a dancer's career length as compared to additional performing art fields, such as music.[2] Third, the combination of physical and artistic demands may lead to various health issues especially relevant to dancers such as musculoskeletal, metabolic, and nutritional disorders, all of which may significantly impact their health-related quality of life.[1, 3-6] Fourth, performance standards at the advanced levels are all but impossible to reach, leading to tremendous emotional stress.[2] Fifth, despite the amount of physical strain placed on the dancer's body, injuries are commonly reported late or not at all.[2, 7] Finally, dancers, as an occupational group, have received little attention overall in the health literature.[1, 5]

Despite dance-related injuries being the subject of several published literature reviews,[1, 2, 7-13] only one[1] has been published meeting current scientific standards for reviews of literature.[14] In this review by Hincapié, et al., whose objective was "to assemble and synthesize the best evidence of the epidemiology, diagnosis, prognosis, treatment, and

prevention of musculoskeletal injuries and pain in dancers," it was found that of the 1865 dance related studies found via various electronic databases, only 32 (representing 29 unique studies) were considered scientifically admissible.

The definition of "injury" has varied considerably across studies and has led to reported prevalence estimates for "injury or pain" varying from a low of 3%[15] to a high of 95%.[16-18] Nonetheless, overall the literature suggests the prevalence of musculoskeletal injury and pain in dancers is high. Chmelar, et al.[19] found the occurrence of a minor injury being present at one point in time using university and professional ballet, modern, and theatrical dancers was 74%. Likewise, the point prevalence of pain related to chronic injuries in professional ballet and modern dancers was found to be 48% by Bowling in 1989.[20] Lifetime prevalence estimates for injury in the professional ballet and preprofessional university dancers ranged from 40% to 84%[20-23] and 26% to 51%[22, 23] respectively. Two "better quality" studies, according the Hincapié, et al. review article, found that 95% of Swedish professional ballet dancers reported musculoskeletal pain in a one-year time period[24, 25] with 90% reporting recurrent pain six years later.[26]

1.2 Perceived Health Status in Dancers

It is important to consider the personal perception of health status and its relationship to injury when treating any athlete. When considering the dancer, these perceptions may be especially important because every performance involves a combination of athletics and artistry. In addition, performers have been shown to possess less ability to detach themselves from work as student-athletes from their sport.[27] Evidence has shown that the emotional stress of a performing arts student may be high enough to hinder proper healing of bodily pain.[28]

One of the most widely used measures of perceived quality of life and mental status is the Short Form 36 Health Survey (SF-36®).[29-32] The SF-36® is a 36 item questionnaire which measures physical and mental functioning on eight sub-scales including physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, and mental health **(Figure 1)**.[33] The SF-36® has been used previously within the dance medicine literature and has been shown to be responsive to musculoskeletal injury and recovery time in the dance population.[34, 35]

The SF-36® was constructed to provide an easy to use comparison across varying disease states and otherwise incomparable disease management strategies.[36] As of 1997, greater than 700 sources had documented the use of the SF-36® in numerous languages and using subjects with varying levels of disease states.[36] Due to the large library of previous research available, population normative perceived health status data have been established in virtually every age group. In fact, dancers have previously been shown to score significantly lower than the SF-36® population-matched normative values in regard to perception of bodily pain.[35] As a result of the limited empirical research related to injury and quality of life in collegiate-aged dancers, the following research questions will guide this study.

1.3 Statement of Purpose

The primary purpose of this research study is to determine the correlation between performance time lost due to injury and perceived health status in collegiate dance students. In addition, this study will analyze the characteristics associated with perceived physical and mental health status among this population, along with analyzing which rehearsal factors are associated with performance time lost due to injury.

The secondary purpose is to determine injury prevalence in the collegiate dance population by virtue of the epidemiologic component of the Performing Arts Medical Questionnaire (PAMQ).

1.4 Research Questions

1. Is there a correlation between total time loss due to injury (in days) and current perceived health status in collegiate dance students?
    a. Is there a correlation between total time loss due to injury (in days) and perceived *physical* health status in collegiate dance students?
    b. Is there a correlation between total time loss due to injury (in days) and perceived *mental* health status in collegiate dance students?
2. How does perceived physical and mental health status differ in collegiate dancers compared to sex related normative values?
    a. How does perceived *physical* health status differ in collegiate dancers compared to sex related normative values?
    b. How does *mental* health status differ in collegiate dancers compared to sex related normative values?
3. Is there a correlation between reported hours of dance rehearsal per week and perceived physical and mental health status in collegiate dance students?
    a. Is there a correlation between reported hours of dance rehearsal per week and perceived *physical* health status in collegiate dance students?
    b. Is there a correlation between reported hours of dance rehearsal per week and perceived *mental* health status in collegiate dance students?

4. Is there a correlation between the number of years of previous dance training and performance time lost due to injury?
5. Is there a difference in performance time lost (in days) due to injury among dance style types (Ballet, Modern, and Other **(Figure 2)**)?

1.5 Research Hypotheses

1. H_R: There will be a significant correlation between total time loss due to injury and current perceived health status in collegiate dance students.
    a. There will be a negative correlation between total time loss due to injury and perceived physical health status in collegiate dance students.
    b. There will be a negative correlation between total time loss due to injury and perceived mental health status in collegiate dance students.
2. H_R: Perceived physical and mental health status will differ significantly in collegiate dance students compared to sex related normative values.
    a. There will be a significant difference in perceived physical health status in collegiate dancers compared to sex related normative values.
    b. There will be a significant difference in perceived mental health status in collegiate dancers compared to sex related normative values.
3. H_R: There will be a negative correlation between reported hours of dance rehearsal per week and perceived physical and mental health status in collegiate dance students.
    a. There will be a negative correlation between reported hours of dance rehearsal per week and perceived physical health status in collegiate dance students.
    b. There will be a negative correlation between reported hours of dance rehearsal per week and perceived mental health status in collegiate dance students.

4. H_R: There will not be a correlation between the number of years of previous dance training and performance time lost due to injury.
5. H_R: There will not be a difference in performance time loss (in days) due to injury among dance style types.

1.6 Independent Variables

RQ1: Total time loss (in days) due to injury

a: Total time loss (in days) due to injury

b: Total time loss (in days) due to injury

RQ2: Normative perceived physical and mental health status values

a: Normative perceived physical health status values

b: Normative perceived mental health status values

RQ3: Reported hours of dance rehearsal per week

a: Reported hours of dance rehearsal per week

b: Reported hours of dance rehearsal per week

RQ4: Total number of years of previous dance training

RQ5: Dance style type (Ballet, Modern, and Other **(Figure 2)**)

1.7 Dependent Variables

RQ1: Total (physical and mental) perceived health status values

a: Perceived physical health status values

b: Perceived mental health status values

RQ2: Mean perceived physical and mental health status values in the study sample

RQ3: Total (physical and mental) perceived health status values

a: Perceived physical health status values

b: Perceived mental health status values

RQ4: Performance time loss (in days) due to injury

RQ5: Performance time loss (in days) due to injury

1.8 Definition of Terms

1. Injury: Any event which causes pain and prevents or limits the subject from *fully* participating in a rehearsal or performance.[2, 37-41]

1.9 Operational Definitions

1. Collegiate dance student: College student who is taking dance classes or who participates in at least one extra-curricular dance group.

2. Performance time loss: Number of days in which the subject was forced to alter participation from rehearsal or performance due to injury. Therefore, they were unable to *fully* participate in a dance rehearsal or performance during a given day.

3. Performance time limited: Number of days in which the subject was able to participate in a rehearsal or performance but was unable to participate fully.

4. Injury: Any event which causes pain and prevents or limits the subject from *fully* participating in a rehearsal or performance.

5. Primary dance style: The dance style to which most of the student's rehearsal time is dedicated.

6. Floor types: The floor type on which most of the student's rehearsal time is spent.

1.10 Assumptions

1. The PAMQ is a valid and reliable measure of performance time loss due to injury.

2. The SF-36® is a valid and reliable measure of perceived mental and physical health status.

3. Participants will complete the PAMQ truthfully and with maximal effort.

4. Participants will be honest, to the best of their ability, regarding their injury history.

5. The PAMQ will be completed in a similar environment by all dancers.

1.11 Delimitations

1. All participants will be college students enrolled within the University of North Carolina at Chapel Hill (UNC-CH).

2. All participants will be currently participating in a dance class or an extra-curricular dance group.

3. All participants will be over the age of 18 years old.

4. All participants will be English speaking and will, therefore, be able to read and comprehend the questions asked by the survey instrument.

1.12 Limitations

1. Injury history recall bias due to the self-report format of the PAMQ.

2. Dancers are often uneducated regarding the signs and symptoms which likely qualify as an injury.

3. Subjects will likely not be completing the PAMQ in the same environment.

4. The sample is not a truly random sample.

5. Surveys administered during on-site visits will probably be returned at a higher rate than those administered by email.

1.13 Significance of the Proposed Study

To date, limited data are published correlating physical and mental stressors to performance time lost in collegiate dance students. Despite being widely used in other populations, minimal research has been previously published using the SF-36® to determine perceived health status among collegiate aged dancers. This data, in addition to the analysis

of rehearsal characteristics associated with time loss due to injury, will aid performing artists and clinicians in further understanding the role that injuries play in perceived health status. Furthermore, use of the SF-36® may aid dance medicine researchers and clinicians implement this survey instrument into clinical practice.

CHAPTER II

REVIEW OF LITERATURE

2.1 Introduction to Dance

A dancer is a hybrid of both artist and athlete. Many dancers are known to train in multiple styles of dance for training value, in addition to economic and social reasons.[42] There are many styles of dance **(Figure 2)**, with each consisting of its own unique characteristics and stressors. Two of the most common styles of dance are classical ballet and modern. Hanson et al.[2] reported in 2006 that in no other profession is the athlete more predisposed to injury than in ballet. In fact, in one school of dance, classical ballet was responsible for up to 67% of all injuries and shown to be independently predictive of injuries, whereas other forms of dance were not.[3] Typically, professional ballerinas start at the age of 5 to 8 years and begin an immediate process of tremendous bodily strain. By the age of 30, most dancers have ended their career.[2] If a female dancer is on track for a professional career, she may start dancing “sur les pointes”, or “on toe” at age 12 **(Figure 3)**. This unnatural position leads to tremendous forces being transmitted to the metatarsalphalangeal and other joints.[2, 10, 43] This and other unusual biomechanical stressors, combined with hypermobility, repetitive motion, delayed menarche, secondary amenorrhea, and lack of job security makes the dancer an athlete like no other.[2]

Modern dance is a unique form of dance whose teachers often incorporate more than one of the traditional styles into their own choreography and improvisation. This frequently results in more varied physical demands and a different, less standard, aesthetic, including a wider range of body types than that of ballet.[44] Despite the style of dance, injury prevalence rates are reported at a frequency consistent with many traditional sports and are deserving of further attention.

2.2 Musculoskeletal Injuries

2.2.1 Foot and Ankle

By far the most common site of injuries in dance, the foot and ankle have been shown to be the location of 20 to 60% of overall injury occurrence.[1, 16-22, 24-26, 42, 45] This predominance is thought to be related to the anatomic requirements of the five basic dance positions **(Figure 4)** which form the basis of classical ballet. Almost every youth dancer begins training with these basic positions.

Injuries to the mid-foot region present a challenging diagnosis due to their infrequency of occurrences in other activities.[42] Subluxation without fracture of the cuboid and talar bones have both been reported and recognized as poorly defined syndromes. However, one study[48] reported a total of 25 subtalar subluxations among 60 dancers in a one-year period. In another study,[49] cuboid subluxations totaled 17% of all foot and ankle injuries, requiring physical therapy during two separate three-week intervals. The Lisfranc joint has also been shown to experience a tremendous amount of stress during ballet activities.[10, 43]

Ankle inversion injuries are the most common injury in all forms of dance[42] and have been shown to affect postural sway in a professional dancer up to 6 weeks after a well-

designed rehabilitation program due to a specialized need for extraordinary balance, flexibility and strength.[46] The same mechanism causing an inversion ankle injury while "en pointe" **(Figure 3)** may cause a "dancer's fracture" or a spiral fracture of the fifth metatarsal diaphysis.[42] Anterior ankle impingement is believed to be caused by utilizing the extremes of ankle dorsiflexion. Conversely, posterior ankle impingement is caused by frequenting the extremes of ankle plantarflexion and is only exacerbated by the presence of an os trigonum.[42] This abnormally large posterior talar tubercle is found in 8-13% of the general population and may cause especially exaggerated symptoms in a dancer.[47]

2.2.2 Knee

Knee pain accounts for approximately 15-50% of injuries reported in dancers.[42, 50] The "turned-out" **(Figure 4)** position of the foot may place abnormal torques on the medial aspect of the knee.[42] In relation to patellar tracking abnormalities, relative quadriceps torque among ballet dancers has been shown to be the lowest among athletes tested, and ballerinas have been shown to have quadriceps strengths in the lower 77th percentile (SD = 1.4) when compared with other female athletes.[51] One study[50] showed a particularly high incidence (50%) of patellofemoral pain in dancers and demonstrated a positive correlation with iliotibial band tightness and increased tibial external rotation.[50] Traumatic synovitis and prepatellar bursitis with altered lower limb biomechanics due to pain have been documented after falls from partner lifts in classical ballet positions.[52]

2.2.3 Hip

The overall incidence of hip problems range from 7-14%, with snapping hip syndrome accounting for roughly 50% of injuries.[53] The majority of lower limb movements in classical ballet are performed with the hip in external rotation ("turn-out") with an

aesthetic emphasis on presentation of the medial aspect of the leg.[42] Anything less than 90 degrees of active hip external rotation may predispose the distal leg structures to injury.[42] A majority of this range of motion is achieved before the age of 16.[54] Snapping Hip Syndrome is believed to be of two types, Lateral and Medial, with the specific mechanism of each type the source of debate. Lateral Snapping Hip Syndrome is generally regarded as originating from the sliding of the iliotibial band or gluteus medius over the greater trochanter.[55, 56] In Medial Snapping Hip Syndrome, sliding of the iliopsoas tendon over the iliopectineal eminence may be caused by a narrow bi-iliac width,[57] sacroiliac joint sprain,[58] muscle or flexibility imbalance,[59] or a tight iliotibial band.[60]

Other hip injuries reported in dancers include greater trochanteric avulsion fractures,[61] greater trochanteric calcific tendinitis, degenerative osteoarthritis of the sacroiliac joint,[62] and avascular necrosis of the femoral head.[63]

2.2.4 Spine

Spinal injuries are reported to represent up to 19% of injuries in dancers.[20] The lumbosacral region is involved in 69% of spinal injuries. Thoracic and cervical injuries occur 21% and 10% of the time, respectively.[64]

Spondylolysis of the lumbar spine is three times more common among adolescent female dancers than in the general population.[65] To achieve the many aesthetic extension movements in ballet, there must be concomitant lumbar spine extension. If there is a reduction in hip extension, then the dancer may compensate by increasing extension of the lumbar spine, which results in excessive torsional stress and hyperextension of the lumbar spine.[66, 67] Lumbar, thoracic, and cervical injuries can be caused by an excessive lumbar

lordosis in male dancers during lifts of another dancer far from the male's center of gravity.[65, 66, 68]

2.2.5 Upper Extremity

Injuries to the upper extremity are less common and account for approximately 10% of ballet injuries.[67, 69] A majority of injuries are of acute nature and typically occur due to bracing the body from a fall.[70]

2.3 Psychological Concerns

2.3.1 Body Image

Dancers tend to possess a distorted body image almost always incongruent with their actual body composition measurements.[71] In fact, evidence has shown that a dancer will commonly express attitudes similar to anorectic patients due to external pressure related to body image[72] even when not showing signs of disordered eating otherwise. Lower self-esteem, diminished self-concept, perceived undesirability, sensitivity, and perceived unattractiveness are frequently observed in dancers with altered body image compared with non-dancing peers.[73, 74] Female dancers specifically have been shown to desire body weights below the 5th percentile (82% of ideal body weight).[75] A study by Abraham in 1996,[76] found that half of the dance student test subjects identified that they had trouble controlling their weight, while two-thirds of the dancers were using some form of weight control (not eating between meals, excessive exercise, vomiting, laxative use, among others).The dancers in the Abraham study all exhibited a well below average percent body fat as compared to age-matched normative values.[76] Of primary concern is the dance population's pre-occupation with controlling body weight and its link to body image.[73]

2.3.2 Eating Disorders

Distorted body image potentially may be linked with eating disorders. It has been shown that there is a strict selection process which weeds out dancers who do not conform to specific aesthetic requirements[77] leading to compulsive dieting and potentially a clinical eating disorder. Dancers who become injured may be more likely to have an eating disorder than dancers who are not injured.[73] The affected dancers are more likely to contribute to the attrition rate of dance students than students who do not develop an eating disorder.[77, 78] Therefore, a connection may be drawn between injuries, eating disorders and eventual attrition from dance.

The prevalence of eating disorders has been shown to be as high as 40% in ballet dancers[79] as compared to 1% reported within the general population.[80] Of course, a majority of eating disorder research is of survey design which leads to skepticism regarding the data due to the sensitive topic of question. To further the point, self-reported caloric intake in this population has been shown to be as low as 21% of actual intake.[81] Nonetheless, eating disorders are a significant problem among dancers and may be partially monitored by assessing an individual's nutritional status as compared to their recommended daily allowances.

2.3.3 Nutritional Considerations

The goal of maintaining an extraordinarily low body weight can lead to food restrictions and cause inadequate nutritional intake.[75, 82] Research regularly has found a discrepancy between the desired energy requirements and the energy intake among this population.[81, 83]

2.3.4 Menstrual Irregularities

Dancers with menstrual irregularities have been found to ingest less protein, iron, and niacin compared to dancers with normal menstrual function.[84] Years of such restriction may lead to a lowering of a dancer's resting metabolic rate,[85, 86] which is positively correlated with decreased bone density.[87] For the menstrual cycle to begin properly at the onset of puberty, a small amount of body fat must be present.[88] Unfortunately, due to a lack of this fat, youth dancers experience hindered menarche which is thought to bring about numerous health problems such as osteopenia, reproductive disruption, an increased incidence of fractures, and an increased incidence of scoliosis.[3] Restricted calorie intake is associated with primary and secondary amenorrhea.[88, 89] Amenorrhea in combination with disordered eating and subsequent bone loss or osteoporosis is known as the Female Athlete Triad.[89] This condition is synonymous with an increased incidence of fractures,[90] which is commonly the most straightforward clue to clinical diagnosis of a menstrual irregularity.

2.3.5 Stress

When the stress of an average college student is compounded with the physical and psychological stressors of dancers, an environment is created where there may be potential to decrease the body's ability to heal.[28] In a 2009 Study by Cardinal,[91] lack of money, lack of time, lack of sleep, fear related to body image and weight, the fear of not meeting dance teachers' expectations of dance technique proficiency, lack of self-confidence, social and peer comparisons, overwhelming lives and workloads, injuries, and career transition were all listed as stressors in the collegiate dance population. Additionally, a 2004 study by Adam, et al.[92] found that dancers who missed rehearsal and performance days due to injury were more likely to report higher levels of perceived stress, anxiety, depression, anger, fatigue, and

confusion than less injured dancers who did not require time off from dance. Sleep problems and daytime sleepiness were also significantly related to dance injuries.

Evidence demonstrates various stress-related factors are significantly correlated with injuries in the dance population, but it is difficult to determine the direction of the correlation. While psychological distress in the form of perceived stress, negative mood states, and poor sleep may predispose dancers to injury, the stress of physical dance training and performance may, in fact lead to a state of psychological distress.[92] Some authors suggest that dancers often experience injuries, as much connected with psychological factors as physical factors, which lead to a significant correlation between psychological stress and total time loss due to injuries for dancers.[93-95] Concerning positive psychological factors, evidence suggests that social support and adequate sleep are positively associated with fewer days missed due to performance-limiting injuries in dance.[92, 94] At the professional level, male dancers have been shown to demonstrate more negative personality traits and psychological stress than female dancers or men in the general population.[21] Personality traits and physical stress suggestive of "overachievers" have been also attributed to injuries in dancers.[21]

2.4 Extrinsic Injury Risks

2.4.1 Flooring

At UNC-CH, student dancers commonly dance on flooring not designed to absorb the forces involved with dance activities. Evidence shows that dancing on floors not adequate for the needs of dancers may predispose them to injury.[68, 96] In fact, a decrease of 80% in musculoskeletal injuries in theatrical dancers has been reported with proper resilience of the floor surface.[69] A study by Fiolkowski and Bauer in 1997[97] looked at plantar pressures for

three different flooring types, a suspended stage floor, a tile floor, and a vinyl mat floor. Significant differences were found in floor contact time between the vinyl mat floor and the other two floor types. Also, there was a significant finding in peak pressure recorded for each of the flooring types. Anterior midtibial stress fractures often result from repeatedly landing from jumps on hard floors that minimize shock absorption.[42] This research suggests that those who dance on inappropriate and varying dance floors may be at an increased risk for injury.

Traditionally, to provide the audience with a better view of the stage, theater manufacturers create a stage which is tilted in the direction of the spectators. This practice is called "raking," and has been linked with an injury rate 2-3 times that of dancers who perform on flat stages.[39, 98, 99] Biomechanical research has shown that performing on a raked stage, as compared to a flat stage, alters hip, knee, and ankle joint angles a significant amount when standing stationary[99] and performing a box-landing task.[100] It is hypothesized by various authors[39, 98, 100] that lower extremity biomechanical adaptations are primarily responsible for the increase in injury incidence among those performing on a raked stage.

2.4.2 Previous Dance Training

When evaluating prior training and the effect on injury, a study by Weigert in 2005 found that among modern dancers at the university level, prior training, regardless of type or duration, does not decrease the overall risk of injury.[44] These findings are most likely due to the lack of structure of modern dance styles. Despite previous training, a unique style of dance will "level the playing field" in regards to a dancer's ability to prevent injury.[44]

2.4.3 Screening for Injuries

Similar to the more traditional sports, the use of pre-season screening in dance has become common as a means to identifying the potential for future injury.[44, 101-106] Very few differences have been found between injured dancers and uninjured dancers calling into question the utility of broad-based screening programs to predict, prevent, or manage injuries in dancers.[103] This is consistent with screenings on a more broad discipline of sports medicine where there is little evidence to support the ability of screenings when measuring differences in intrinsic variables.[103, 107-112]

2.5 Health Related Quality of Life; The SF-36® Health Survey

2.5.1 Background

One of the most extensive applications of psychometric theory and methods of development and refinement of health status surveys took place during the Health Insurance Experiment (HIE).[113-115] The goal of the HIE was to construct the best possible scales for measuring a broad array of functional status and well-being concepts for non-aged adults and children.[33] The Medical Outcomes Study (MOS) later provided the opportunity for a large scale test of the feasibility of self-administered questionnaires and generic health scales from questions originally brought up by the HIE.[33] The MOS surveys were more comprehensive, assessing 40 physical and mental health concepts. The SF-36® was constructed to represent eight of the most important health concepts included in the MOS and other widely used health surveys.[33] The eight subscales are further explained in this chapter.

Before the development of the SF-36®, little was known about how patients suffering from one chronic medical or psychiatric condition differ from patients suffering from another in terms of functional status and well-being.[33] The SF-36® provided a way to compare

varying populations to those sampled from the general population using normative values. The SF-36® is practical because, for the majority of respondents, it can be self-administered. Self-administered surveys were adopted for use in the MOS on the strength of pilot studies in which self-administration worked well while using standard survey methods.[33]

An international team of 15 investigators has been developing and evaluating translations of the SF-36® over the past few years for the International Quality of Life Assessment Project.[116, 117] The goal of this project was to culturally adapt, translate, validate, and normalize the SF-36® for use in Argentina, Australia, Belgium, Canada, Denmark, France, Germany, Italy, Japan, the Netherlands, Norway, Spain, Sweden, the United Kingdom, and the United States (including the Mexican-American version).[33]

Perceived well-being is subjective and refers to how an individual feels. Well-being is a psychological state that cannot be completely inferred from observable behavior.[118, 119] Factors limiting the rate of progress in monitoring health outcomes from the patient point of view have included the absence of measurement tools with good psychometric properties that are easily administered and well-documented. The SF-36® offers one approach for achieving such objectives.[33]

2.6 Perceived Physical Health Status

The following four subscales make up the perceived physical health status portion of the SF-36®. The sum of the four subscales is commonly used to compare subject data to normalized data regarding perceived physical health.

2.6.1 Physical Functioning

2.6.1.1 Background

The full length Physical Functioning (PF) scale was adopted without modification from the MOS questionnaire. This scale features 10 different questions which are capable of assessing physical function on 21 different levels.[33] The lowest possible score in this section means that the subject was "limited a lot in performing all physical activities including bathing or dressing due to health."[31] The highest possible score in this section means that the subject was able to perform "all types of physical activities including the most vigorous without limitations due to health."[31]

2.6.1.2 Statistics

An almost perfect negative correlation exists between the subject's score in the PF portion of the survey and their ability to perform every day activities. **Table 1** presents the percentages of MOS panel participants at each of the 10 levels of the PF scale that reported that their health kept them from working at a paying job (N=2,192).[33] These percentages range from a high of 68.9% for PF scores below 20 to a low of 3% to 6% for scores between 80 and 100.[33]

As of 2005, numerous studies[29, 120-125] have determined reliability estimates for the PF section of the SF-36®. These studies showed reliability values of 0.81 to 0.94 with a mean of 0.90. This exceeds the accepted standards for measures used in group comparison of 0.80.

2.6.1.3 Scoring

The sum of the ten coded PF questions (3a+3b+3c+3d+3e+3f+3g+3h+3i+3j) has a range of 10 to 30 with 30 being the highest perceived PF score and 10 the lowest. The possible raw score range is 20 (30-10=20). **Table 2** shows the questions for the PF portion of

the survey followed by their coded value. The scale is transformed by subtracting the lowest possible raw score from the actual raw score. The resulting number is divided by the possible raw score range, and the result is multiplied by 100.

For example, a raw PF score of 21 would be transformed using the equation: [(21-10)/20]x100. The resulting transformed PF score, for this example, is 55.

2.6.2 Role – Physical

2.6.2.1 Background

The Role – Physical (RP) portion of the SF-36® differs from previous versions in that it covers a more wide array of role limitations, including: limitations in the kind of work or other usual activities, reducing the amount of time spent in work or other usual activities, and the difficulty performing work or other usual activities.[33] Additionally, the SF-36® makes an important division between role limitations due to physical health and limitations due to mental problems (the Role – Mental section is discussed later in this chapter). The RP section has 4 items measured at 5 different levels.

2.6.2.2 Statistics

By the SF-36® making a division between role limitations in physical health and mental health, the researcher is able to achieve improved precision, from previous versions, in discriminating among groups known to differ in mental and psychiatric conditions.[33, 126, 127] The validity was evaluated by computing mean general health scale scores for the general United States population at each of the five RP scale levels **(Table 3)**. The means differed substantially and were ordered consistently with the scale levels (from a low of 46.4 to a high of 77.5, $F=56.1$, $p<0.001$)[33]

As of 2005, many authors[29, 120-125] have demonstrated the reliability of the RP section of the SF-36®. Reliability scores ranged from 0.60 to 0.96 with a mean of 0.82. This exceeds the accepted standards for measures used in group comparison of 0.80.

2.6.2.3 Scoring

The sum of the four coded RP questions (4a+4b+4c+4d) has a range of 4 to 8 with 8 being the highest perceived RP score and 4 the lowest. The possible raw score range is 4 (8-4=4). **Table 4** shows the questions for the RP portion of the survey followed by their coded value. The scale is transformed by subtracting the lowest possible raw score from the actual raw score. The resulting number is divided by the possible raw score range, and the result is multiplied by 100.

For example, a raw RP score of 6 would be transformed using the equation: [(6-4)/4]x100. The resulting transformed RP score, for this example, is 50.

2.6.3 Bodily Pain

2.6.3.1 Background

Questions pertaining to bodily pain (BP) were retained from previous versions of the MOS health survey with one addition.[33] An item measuring the extent of interference with normal activities due to pain was included because it is the best predictor (r = 0.84) of the total score for the Behavioral Effects of Pain scale used in the MOS.[128] The BP portion of the SF-36® contains 2 items with 11 different levels.

2.6.3.2 Statistics

A portion of the MOS analyzed bodily pain and its relationship with a person's ability to do work. **Table 5** shows the percentages of MOS panel participants at each of 10 levels of the BP scale who reported that their health kept them from working at a paying job

(N=2,187). A very large increase in disability (60.8% to 74.9%) was present for the three lowest levels with percentages ranging from a high of 74.9% to a low of 8.7%.[33]

As of 2005, many authors[29, 120-125] have demonstrated the reliability of the BP section of the SF-36®. Reliability scores ranged from 0.43 to 0.88 with a mean of 0.78. However, when the value of 0.43 is removed from mean calculations, the mean becomes 0.83 which exceeds the accepted standards for measures used in group comparison of 0.80.

2.6.3.3 Scoring

The sum of the two coded BP questions (7+8) has a range of 2 to 12 with 12 being the highest perceived BP score and 2 the lowest. The possible raw score range is 10 (12-2=10). **Table 6** shows the questions for the BP portion of the survey followed by their coded value. The scale is transformed by subtracting the lowest possible raw score from the actual raw score. The resulting number is divided by the possible raw score range, and the result is multiplied by 100.

For example, a raw BP score of 6 would be transformed using the equation: [(6-2)/12]x100. The resulting transformed BP score, for this example, is 33.3.

2.6.4 General Health

2.6.4.1 Background

The General Health (GH) scale is often used as a "criterion" in validating other scales because it is a direct measure of the subject's personal evaluation of their health.[33] Previous versions of the GH portion of the SF-36® combined the widely used single-item rating of health (in terms of excellent-poor) and four items from the Current Health scale constructed from the Health Perceptions Questionnaire.[33, 129, 130] Although this five item scale has performed well in studies, a number of potential improvements were achieved with the SF-

36® five-item version, the most important of which is it correlates highly (r = 0.96) with the General Health Rating Index (GHRI) summary score. A considerable amount of empirical evidence of validity has accumulated for the GHRI.[33, 128, 129] It is important to note that the GHRI has been shown to differentiate the impact of serious and minor acute symptoms. The GH scale has 5 items measuring 21 different levels.

2.6.4.2 Statistics

GH scale and item scores, in the MOS, have been linked to several indicators of the utilization of health care services.[87] **Table 7** shows that patients with less favorable general health perceptions have a significantly greater utilization rate for three types of health care services (hospitalization, annual office visits, and prescriptions per visit).[87] These findings are consistent with previous findings related to predicting outpatient utilization.[131] Interestingly, using models of insurance claims data,[132] annual expenditures for hospital services for those scoring in the bottom 20% of the GHRI totaled more than $900 in the following year compared with less than $300 for those scoring in the top 20%.[33]

As of 2005, many authors[29, 120-125, 133] have demonstrated the reliability of the GH section of the SF-36®. Reliability scores ranged from 0.78 to 0.95 with a mean of 0.84. This exceeds the accepted standards for measures used in group comparison of 0.80.

2.6.4.3 Scoring

The sum of the five coded GH questions (1+11a+11b+11c+11d) has a range of 5 to 25 with 25 being the highest perceived GH score and 5 the lowest. The possible raw score range is 20 (25-5=20). **Table 8** shows the questions for the GH portion of the survey followed by their coded value. The scale is transformed by subtracting the lowest possible

raw score from the actual raw score. The resulting number is divided by the possible raw score range, and the result is multiplied by 100.

For example, a raw GH score of 12 would be transformed using the equation: [(12-5)/20]x100. The resulting transformed GH score, for this example, is 35.

2.7 Perceived Mental Health Status

The following four subscales make up the perceived physical health status portion of the SF-36® Health Survey. The sum of the four subscales is commonly used to compare subject data to normalized data regarding perceived physical health.

2.7.1 Vitality

2.7.1.1 Background

A four-item measure of vitality (VT) (energy level and fatigue), not included in previous health status questionnaires, was added to the SF-36® to better capture differences in subjective well-being.[33] The selected items have an impressive track record in terms of empirical validity and contain a balance between favorably and unfavorably worded items to control for response set effects.[33] The VT section has 4 items measuring 21 different levels.

2.7.1.2 Statistics

Previous research has yielded thorough evaluations of the VT scale's psychometric properties and documented item-discriminate validity and scale reliability.[134] The scale's sensitivity to the impact of disease and treatment has been demonstrated in clinical trials involving patients with hypertension,[135] prostate disease,[136] and various states of AIDS.[137, 138]

As of 2005, many authors[29, 120-125] have demonstrated the reliability of the VT section of the SF-36®. Reliability scores ranged from 0.62 to 0.96 with a mean of 0.82. This exceeds the accepted standards for measures used in group comparison of 0.80.

2.7.1.3 Scoring

The sum of the four coded VT questions (9a+9e+9g+9i) has a range of 4 to 24 with 24 being the highest perceived VT score and 4 the lowest. The possible raw score range is 20 (24-4=20). **Table 9** shows the questions for the VT portion of the survey followed by their coded value. The scale is transformed by subtracting the lowest possible raw score from the actual raw score. The resulting number is divided by the possible raw score range, and the result is multiplied by 100.

For example, a raw VT score of 12 would be transformed using the equation: [(12-4)/20]x100. The resulting transformed VT score, for this example, is 40.

2.7.2 Social Functioning

2.7.2.1 Background

The Social Functioning (SF) scale extends measurements beyond the individual to capture both the quantity and quality of social activities with others.[33] The SF-36® improves upon previous health status surveys in that it has two SF items. Most measures of social activity ask respondents to report the number of contacts and activities or frequency of participation in different activities.[139] They do not usually ask respondents to indicate whether their social activities have been affected by their own health problems.[33] Thus most of the variation reported in social activities reflects non-health-related factors.[140] To measure health outcomes, the SF-36® items ask specifically about the impact of either physical health or emotional problems on social activities. The resulting two-item scale defines more levels of social functioning and achieves a higher level of precision than previous health status surveys.[33, 141] The SF section has 2 items measured at 9 different levels.

2.7.2.2 Statistics

As of 2005, many authors[29, 120-125] have demonstrated the reliability of the SF section of the SF-36®. Reliability scores ranged from 0.60 to 0.85 with a mean of 0.72.

2.7.2.3 Scoring

The sum of the two coded SF questions (6+10) has a range of 2 to 10 with 10 being the highest perceived SF score and 2 the lowest. The possible raw score range is 8 (10-2=8). **Table 10** shows the questions for the SF portion of the survey followed by their coded value. The scale is transformed by subtracting the lowest possible raw score from the actual raw score. The resulting number is divided by the possible raw score range, and the result is multiplied by 100.

For example, a raw SF score of 8 would be transformed using the equation: [(8-2)/8]x100. The resulting transformed SF score, for this example, is 75.

2.7.3 Role-Emotional

2.7.3.1 Background

The Role – Emotional (RE) portion of the SF-36® differs from previous versions in that it covers a more wide array of role limitations, including: limitations in the kind of work or other usual activities, reducing the amount of time spent in work or other usual activities, and the difficulty performing work or other usual activities.[33] This has been previously discussed in chapter II, section 2.6.2. The SF-36® items define two scales that distinguish between role limitations due to physical health and mental problems. Previous health surveys did not ask specifically about limitations due to emotional problems.[33] The RE section has 3 items measured at 4 different levels.

2.7.3.2 Statistics

Table 11 represents Mental Health scale scores for four levels of the RE scale from the general United States population (N=2,419). Large differences in average MH scale scores were observed for MOS patients across the four RE scale levels ($F=113.2$, $p<0.001$).[33] The differences in MH scores between RE levels are approximately equal. These results support the scoring and interpretation of the RE scale as a roughly "interval" measure.[33]

As of 2005, many authors[29, 120-125] have demonstrated the reliability of the RE section of the SF-36®. Reliability scores ranged from 0.60 to 0.96 with a mean of 0.80. This matches the accepted standards for measures used in group comparison of 0.80.

2.7.3.3 Scoring

The sum of the three coded RE questions (5a+5b+5c) has a range of 3 to 6 with 6 being the highest perceived RE score and 3 the lowest. The possible raw score range is 3 (6-3=3). **Table 12** shows the questions for the RE portion of the survey followed by their coded value. The scale is transformed by subtracting the lowest possible raw score from the actual raw score. The resulting number is divided by the possible raw score range, and the result is multiplied by 100.

For example, a raw RE score of 4 would be transformed using the equation: [(4-3)/3]x100. The resulting transformed RE score, for this example, is 33.3.

2.7.4 Mental Health

2.7.4.1 Background

The Mental Health (MH) portion of the SF-36® health survey was modified only in format from the five-item Mental Health scale (MHI-5).[33] It includes one or more items from each of the four major mental health dimensions (anxiety, depression, loss of

behavioral/emotional control, and psychological well-being) confirmed in factor analysis studies of the full length Mental Health Inventory.[142] The MH section has 5 items measured at 26 different levels.

2.7.4.2 Statistics

As of 2005, many authors[29, 120-125, 133, 138, 143, 144] have demonstrated the reliability of the MH section of the SF-36®. Reliability scores ranged from 0.67 to 0.95 with a mean of 0.83. This exceeds the accepted standards for measures used in group comparison of 0.80.

2.7.4.3 Scoring

The sum of the five coded MH questions (9b+9c+9d+9f+9h) has a range of 5 to 30 with 30 being the highest perceived MH score and 5 the lowest. The possible raw score range is 25 (30-5=25). **Table 13** shows the questions for the MH portion of the survey followed by their coded value. The scale is transformed by subtracting the lowest possible raw score from the actual raw score. The resulting number is divided by the possible raw score range, and the result is multiplied by 100.

For example, a raw MH score of 20 would be transformed using the equation: [(20-5)/30]x100. The resulting transformed MH score, for this example, is 50.

2.8 Normative Values for Perceived Health Status

Tables 14, 15, and 16 present descriptive statistics for each of SF-36® scales in the general United States population (males and females combined and separately). These include the mean, median (50^{th} percentile), 25^{th} and 75^{th} percentiles, standard deviation, observed range or scores, and the percentage scoring at the ceiling (highest possible score) and at the floor (lowest possible score) for each SF-36® scale.[33]

Tables 17, 18, and 19 present descriptive statistics for each of the SF-36® scales in the United States population for the combined gender age range of 18-24 years, the normative male scores aged 18-24 years, and the female normative data for that same age group respectively.[33]

Table 20 presents the sample size needed to detect 2-20 point differences between a group mean and a fixed normative value.[33]

Table 21 presents the SF-36® confidence intervals for individual respondents in the general United States population.[33]

2.9 Summary of Rationale for study

Dancers are a unique population whose performance involves a distinctive combination of both athletic and artistic qualities. While a fair amount of research has been completed using dancers as subjects, a vast majority of previous focus has been completed without meeting current scientific standards.[1, 14] As outlined in Chapter II, sections 2.2-2.4, dancers are at risk for injuries which may affect their quality of life, both relating to their activities of daily living and their artistic livelihood.

One of the most widely used measurement tools for self-perceived health status is the SF-36® health survey. Little is known about how perceived health status affects performance time lost due to injury in the dance population. This is surprising because, more so than traditional student-athletes, the dancer is placed under tremendous mental and physical stress. By implementing the use of this perceived health status tool, and comparing the results to pre-established normative values, we hope to better establish the relationship between injury, rehearsal characteristics, and quality of life in this population.

CHAPTER III

METHODS

3.1 Research Design

A cross-sectional, survey design was used to assess the correlation between reported time loss due to injury and perceived health status among collegiate dance students, in addition to the subsequent research questions. This data was collected by using the PAMQ **(Appendix 1a-d)**, which was developed and pilot tested for this research study, and the pre-validated SF-36® health survey **(Appendix 1b)**.

3.2 Participants

Seventy-seven (77) collegiate aged (18-24) student dancers at UNC-CH completed the survey instrument. This included students enrolled in dance classes and students who participated in at least one student run dance organization. Current health of the subject did not matter in regards to subject sampling. Sex, ethnicity, race, and age data were collected strictly for demographic purposes.

3.3 Instrumentation and Outcome Measures

The PAMQ (**Appendix 1**) contained four sections, including demographic information (**Appendix 1a**), perceived health status (SF-36®) (**Appendix 1b**), injury history (**Appendix 1c**), and dance specific questions (**Appendix 1d**). The background and scoring of

the SF-36® for each of the eight sub-sections have been discussed in detail in chapter II, sections 2.6-2.7.

3.4 Procedures

The instructors of UNC-CH dance classes were contacted via email regarding participation in this study in September-October 2009. Additionally, the presidents of various student run dance organizations were contacted in the same manner. After permission was granted, a member of the research team visited the dance classes and dance organizations at an arranged date near the end of the 2009 Fall semester (November 2009) to inform potential participants of what was required should they agree to participate. PAMQ packets were then handed to the subjects who agreed to participate. Each questionnaire packet included an introduction letter (**Appendix 2**), a fact sheet (**Appendix 3**), the PAMQ, a sealable envelope, an ink pen, and a UNC-CH campus mail envelope. Subjects who volunteered to participate were asked to complete the questionnaire on their own time so there was no conflict with class or rehearsal time. The introduction letter had directions to seal the PAMQ into the provided envelope and place the envelope, with the ink pen, into the provided campus mail envelope. Subjects were then asked to place the campus mail envelope into a campus mailbox so that it may be returned to the research facility. Completing the survey instrument and returning the PAMQ packet acted as implied consent and replaced the participant signing a consent form. All completed surveys were scanned into TeleForm (Cardiff, Vista, CA) for review. Once the data were reviewed by a member of the research team, it was then imported into Excel 2007 (Microsoft, Redmond, WA) and later SPSS Version 16.0 (SPSS Inc., Chicago, IL) for data analysis.

As a supplementary method of survey completion, the subjects were given access to a secure website which contained the PAMQ in the exact same format as the paper copy. The electronic version was completed in the same manner, but was able to be sent to the researcher via the internet. Of the 77 surveys completed, 23 were completed online. The online method of survey completion has been used previously and has shown to be secure. The submitted electronic surveys were imported directly into TeleForm (Cardiff, Vista, CA) for review. Records were kept indicating method of completion.

3.5 Scoring the SF-36®

The SF-36® portion of the PAMQ was scored as recommended by the SF-36® Health Survey: Manual and Interpretation Guide by Ware et al.[33] This process is described in chapter II, sections 2.6-2.7.

3.6 Data Analysis

For *Research Question 1*, Pearson Bivariate Correlation was used to determine the correlation between time loss due to injury and perceived health status among collegiate dance students. A secondary analysis was run to determine how, if at all, the eight SF-36® subscales were correlated. To address *Research Question 2,* separate one-sample t-tests were employed for the two main sub-components of the SF-36® (physical and mental health status) when comparing to sex matched normative values. A secondary analysis was run to determine how, if at all, the eight SF-36® subscales differed from set matched normative values. Pearson Bivariate Correlations were used for *Research Questions 3-4* to determine 1) the correlation between the reported hours of dance rehearsal per week and the perceived health status and 2) the correlation between the reported number of years of previous dance training and performance time lost due to injury. A secondary analysis was run for question 4

to determine the correlation between number of types of dance style training and performance time loss due to injury. For Research Question 5, a one-way analysis of variance (ANOVA) was used to determine the difference between reported performance time lost (in days) due to injury and the primary dance style type.

Table 22 lists the research questions with associated variables, data source, and method of statistical analyses.

CHAPTER IV

RESULTS

The purpose of this study was to determine the correlation between performance time loss due to injury and perceived health status in collegiate dance students. Additionally, we sought to investigate the characteristics associated with perceived physical and mental health status among this population. This was accomplished through the administration of the Performing Arts Medical Questionnaire, which was fully discussed in Chapter 3. A total of 314 surveys were distributed with 77 returned (24.5%). Of the 314 surveys administered, 89 were by paper, with 54 returning (60.7%) and 225 were via the internet, with 23 returning (10.2%) **Tables 23 and 24** provide demographic information on the participants of this study. **Table 25** provides the answers to questions pertaining to dance flooring.

4.1 Research Question 1

4.1.1 Primary Analysis

Time loss due to injury was first analyzed as the total number of days each subject spent completely sitting out from participation for all injuries. Subjects were removed from the data set if they reported limitations for more days than available during the Fall semester. No significant correlation was found when examining time loss due to injury to the physical ($N = 73$, $r = -.096$, $p = .421$) and mental ($N = 72$, $r = .006$, $p = .958$) SF-36® scales. Analysis was performed using the total number of days in which a subject reported limitation while

dancing. Again, subjects were removed from the data set if they reported limitations for more days than available during the Fall semester. Significant negative correlation was found when comparing the adjusted time variable to the physical (N = 73, r = -.239, p = .042) SF-36® scale (**Figure 5)**, but not when analyzing the mental (N = 72, r = -.036, p = .765) scale. Analysis was then performed using the total number of days spent completely sitting out from participation plus the total number of days in which participation was limited due to injury. Both the physical (N = 73, r = -.221, p = .061) and mental (N = 72, r = -.023, p = .849) scales showed no significance, although the physical scale was approaching significance. These results may be found in **Table 26.1**.

Of the eight SF-36® subscales **(Figure 1)**, Bodily Pain and Social Functioning were correlated with performance time limited (N = 73, r = -.339, p = .003; N = 72, r = -.233, p = .049) respectively. The same two subscales were correlated with total performance time affected (time lost + time limited) (N = 73, r = -.321, p = .006; N = 72, r = -.251, p = .033) respectively. The six other subscales were not correlated to any of the performance time lost or limited variables. These results may be found in **Table 27**.

4.1.2 Secondary Analysis

The eight SF-36® subscales showed correlation with each other in many cases. These relationships are shown as part of **Table 28**.

The Physical (sum of the four physical subscales) and Mental (sum of the four mental subscales) SF-36® scales showed significant results when compared to each other (N = 76, r = .595, p < .000). This relationship is represented in **Table 29** and graphically in **Figure 5**.

4.2 Research Question 2

4.2.1 Primary Analysis

Two one-sample t-tests were used to determine how physical and mental health status differs in collegiate dancers compared to gender matched normative values. Because the normative values for males and females differ from each other, and only four males responded to the survey, male subjects were removed from the data set. These values were compared to the normative values for females only instead of the age-matched normative. The relationship between physical health status normative values and measured values was not significant (t = 1.545, df = 72, p = 1.127). Conversely, the relationship between mental health status normative values and measured values was statistically significant (t = -2.033, df = 71, p = .046). These results may be found in **Table 30.**

4.2.2 Secondary Analysis

Eight one-sample t-tests were used to determine how physical and mental health status differs in collegiate dancers compared to gender matched normative values. Of the eight subscales, Physical Functioning (t = 7.100, df = 72, p < .001), Role – Physical (t = 1.991, df = 72, p = .050), Bodily Pain (t = -2.549, df = 72, p = .013), Vitality (t = -6.165, df = 72, p < .001), and Mental Health (t = -2.459, df = 72, p = .016) were statistically significant when compared to normative values. These results may be found in **Table 30**.

4.3 Research Question 3

An analysis was run to determine the correlation between the number of rehearsal hours per week and physical and mental SF-36® scores. The results may be found in **Table 31.** Both the physical (N = 77, r = .102, p = .377) and mental (N = 76, r = .030, p = .794) analyses showed no correlation with number of rehearsal hours per week.

4.4 Research Question 4

4.4.1 Primary Analysis

An analysis was run to determine the correlation between the maximum number of years of previous dance training and performance time loss due to injury. The results may be found in **Table 32**. No significant correlation was found between these variables (N = 76, r = -.081, p = .488).

4.4.2 Secondary Analysis

As a secondary analysis, subjects who have received training in one to six dance styles and subjects who have received training in more than six dance styles were split into two separate groups. Statistics were then run to determine the correlation between each of these two groups and performance time loss due to injury. The results may be found in **Table 32**. No significant correlation was found between these variables.

4.5 Research Question 5

A one-way ANOVA was used to determine differences in time lost across dance types. Performance time lost between the three dance styles (Ballet, Modern, and Other) was not significant (F = .406, df = 2,67, p = .843). Likewise, when the performance time limited and total performance time affected were analyzed between the three groups, the results were not significant (F = .822, df = 2,67, p = .539) and (F = .150, df = 2,67, p = .979) respectively. As a result of a non-significant omnibus finding, no post-hoc analyses were run. These results may be found in **Table 33**.

4.6 Neurovascular, Pain Symptoms, & Total Number of Injuries

Neurovascular symptoms were reported by the 77 subjects a total of 248 times (mean = 3.22 per subject). Likewise, pain was reported 265 times (mean = 3.44 per subject). The total number of injuries reported was 161 by 47 people (mean = 3.43 per subject). 30 people

did not report an injury. The total number of injuries sustained during dance activities were 111 by 39 people (mean = 2.85 per subject).

CHAPTER V

DISCUSSION

There are many gaps in the dance medicine literature. We hope that this research will help make pre-season screening for the dance population more efficient, specifically when identifying objective measures of mental health status. The most important findings in this study are: 1) mental health status in collegiate dancers differs significantly from age matched normative values, 2) mental and physical health status correlate among this population, and 3) injuries were reported at a low rate compared to the amount of times neurovascular and pain symptoms were reported.

We believe that the population utilized for this research study is unique to the literature because previous studies have focused on conservatory,[23, 74, 75, 103] professional,[16-18, 21, 34, 38, 39, 98, 103, 145, 146]or university dancers who are students of a dance major program.[44, 105]At UNC-CH, the students do not have the option to fulfill a dance major or minor, so all dance activities are extra-curricular and are strictly done for the love of dance. Additionally, due to recent campus construction, the university has little appropriate dance flooring, which forces many dance organizations to use inappropriate spaces.

5.1 Correlation between SF-36® Scores and Performance Time Loss

It is interesting that time loss due to injury was shown to not be correlated to mental and physical health status. It seems that missing time would be positively correlated with

both types of health status. A possible explanation for this is that the SF-36® utilizes a four week time frame, whereas we measured performance time loss over an entire semester. This may be a noteworthy oversight on our part because, at the time of survey completion, many of the injuries which were reported in the questionnaire had resolved. Unlike the correlation between the time spent completely sitting out from dance and health status, time limited was negatively correlated with perceived physical health status. It is intuitive that as the amount of performance time limited increased, the physical health status score would decrease. However, surprisingly, mental health status was not correlated with this increase in the number of performance days limited.

From these results, we believe that the role performance time loss plays on physical and mental health status is not significant although the addition of subjects and a more accurate record keeping method may show that there is a significant correlation between these variables. To what degree this interaction is clinically relevant is unknown because there is no current literature to suggest that previous injuries significantly affect perceived health status.

5.2 Mental and Physical Health Status

The mental and physical health status scales showed positive correlation. When physical health status decreases, it is easy to assume that mental health status would also decrease and vise-versa. However, it is unknown to what degree the two scales are meant to be correlated, but it seems that the developing body of the SF-36® would not make the survey twice as long as necessary, by including two sections which were correlated. One of the original goals when developing the SF-36® was to develop a short survey.[33]

In dancers, this correlation may be important because it shows that a decrease in physical ability to dance plays a significant role in mental status. While this relationship has been investigated previously in dancers,[34] it has rarely been objectively measured using the SF-36®.[34, 147, 148] In one case,[147] the SF-36® was used to determine return to activity after a surgical repair of the extensor hallucis longus tendon. In another case,[148] this measure was used to determine return to activity after a sesamoid fracture. Both of these case studies failed to evaluate the different factors associated with quality of life measurements but were primarily focused on return to full activity. In another study,[34] the SF-36® was compared to the "Dance Functional Outcome Score," a return to play questionnaire which is currently in development. Again, this study did not specifically analyze the factors associated with SF-36® quality of life scores among dancers but simply examined the difference between the two scales. Our study is unique to these previous studies because we focused on the factors associated with varying quality of life measurements in dancers.

A correlation between the physical and mental scales may be important to future researchers because it shows that dancers may be unable to separate physical stress and mental stress. As a college student, this separation is important to maintain a reasonable quality of life. These subjects are not receiving credit for their participation in dance but are active simply because they have a passion for dance.

Previous research[149] has demonstrated that each of the eight SF-36® subscales differ in collegiate varsity athletes compared to age matched normative values. Dancers are a population who frequently utilize athletic ability to perform complex movements in a controlled manner. However, in our study, dancers showed significant differences in five of

the eight subscales: physical functioning, role – physical, bodily pain, vitality, and mental health.

5.3 SF-36® and Rehearsal Hours per Week

A 2008 profile on dance training characteristics by Weiss, et al. showed that modern dancers spend an average of 8.3 +/- 6.0 hours in class and 17.2 +/- 12.6 hours in rehearsal each week.[150] In our study, dancers spent an average of 7.9 +/- 7.4 hours in class and rehearsal per week. Our standard deviation was large due to a large amount of variance within our population results (min = 1, max = 45). This variance was present across all levels and styles of dance. The overall average rehearsal time was small for two reasons. First, the dancers at UNC-CH are simply taking part in a dance organization because they enjoy the activity, not because they are receiving academic credit or planning for their future as a dancer. This is important because their primary concern is fulfilling requirements for graduation, not dancing. Second, a lack of rehearsal facilities limits the amount of time any singular group is able to rehearse.

Despite a large amount of variance within our population regarding rehearsal time per week, there was no correlation between physical and mental health scores and the number of hours of rehearsal per week. This may be partially due to results from our study which show that mental health status is low in dancers overall and is not specifically correlated with performance time per week. In other words, despite the variables associated with dance rehearsal, mental health status remained less than in the average population.

When we initially designed this study, beginner level dancers were included in the study population. We decided to remove them from the study because most of the students available were truly beginner dancers and rehearsed much less than the more experienced

dancers we used in our study. Including beginner dancers in the study may have helped to show increased correlation between the SF-36® scores and the number of rehearsal hours per week, but their results would have watered-down the significance of our other research questions.

5.4 Years of Dance Training and Performance Time Loss

The number of years of previous dance training did not correlate with performance time lost through the semester. These results are somewhat surprising because it shows that dancers at this level, who have had many years of experience, are just as likely to sustain an injury as those who have had limited experience. Likewise, dancers who have had experience in many different dance styles (6 or more) are just as likely to sustain injuries as those who have had training in less than 6 dance styles. These results show that, although experienced dancers may be better educated in appropriate dance techniques than inexperienced dancers, all dancers are just as likely to sustain injuries. A 1996 study by Wiesler, et al.[45] found that previous years of dance training was not a predictor of ankle flexibility and injuries in dancers. A study by Pigeon, et al.[151] found that 16% of adolescent females who had been participating in dance activities, most commonly ballet, showed a noticeably decreased growth velocity compared with a control group. This is significant because it demonstrates that training for dance at a young age may have profound effects on a dancer later in life. Our results argue that dance training has no effect on performance time lost, although we did not analyze intrinsic factors associated with each subject.

Experienced dancers, as previously discussed, are less likely to report injuries than the average population. Therefore, it may be hypothesized that a group of experienced

dancers may be sustaining injuries at an increased rate and simply not reporting them because they believe that they are experiencing the “normal wear and tear” of dance.

Additionally, experienced dancers may be participating in more difficult dance activities than inexperienced dancers. With this scenario, both groups of dancers would be challenging themselves in such a way that they sustain injuries at the same rate, even though the experienced dancers are performing more difficult dance rehearsals.

5.5 Dance Style and Performance Time Loss

The previous dance research shows that ballet and modern style dancers sustain injury rates at a higher frequency than other dance styles. Our results show that dance style is not correlated with performance time loss. We did not, however, analyze whether or not the frequency of injuries correlated to the amount of performance time lost. It may be possible that the ballet and modern dance students sustained a higher number of injuries but did not lose performance time at the same rate as other dance styles. In other words, it may be possible that ballet and modern dancers simply do not sit out from dance activities as frequently as dancers of other styles.

5.6 Education

Neurovascular and pain symptoms were reported 513 times while a total of 161 injuries were reported. In addition, each subject averaged 2.1 injuries reported and only 2.9 days completely sitting out from dance. This variance is important because it suggests that there is a lack of injury education among this population. The current structure of UNC-CH does not provide any type of dance education class. During the research team’s on-site visits, the need for dance injury education classes was specifically mentioned by the subjects. Most universities with dance major and minor curricular choices require dance kinesiology and

injury education classes in an attempt to better educate the dancers on how neurovascular and pain symptoms may develop into serious injuries. These symptoms are most likely due to a repeated stress placed on the nerve.[152] Previous studies[153] demonstrate this relationship by stating that neurovascular symptoms which go undiagnosed may cause serious future complications.

A possible secondary explanation for the lack of injury reporting was explained in a 2006 study by Rip, et al.[154] In this study it was demonstrated that a passion for dance may be associated with prolonged suffering from chronic injuries, more rigid involvement in dance activities when injured, and the tendency to report that pride is a major factor preventing one from obtaining adequate treatment. In this study, the authors concluded that passion for dance may constitute a risk factor for sustaining chronic injuries.

5.7 Flooring

The primary environmental factor implicated in the occurrence of athletic and dance injuries is the interaction between an athlete or dancer's shoe and the playing performing surface.[39, 69, 98, 155-157] It is difficult to determine the exact role the floor surface played in injury occurrence in our population, but while the research team was performing on-site visits to the dance organizations, it was obvious that the floors on which the dancers perform were inconsistent, at best. Proper, "sprung," dance floors were located off-campus and only available to the intermediate and advanced level ballet classes while the student dance team rehearsed on field-turf, cement, and a Marley-like material which was unrolled in three foot strips and left with large gaps and uneven wrinkles. Other groups reported dancing on cement, stone, asphalt, carpet, and plastic tiles.

A 1994 study by Milan[96] suggests that dance floor surface plays a significant role in injuries of the ballet dancer. Likewise, a 1978 study by Washington[69] found that floor surface plays a role in injuries to the theatrical dancer. In a study analyzing "poorly constructed" dance floors, Evans, et al.[39] suggest that floors are one of the most important extrinsic variables related in injuries.

5.8 Injury Prevalence

A majority of the injuries sustained during the testing period were to the lower extremity. This is consistent with previous epidemiological research.[1, 16-22, 24-26, 42, 45] A study by Liederbach[158] found that dancers perform an average of 200 jumps per 1.5 hour daily technique class, more than half of which involve single-leg landings and all of which involve intentional pointing of the feet, an aesthetic demand of the activity.[159] In addition, the forces placed at the knee during some jump landings have been measured to exceed 12 times body weight.[160]

5.9 Clinical Significance

From our study, we believe that we have successfully shown that mental health status of the university dancer may be unique to gender-matched normative values. This is significant clinically because we believe there has not previously been a consistently validated and accurate measure of mental health status. Because mental status is such an important factor when considering the performing artist, it may be clinically pertinent to obtain these objective measurements. The SF-36® health survey takes only a few minutes to complete and could easily be administered to an injured athlete.

The relationship between physical and mental health status may be important because it demonstrates that dancers have a difficult time separating physical and mental stressors. At

UNC-CH, this separation may be important because dance is simply an accessory activity to many of the students.

5.10 Limitations

The primary limitation to this study is that injury and performance time missed recall questions may be altered due to the survey being administered at the end of the semester. The small number of surveys returned also limits our findings. Previous comparable research[145] has used a continuous form of record keeping with an on-site Physical Therapist documenting the injuries and performance time missed as it was occurring. The current structure of the UNC-CH student-run dance organizations does not easily leave an opening for accurate and consistent medical coverage because rehearsals are held in numerous locations at varied times throughout the week. Therefore, record keeping is entirely based upon dancer reporting, which has been previously shown to be low in dancer populations.[2, 13, 23, 25, 38, 39, 91, 98, 105, 161, 162]

Although the SF-36® is a previously validated and reliable form of measuring quality of life, it only references the four weeks prior to the completion of the survey. Our survey compared the results from this four week time frame to the subject's performance time missed over a complete semester. Many of the injuries which the dancers suffered during the semester were resolved by the time the survey was completed. Therefore, results from the three month testing period time frame may not be reasonably compared to the four week SF-36® time frame, although, the research is not clear to this point.

Most dancers do not receive the education regarding injuries that is necessary to properly prevent serious injuries from developing. Thus, pain which may have been

perceived by the dancer as “common” dance pain may have, in fact, been pain which was deserving of being reported during survey completion.

5.11 Future Research

Because the SF-36® utilizes a four week time frame, future research using this measure should be conducted by administering the questionnaire every four weeks. Quality of life status could then be measured as the dancer progresses through an injury to recovery continuum.

Normative SF-36® values should be established for the male and female dancer population by administering the survey to a large population. This is important because this population showed to be statistically significant in many of the eight subscales when compared to gender matched normative values.

5.12 Conclusions

The results from our study suggest that the SF-36® health survey should be administered during a pre-season injury screen to create a baseline value for individual dancers because, as a group, dancers show significantly different results than sex-matched normative values. Our study suggests that these baseline values will be difficult to correlate with any characteristics of injury in this specific dance population. However, if the survey is administered every four weeks after an injury, return to baseline progress could be measured in a way that was difficult to previously measure in this population, specifically, the mental aspect of injury rehabilitation.

From our study, physical and mental health status correlated in an unexpected way. It is necessary for a practitioner to understand that dancers may have trouble disconnecting the

physical and mental aspect of dance. The collegiate dancer may be unable to demonstrate that physical stress does not necessarily need to alter mental stress, and vise-versa.

Additionally, dance education classes should be made available to UNC-CH students despite lacking a dance major or minor because a large number of students participate in dance activities. A class such as this should better educate the student dancer on how to properly identify an injury. Within the curricula of this class, a lesson on identifying dangerous psychological variables, such as excessive passion, may be helpful.

TABLE 1: Percentage of MOS patients that cannot work because of health problems, ten levels of the physical functioning (PF) scale (N=2,192)[33]

	PF Scale			
Levels*	Range	Mean	N	% Cannot Work
1	100	100	338	4.7
2	90-99.9	95	253	3.2
3	80-89.9	87.6	360	6.1
4	70-79.9	77.3	291	18.9
5	60-69.9	67.7	207	24.2
6	50-59.9	55.3	255	36.9
7	40-49.9	44.9	55	38.2
8	30-39.9	37	128	61.7
9	20-29.9	26.9	112	54.5
10	0-19.9	10.8	193	68.9

* 21 PF scale levels collapsed to 10

TABLE 2: Physical Functioning SF-36® questions and their coded values[33]

	Question
3a	Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports
3b	Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf
3c	Lifting or carrying groceries
3d	Climbing several flights of stairs
3e	Climbing one flight of stairs
3f	Bending, kneeling, or stooping
3g	Walking more than a mile
3h	Walking several blocks
3i	Walking one block
3j	Bathing or dressing yourself

Response Choices	Coded Item Value
Yes, limited a lot	1
Yes, limited a little	2
No, not limited at all	3

TABLE 3: Mean General Health scores for respondents at five levels of the Role-Physical scale, general United States population (N=2,422)[33]

			General Health Evaluation*	
Score	f	%	Mean	Transformed
100	1580	65.2	77.5	100
75	212	8.8	68.5	71.1
50	141	5.8	61.3	47.9
25	172	7.1	53.4	22.5
0	317	13.1	46.4	0

* Average GH Scale Score

Note: $F = 56.1$, $p < 0.001$, for differences among means across levels

TABLE 4: Role-Physical SF-36® questions and their coded values[33]

	Question
4a	Cut down the amount of time you spent on work or other activities
4b	Accomplished less than you would like
4c	Were limited in the kind of work or other activities
4d	Had difficulty performing the work or other activities (for example, it took extra effort)

Response Choices	Coded Item Value
Yes	1
No	2

TABLE 5: Percentage of MOS patients that cannot work because of health problems at ten levels of the Bodily Pain scale (N=2,187)[33]

	Bodily Pain Scale			
Levels[#]	Range	Scale Mean	(N)	Criterion (%)*
1	100	100.0	350	12
2	90-99.9	92.5	201	10.1
3	80-89.0	83.5	329	8.7
4	70-79.9	72.8	288	12.9
5	60-69.9	61.8	284	18.2
6	50-59.9	51.4	230	27.5
7	40-49.9	41.3	185	34.7
8	30-39.9	31.2	147	60.8
9	20-29.9	21.9	102	62.5
10	0-19.9	7.0	71	74.9

11 Bodily Pain scales collapsed to 10; level 10 collapses two scale levels

* Criterion = Does your health keep you from working at a paying job?

TABLE 6: Bodily Pain SF-36® questions and their coded values[33]

	Question
7	How much bodily pain have you had during the past 4 weeks?
8	During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

7	Response Choices	Coded Item Value
	None	6.0
	Very mild	5.4
	Mild	4.2
	Moderate	3.1
	Severe	2.2
	Very severe	1.0

If both questions 7 and 8 are answered

8	Response Choices	Coded Item Value
	Not at all*	6
	Not at all#	5
	A little bit	4
	Moderately	3
	Quite a bit	2
	Extremely	1

* If precode value for 8 = 1 and precode value for 7 = 1

If precode value for 8 = 1 and precode value for 7 = 2 through 6

If question 7 is not answered

8	Response Choices	Coded Item Value
	Not at all	6.0
	A little bit	4.8
	Moderately	3.5
	Quite a bit	2.3
	Extremely	1.0

TABLE 7: Health care utilization rates for patients differing in General Health evaluations[87]

General Health Item 1	Scale Score	Percent Hospitalized Past 3 Months	Annual Visit Rate per Year	Prescriptions Per Visit
Excellent	100	2.7	3.09	0.8
Very Good	84	3.5	3.84	1.1
Good	61	5.9	4.88	1.7
Fair	25	14.5	6.55	2.6
Poor	0	25.8	8.11	3.1

TABLE 8: General Health SF-36® questions and their coded values[33]

	Question
1	In general, would you say your health is:
11a	I seem to get sick a little easier than other people
11b	I am as healthy as anybody I know
11c	I expect my health to get worse
11d	My health is excellent

1	Response Choices	Coded Item Value
	Excellent	5.0
	Very good	4.4
	Good	3.4
	Fair	2.0
	Poor	1.0

11a & 11c	Response Choices	Coded Item Value
	Definitely True	1
	Mostly True	2
	Don't Know	3
	Mostly False	4
	Definitely False	5

11b & 11d	Response Choices	Coded Item Value
	Definitely True	5
	Mostly True	4
	Don't Know	3
	Mostly False	2
	Definitely False	1

TABLE 9: Vitality SF-36® questions and their coded values[33]

	Question
9a	Did you feel full of pep?
9e	Did you have a lot of energy?
9g	Did you feel worn out?
9i	Did you feel tired?

9a & 9e	Response Choices	Coded Item Value
	All of the time	6
	Most of the time	5
	A good bit of the time	4
	Some of the time	3
	A little of the time	2
	None of the time	1

9g & 9i	Response Choices	Coded Item Value
	All of the time	1
	Most of the time	2
	A good bit of the time	3
	Some of the time	4
	A little of the time	5
	None of the time	6

TABLE 10: Social Functioning SF-36® questions and their coded values[33]

	Question
6	During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?
10	During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

6 Response Choices	Coded Item Value
Not at all	5
Slightly	4
Moderately	3
Quite a bit	2
Extremely	1

10 Response Choices	Coded Item Value
All of the time	1
Most of the time	2
Some of the time	3
A little of the time	4
None of the time	5

TABLE 11: Mean Mental Health scores for respondents at four levels of the Role-Emotional scale, general United States population (N=2,419)[33]

	Prevalence		Mental Health Scale	
Score	f	%	Mean	Transformed
100	1687	69.7	80.8	100.0
66.7	267	11.0	70.4	64.3
33.3	197	8.2	61.1	32.3
0	268	11.1	51.7	0.0

Note: $F = 113.2$, $p < 0.001$, for differences among means across levels.

TABLE 12: Role-Emotional SF-36® questions and their coded values[33]

	Question
5a	Cut down the amount of time you spent on work or other activities
5b	Accomplished less than you would like
5c	Didn't do work or other activities as carefully as usual

Response Choices	Coded Item Value
Yes	1
No	2

TABLE 13: Mental Health SF-36® questions and their coded values[33]

	Question
9b	Have you been a very nervous person?
9c	Have you felt so down in the dumps that nothing could cheer you up?
9d	Have you felt calm and peaceful?
9f	Have you felt downhearted and blue?
9h	Have you been a happy person?

9b, 9c, & 9f	Response Choices	Coded Item Value
	All of the time	1
	Most of the time	2
	A good bit of the time	3
	Some of the time	4
	A little of the time	5
	None of the time	6

9d & 9h	Response Choices	Coded Item Value
	All of the time	6
	Most of the time	5
	A good bit of the time	4
	Some of the time	3
	A little of the time	2
	None of the time	1

TABLE 14: Normative values for the general United States population, total sample[33]

Total Sample (N=2,474)		PF	RP	BP	GH	VT	SF	RE	MH
	Mean	84.15	80.96	75.15	71.95	60.86	83.28	81.26	74.74
	25th Percentile	70.00	50.00	61.00	57.00	45.00	75.00	66.67	64.00
	50th Percentile (median)	90.00	100.00	74.00	72.00	65.00	100.00	100.00	80.00
	75th Percentile	100.00	100.00	100.00	85.00	75.00	100.00	100.00	88.00
	Standard Deviation	23.26	34.00	23.69	20.34	20.96	22.69	33.04	18.05
	Range	0-100	0-100	0-100	5-100	0-100	0-100	0-100	0-100
	% Ceiling	38.79	70.85	31.85	7.40	1.50	52.32	71.01	3.91
	% Floor	0.84	10.33	0.58	0.00	0.52	0.64	9.61	0.00

TABLE 15: Normative values for the general United States population, total sample, males only[33]

Males (N=1,055)		PF	RP	BP	GH	VT	SF	RE	MH
	Mean	87.18	86.61	76.88	73.48	63.59	85.23	83.29	76.37
	25th Percentile	80.00	75.00	62.00	62.00	50.00	75.00	66.67	68.00
	50th Percentile (median)	95.00	100.00	84.00	75.00	65.00	100.00	100.00	80.00
	75th Percentile	100.00	100.00	100.00	87.00	80.00	100.00	100.00	88.00
	Standard Deviation	21.29	30.88	22.97	20.02	20.04	21.28	31.31	17.16
	Range	0-100	0-100	0-100	5-100	0-100	0-100	0-100	12-100
	% Ceiling	45.18	75.10	34.26	8.79	2.25	55.80	73.44	4.75
	% Floor	0.67	7.92	0.32	0.00	0.23	0.35	7.96	0.00

TABLE 16: Normative vales for the general United States population, total sample, females only[33]

Females (N=1,412)		PF	RP	BP	GH	VT	SF	RE	MH
	Mean	81.47	77.77	73.59	70.61	58.43	81.53	79.47	73.25
	25th Percentile	65.00	50.00	52.00	57.00	45.00	62.50	66.67	64.00
	50th Percentile (median)	90.00	100.00	74.00	72.00	60.00	87.50	100.00	80.00
	75th Percentile	100.00	100.00	100.00	85.00	75.00	100.00	100.00	88.00
	Standard Deviation	24.60	36.20	24.25	21.50	21.47	23.74	34.43	18.68
	Range	0-100	0-100	0-100	5-100	0-100	0-100	0-100	0-100
	% Ceiling	33.05	67.14	29.64	6.13	0.82	49.21	68.85	3.12
	% Floor	0.99	12.37	0.81	0.00	0.74	0.86	11.06	0.06

TABLE 17: Normative values for the general United States population, total sample, ages 18-24, males & females[33]

Ages 18-24 Males & Females (N=173)		PF	RP	BP	GH	VT	SF	RE	MH
	Mean	92.13	89.14	80.82	76.71	62.53	83.88	83	74.73
	25th Percentile	95.00	100.00	72.00	67.00	50.00	75.00	66.67	64.00
	50th Percentile (median)	100.00	100.00	84.00	82.00	65.00	87.50	100.00	80.00
	75th Percentile	100.00	100.00	100.00	87.00	75.00	100.00	100.00	88.00
	Standard Deviation	18.34	26.81	21.33	18.22	19.76	20.64	31.12	18.09
	Range	0-100	0-100	12-100	15-100	10-100	12.5-100	0-100	10-100
	% Ceiling	61.90	82.00	43.50	8.70	2.20	48.00	72.00	2.90
	% Floor	0.60	5.40	0.00	0.00	0.00	0.00	7.80	0.00

TABLE 18: Normative values for the general United States population, total sample, ages 18-24, males only[33]

Ages 18-24		PF	RP	BP	GH	VT	SF	RE	MH
Males	Mean	94.14	93.5	79.62	76.95	65.41	86.09	87.49	78.02
(N=71)	25th Percentile	95.00	100.00	62.00	62.00	55.00	75.00	100.00	68.00
	50th Percentile (median)	100.00	100.00	84.00	80.00	70.00	100.00	100.00	80.00
	75th Percentile	100.00	100.00	100.00	90.00	80.00	100.00	100.00	88.00
	Standard Deviation	16.30	21.39	21.47	17.87	19.11	20.18	27.50	16.05
	Range	15-100	0-100	12-100	25-100	25-100	25-100	0-100	20-100
	% Ceiling	68.70	89.00	41.80	12.10	2.10	54.40	77.90	4.70
	% Floor	0.00	3.50	0.00	0.00	0.00	0.00	6.40	0.00

TABLE 19: Normative values for the general United States population, total sample, ages 18-24, females only[33]

Ages 18-24		PF	RP	BP	GH	VT	SF	RE	MH
Females	Mean	90.18	84.91	82	76.48	59.71	81.73	78.63	71.53
(N=102)	25th Percentile	90.00	75.00	72.00	72.00	45.00	75.00	66.67	64.00
	50th Percentile (median)	100.00	100.00	84.00	82.00	60.00	87.50	100.00	76.00
	75th Percentile	100.00	100.00	100.00	87.00	75.00	100.00	100.00	84.00
	Standard Deviation	20.04	30.73	21.31	18.66	20.09	20.98	33.86	19.44
	Range	0-100	0-100	22-100	15-100	10-100	12-100	0-100	24-100
	% Ceiling	55.20	75.10	45.10	5.30	2.40	41.80	66.30	1.10
	% Floor	1.10	7.30	0.00	0.00	0.00	0.00	9.20	0.00

TABLE 20: Sample size needed to detect 2-20 point differences between a group mean and a fixed norm[33]

	Number of Points Difference			
Scale	2	5	10	20
Physical Functioning	1067	171	44	12
Role-Physical	2282	366	92	24
Bodily Pain	1103	177	45	12
General Health	818	132	34	9
Vitality	866	139	36	10
Social Functioning	1012	163	41	11
Role-Emotional	2152	345	87	22
Mental Health	644	104	27	8

Note: Estimates assume alpha = 0.05, two-tailed t-test, power-80%[163]

TABLE 21: SF-36® confidence intervals for individual respondents, general United States population

	Confidence Interval		
Scale	68%*	90%#	95%@
Physical Functioning	6.2	10.2	12.3
Role-Physical	11.3	18.7	22.6
Bodily Pain	7.5	12.4	15
General Health	8.8	14.7	17.6
Vitality	7.8	13	15.6
Social Functioning	12.8	21.3	15.7
Role-Emotional	14	23.2	28
Mental Health	7.2	12	14

* 68% confidence interval equals 1 standard error of measurement (SEM)

90% confidence interval equals 1.64 SEMs

@ 95% confidence interval equals 2 SEMs

TABLE 22: Data analysis table

	Research Question	Independent Variables	Dependent Variables	Data Source	Analyses
1	Is there a correlation between total time loss due to injury (in days) and current perceived health status in collegiate dance students?	Total time loss	Mean perceived physical and mental health status scores	PAMQ (Sum of time lost); SF-36®	Pearson Bivariate Correlation
	a Physical health status				
	b Mental health status				
2	How does perceived physical and mental health status differ in collegiate dancers compared to age related normative values?	Normative perceived physical and mental health status scores	Mean perceived physical and mental health status scores	Manual & Interpretation guide; SF-36®	One Sample T-Tests
	a Physical health status				
	b Mental health status				
3	Is there a correlation between reported hours of dance rehearsal per week and perceived health status in collegiate dance students?	Reported hours of dance rehearsal per week	Perceived health status scores	PAMQ (Sum of dance hours per week); SF-36®	Pearson Bivariate Correlation
	a Physical health status				
	b Mental health status				
4	Is there a correlation between the number of years of previous dance training and performance time lost due to injury?	Total number of years of previous dance training	Performance time lost due to injury	PAMQ (Maximum dance training years); PAMQ (Sum of time lost)	Pearson Bivariate Correlation
5	Is there a difference in performance time lost (in days) due to injury among dance style types (Ballet, Modern, Percussive, and Mixture)?	Dance style type	Performance time lost due to injury	PAMQ (Reported primary dance style); PAMQ (Sum of time lost)	One-Way ANOVA

TABLE 23: Demographic Information

	N	Female	Male				
Sex	77	73 (94.8%)	4 (5.2%)				
	N	Mean	Std. Deviation				
Age	75	19.84	1.661				
	N	Caucasian	African American	Asian	Native Hawaiian / Pacific Islander	Hispanic	Other
Race	75	59 (78.7%)	5 (6.7%)	3 (4.0%)	1 (1.3%)	2 (2.6%)	5 (6.7%)
	N	Right	Left	Either			
Dominant Arm	77	69 (89.6%)	7 (9.1%)	1 (1.3%)			
Dominant Leg	77	49 (63.6%)	14 (18.2%)	14 (18.2%)			
	N	Undergraduate	Graduate	Faculty / Staff	Other		
University Classification	77	72 (93.5%)	4 (5.2%)	0	1 (1.3%)		

TABLE 24: Dance specific demographic information

	N	Mean	Std. Deviation	1	2	3	4	
Number of Dance Groups / Classes per Subject	77	2.12	1.013	27 (35.1%)	22 (28.6%)	20 (26.0%)	8 (10.4%)	
	N	Ballet	Modern	Jazz	Tap	Hip Hop	Contemporary	Other
Primary Dance Style	77	33 (42.9%)	11 (14.3%)	12 (15.6%)	5 (6.5%)	3 (3.9%)	11 (14.3%)	2 (2.6%)
Secondary Dance Style	77	16 (20.8%)	6 (7.8%)	24 (31.2)	8 (10.4%)	4 (5.2%)	11 (14.3%)	3 (3.9%)
	N	Mean	Std. Deviation	Minimum	Maximum			
Hours per Week Spent Dancing as Part of UNC Groups	77	6.32	5.823	0	45			
Hours per Week Spent Dancing as Part of Non-UNC Groups	77	1.62	2.819	0	15			
Amount of Warm-up Time (min)	77	18.51	11.299	0	45			
	N	Excellent	Good	Average	Poor	Very Poor		
Posture While Dancing	76	17 (22.4%)	43 (56.6%)	14 (18.4%)	2 (2.6%)	0 (0.0%)		

TABLE 25: Floor specific demographic information

	N	Cement	Stone	Hardwood Floor Not Designed for Dancing	Hardwood Floor Designed for Dancing	Carpet	Plastic	Marley
Frequency	77	14 (18.2%)	6 (7.8%)	51 (66.2%)	54 (70.1%)	5 (6.5%)	18 (23.4%)	5 (5.6%)

	N	I have not sustained any injuries	Yes	No	I do not know
In your opinion, have you sustained any injuries DIRECTLY due to the floor surface on which you dance?	77	9 (11.9%)	16 (20.8%)	16 (20.8%)	36 (46.8%)

TABLE 26: SF-36® & performance time loss correlation

	N	Mean	Std. Deviation	Minimum	Maximum
Time Loss Due to Injury	76	3.01	8.59	0	56
Time Limited Due to Injury	73	7.44	12.63	0	63
Total Time Loss + Limited Due to Injury	73	10.45	17.42	0	68
	Physical Health Status			Mental Health Status	
Time Loss Due to Injury	N = 73, r = -.096, p = .421			N = 72, r = .006, p = .958	
Time Limited Due to Injury	N = 73, r = -.239*, p = .042			N = 72, r = -.036, p = .765	
Total Time Loss + Limited Due to Injury	N = 73, r = -.221, p = .061			N = 72, r = -.023, p = .849	

* = Correlation is significant at the 0.05 level (2-tailed)

TABLE 27: SF-36® subscale & performance time correlation
N = 73 unless otherwise noted

Subscale	Time Lost	Time Limited	Total (Lost + Limited)
Physical Functioning	r = .010, p = .581	r = -.162, p = .170	r = -.113, p = .342
Role-Physical	r = -.093, p = .436	r = -.091, p = .445	r = -.111, p = .348
Bodily Pain	r = -.153, p = .198	r = -.399**, p = .003	r = -.321**, p = .006
General Health	r = -.011, p = .925	r = -.169, p = .154	r = -.128, p = .282
Vitality	r = -.018, p = .882	r = .098, p = .410	r = .062, p = .601
Social Functioning	N = 72, r = -.166, p = .162	N = 72, r = -.233*, p = .049	N = 72, r = -.251*, p = .033
Role-Emotional	r = .082, p = .492	r = -.085, p = .475	r = -.021, p = .858
Mental Health	r = .058, p = .625	r = .185, p = .117	r = .163, p = .169

* = Correlation is significant at the 0.05 level (2-tailed)
** = Correlation is significant at the 0.01 level (2-tailed)

TABLE 28:

SF-36 SUBSCALE CORRELATIONS (N = 77, Unless Otherwise Noted)								
	Physical Functioning	Role - Physical	Bodily Pain	General Health	Vitality	Social Functioning (N = 76)	Role - Emotional	Mental Health
Physical Pain		**r = .384, p < .001**	**r = .355, p < .002**	**r = .413, p < .001**	r = .156, p = .175	r = .132, p = .256	**r = .316, p = .005**	r = -.086, p = .460
Role - Physical	**r = .384, p < .001**		**r = .498, p < .000**	*r = .498, p = .021*	r = .169, p = .141	r = .173, p = .136	**r = .720, p < .001**	r = .094, p = .418
Bodily Pain	**r = .355, p < .002**	**r = .498, p < .001**		**r = .300, p < .008**	r = .188, p = .102	**r = .314, p = .006**	**r = .381, p = .001**	r = .110, p = .341
General Health	**r = .413, p < .001**	r = *.263, p = .021*	**r = .300, p < .008**		**r = .354, p = .002**	**r = .435, p < .001**	**r = .328, p = .004**	**r = .323, p = .004**
Vitality	r = .156, p = .175	r = .169, p = .141	r = .188, p = .102	**r = .354, p < .002**		**r = .319, p = .005**	r = .189, p = .099	**r = .628, p < .001**
Social Functioning (N = 76)	r = .132, p = .256	r = .173, p = .136	r = .314, p < .006	**r = .435, p < .001**	**r = .319, p = .005**		*r = .255, p = .026*	**r = .523, p < . 001**
Role - Emotional	**r = .316, p < .005**	**r = .720, p < .001**	**r = .381, p < .001**	**r = .328, p < .004**	r = .189, p = .099	r = .255, p = .026		r = .172, p = .135
Mental Health	r = -.086, p = .460	r = .094, p = .418	r = .110, p = 341	**r = .323, p < .004**	**r = .628, p < .001**	**r = .523, p < .001**	r = .172, p = .135	
Bold = Correlation is significant at the 0.01 level (2-tailed)								
Italics = correlation is significant at the 0.05 level (2-tailed)								

TABLE 29: SF-36® physical & mental scale correlation

	Mental Scale
Physical Scale	N = 76, r = .595, p < .001

TABLE 30: SF-36® measured & normative values

	N	Normative Mean	Measured Mean	Measured Std. Deviation	SEM	t	df	p	Mean Difference	Confidence Interval	
Physical Health Status	73	303.44	313.52	55.762	6.526	1.545	72	0.127	10.081	-2.9297	23.0908
Mental Health Status	72	292.69	279.6	54.631	6.438	-2.033	71	0.046	-13.088	-25.9258	-0.2505
SUBSCALES											
Physical Functioning	73	81.47	91.919	12.573	1.472	7.1	72	0.001	10.448	7.5143	13.3813
Role - Physical	73	77.77	84.247	27.797	3.254	1.991	72	0.05	6.477	-0.009	12.9622
Bodily Pain	73	73.59	68.48	12.13	2.005	-2.549	72	0.013	-5.111	-9.1072	-1.1139
General Health	73	70.61	68.877	18.06	2.114	-0.82	72	0.415	-1.733	-5.947	2.4804
Vitality	73	58.43	47.26	15.479	1.812	-6.165	72	0.001	-11.169	-14.781	-7.558
Social Functioning	72	81.54	78.819	17.757	2.093	-1.3	71	0.198	-2.721	-6.8933	1.4521
Role - Emotional	73	79.47	85.388	29.39	3.44	1.72	72	0.09	5.918	-0.9391	12.7753
Mental Health	73	73.25	69.041	14.622	1.711	-2.459	72	0.016	-4.209	-7.6204	-0.7974

TABLE 31: SF-36® measured values & rehearsal hours

	Rehearsal Hours Per Week
Physical Health Status	N = 77, r = .102, p = .843
Mental Health Status	N = 76, r = .030, p = .794

TABLE 32: Dance style training & performance time lost

	N	Mean	Std. Deviation	Minimum	Maximum	SEM
Time Lost (Group 1-6)	43	1.93	5.73	0.00	30.00	0.87
Time Lost (Group 7+)	29	4.72	11.63	0.00	56.00	2.16
	T	df	P	Mean Difference	Lower 95% CI	Upper 95% CI
Comparing Means	-1.35	70.00	0.18	-2.79	-6.91	1.32

TABLE 33: Primary dance style & performance time lost

		Sum of Squares	df	Mean Square	F	p
Time Lost	Between Groups	2360.304	2	1180.152	0.66	0.52
	Within Groups	1323570514	74	1788.615		
	Total	134717.818	76			
Time Limited	Between Groups	3248.778	2	1624.389	0.244	0.784
	Within Groups	493405.534	74	6667.642		
	Total	496654.312	76			
Total Time	Between Groups	4493.483	2	2246.742	0.19	0.827
	Within Groups	873092.465	74	11798.547		
	Total	877585.948	76			

FIGURE 1: Levels of SF-36® scales

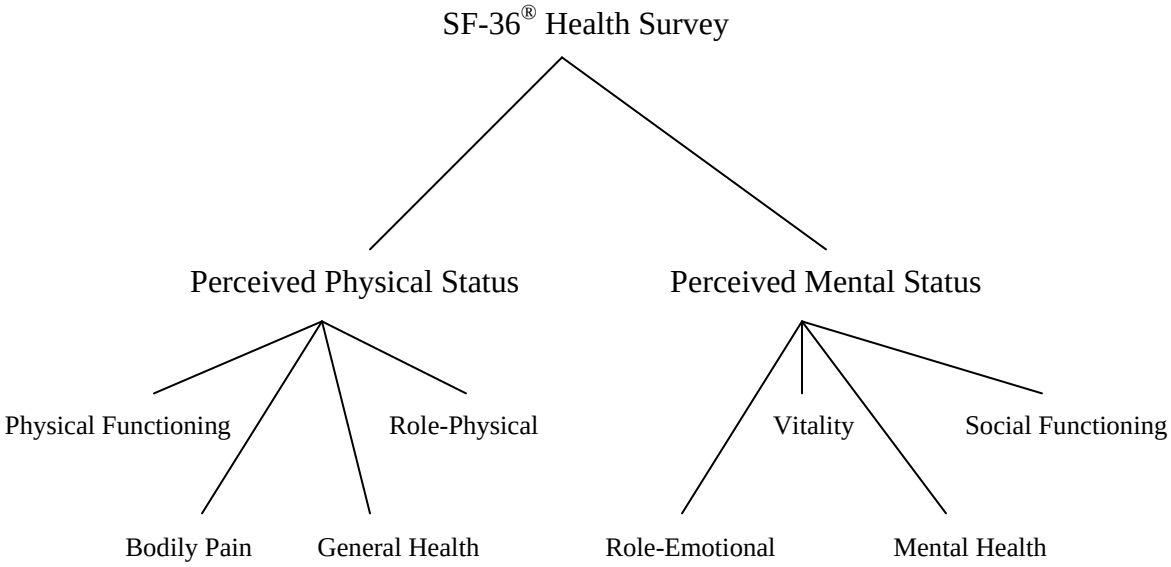


FIGURE 2: Categories of dance styles

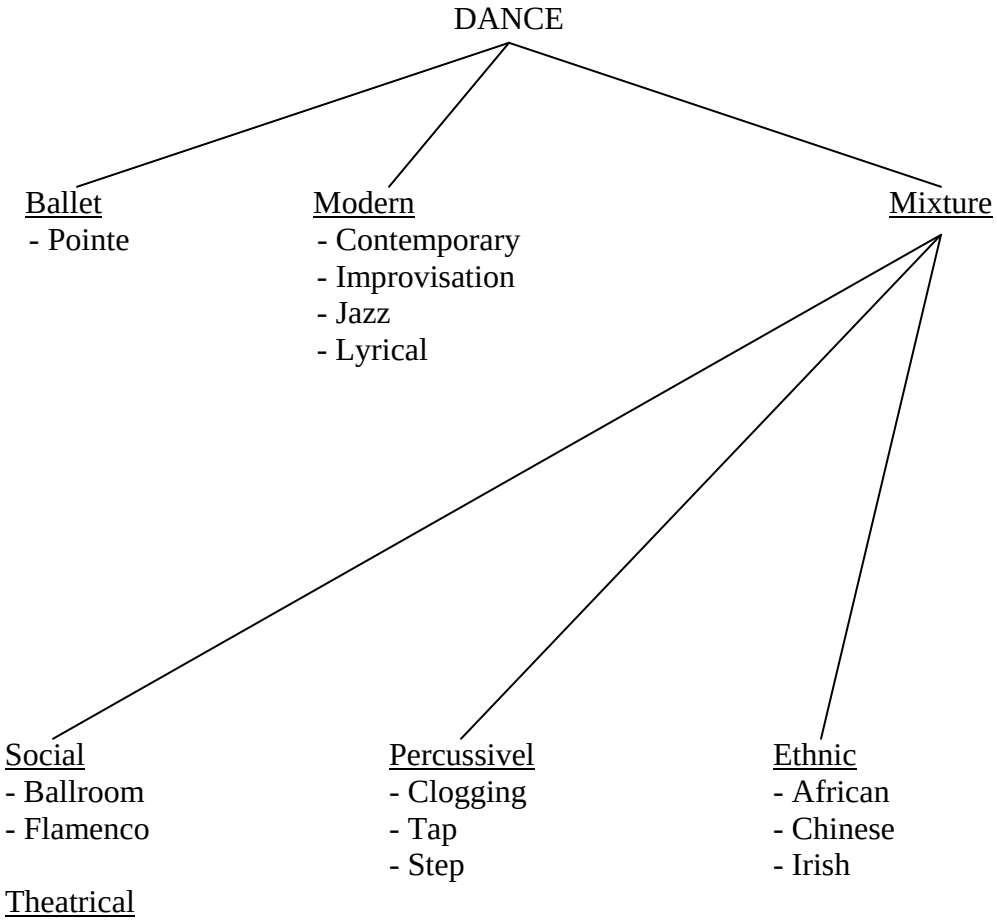


FIGURE 3: Dancer “en pointe”[43]

Figure 4: The 5 classical ballet positions[42]

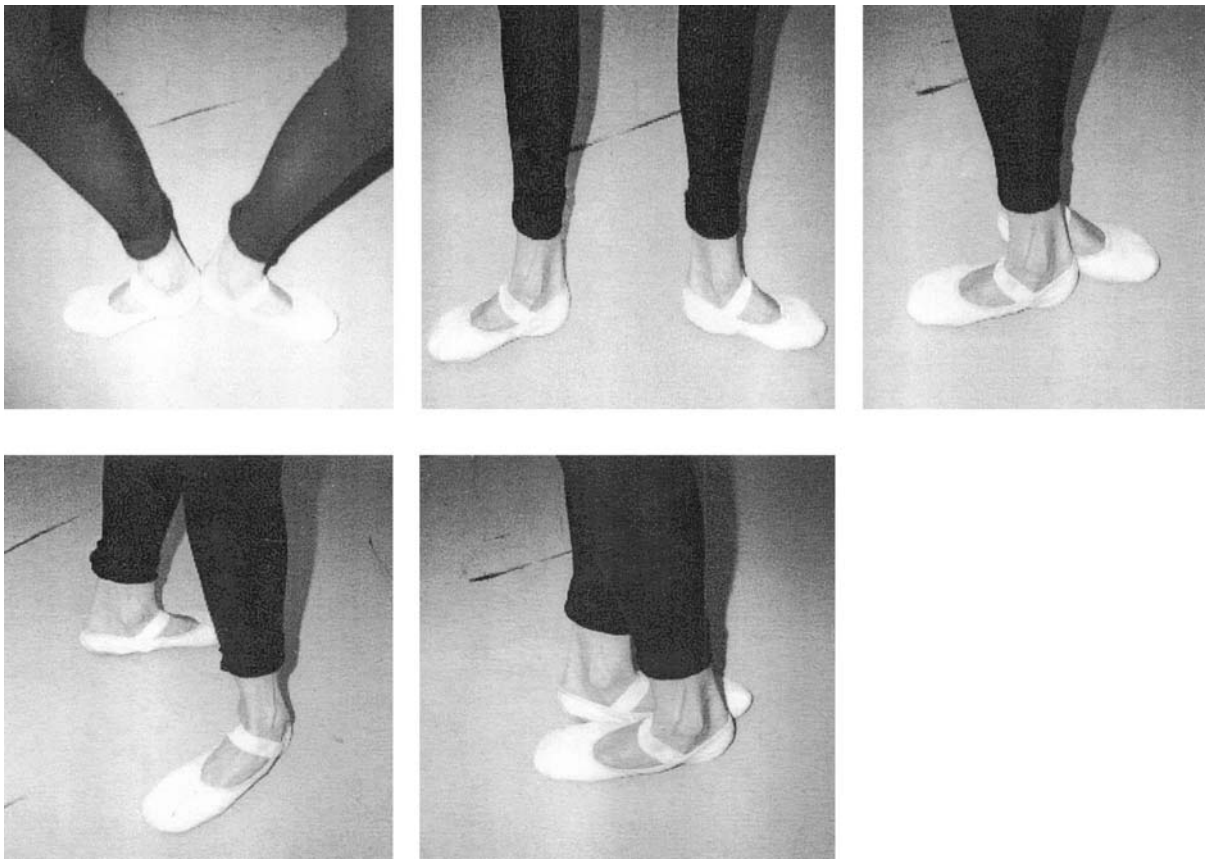


FIGURE 5: SF-36® mental scale & performance days limited correlation scatter plot

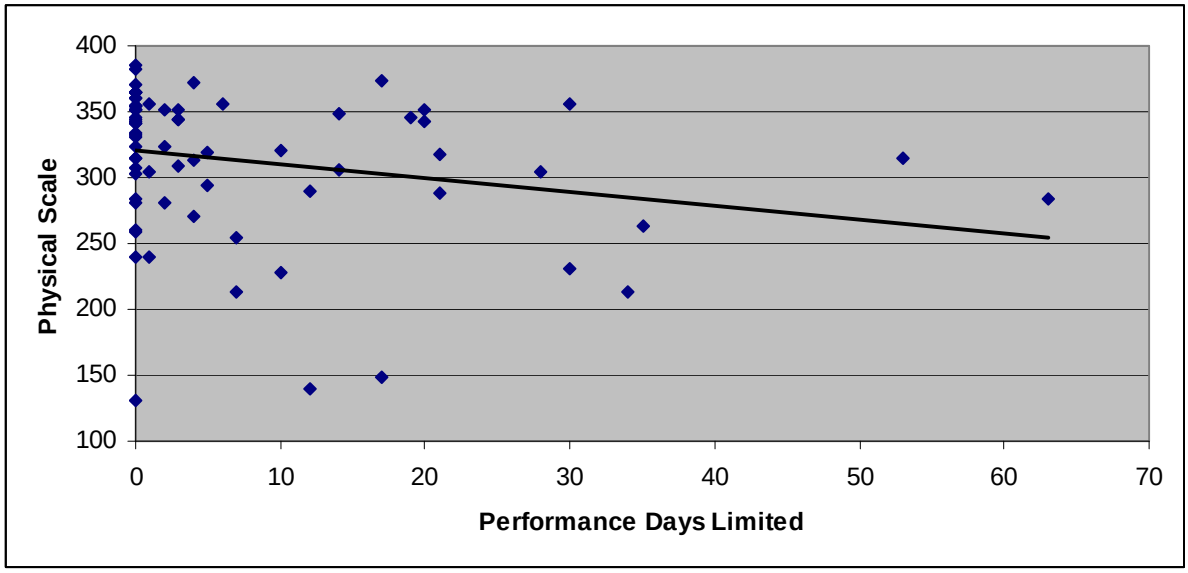
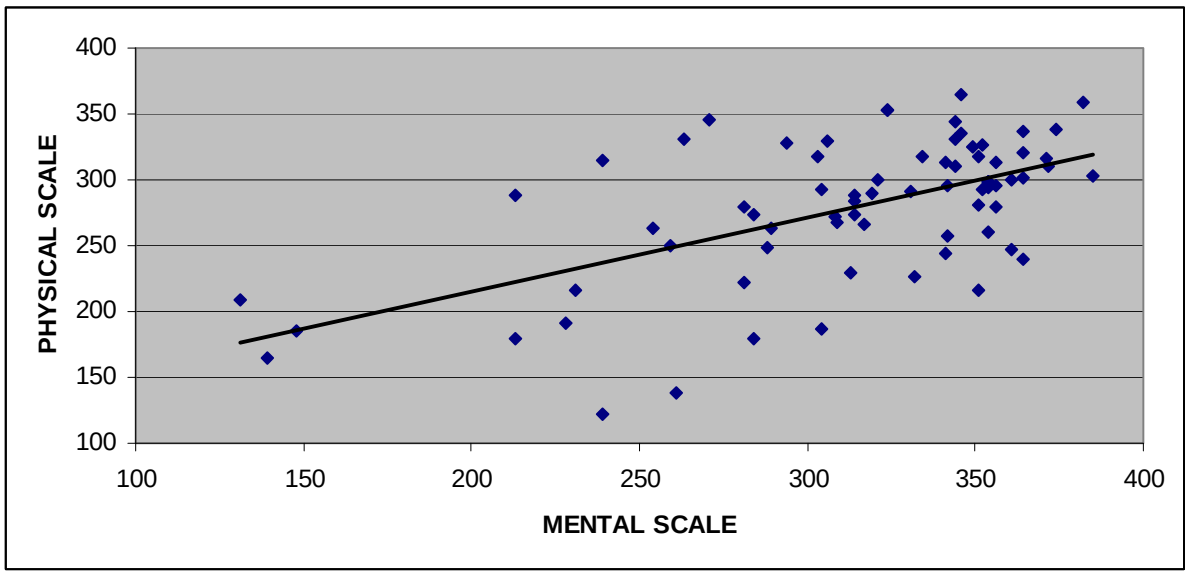


FIGURE 6: SF-36® physical & mental scale correlation scatter plot



APPENDIX 1a: Performing Arts Medical Questionnaire; Demographic section

(From beginning to second dashed line)

Draft

PERFORMING ARTS MEDICAL QUESTIONNAIRE

Please complete the following questionnaire to the best of your ability. Your participation in this research study is voluntary. No participants will be identified in any report or publication, and research records will be kept confidential. By completing and submitting this survey, you are agreeing to take part in this research study. If you have any questions, feel free to contact Eric Bengtson at (919) 417-2277 or ebengtson@unc.edu. ***PLEASE USE PEN AND WRITE IN ALL CAPITAL LETTERS.***

Your First Name | Your MI | Your Last Name

Your UNC Email Address @email.unc.edu

Today's Date (month) / (day) / 2009 (year)

Sex
☐ Female
☐ Male

Your Age

Racial / ethnic category: (mark all that apply)
☐ Caucasian
☐ African American
☐ Asian
☐ Native Hawaiian/Pacific Islander
☐ Hispanic
☐ Other (specify):

Which arm is your dominant arm?
☐ Right
☐ Left
☐ Either

Which leg is your dominant leg?
☐ Right
☐ Left
☐ Either

In your opinion, would it be beneficial to have a medical professional specifically trained in musculoskeletal conditions on location at rehearsals / performances?
☐ No ☐ Yes

If a medical professional were available, would you actually take advantage of their services?
☐ No ☐ Yes

Have you ever participated with an injury because you were afraid that you might lose your spot in a performance?
☐ No ☐ Yes

In general, how would you rate your health? ☐ Excellent ☐ Very Good ☐ Good ☐ Fair ☐ Poor

Compared to ONE YEAR AGO, how would you rate your health in general now?

☐ Much better now ☐ Somewhat better now ☐ About the same ☐ Somewhat worse ☐ Much worse

The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports	☐ Yes, limited a lot	☐ Yes, limited a little	☐ No, not limited at all
Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or palying golf	☐ Yes, limited a lot	☐ Yes, limited a little	☐ No, not limited at all
Lifting or carrying groceries	☐ Yes, limited a lot	☐ Yes, limited a little	☐ No, not limited at all
Climbing several flights of stairs	☐ Yes, limited a lot	☐ Yes, limited a little	☐ No, not limited at all
Climbing one flight of stairs	☐ Yes, limited a lot	☐ Yes, limited a little	☐ No, not limited at all
Bending, kneeling or stooping	☐ Yes, limited a lot	☐ Yes, limited a little	☐ No, not limited at all
Walking more than one mile	☐ Yes, limited a lot	☐ Yes, limited a little	☐ No, not limited at all
Walking several blocks	☐ Yes, limited a lot	☐ Yes, limited a little	☐ No, not limited at all
Walking one block	☐ Yes, limited a lot	☐ Yes, limited a little	☐ No, not limited at all
Bathing or dressing yourself	☐ Yes, limited a lot	☐ Yes, limited a little	☐ No, not limited at all

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APPENDIX 1b: Performing Arts Medical Questionnaire; SF-36® Health Survey

(From second dashed line through the end of the page)

Draft

PERFORMING ARTS MEDICAL QUESTIONNAIRE

Please complete the following questionnaire to the best of your ability. Your participation in this research study is voluntary. No participants will be identified in any report or publication, and research records will be kept confidential. By completing and submitting this survey, you are agreeing to take part in this research study. If you have any questions, feel free to contact Eric Bengtson at (919) 417-2277 or ebengtson@unc.edu. ***PLEASE USE PEN AND WRITE IN ALL CAPITAL LETTERS.***

Your First Name | Your MI | Your Last Name

Your UNC Email Address @email.unc.edu

Today's Date (month) / (day) / 2009 (year)

Sex
☐ Female
☐ Male

Your Age

Racial / ethnic category: (mark all that apply)
☐ Caucasian
☐ African American
☐ Asian
☐ Native Hawaiian/Pacific Islander
☐ Hispanic
☐ Other (specify):

Which arm is your dominant arm?
☐ Right
☐ Left
☐ Either

Which leg is your dominant leg?
☐ Right
☐ Left
☐ Either

In your opinion, would it be beneficial to have a medical professional specifically trained in musculoskeletal conditions on location at rehearsals / performances?
☐ No ☐ Yes

If a medical professional were available, would you actually take advantage of their services?
☐ No ☐ Yes

Have you ever participated with an injury because you were afraid that you might lose your spot in a performance?
☐ No ☐ Yes

In general, how would you rate your health? ☐ Excellent ☐ Very Good ☐ Good ☐ Fair ☐ Poor

Compared to ONE YEAR AGO, how would you rate your health in general now?

☐ Much better now ☐ Somewhat better now ☐ About the same ☐ Somewhat worse ☐ Much worse

The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports	☐ Yes, limited a lot	☐ Yes, limited a little	☐ No, not limited at all
Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or palying golf	☐ Yes, limited a lot	☐ Yes, limited a little	☐ No, not limited at all
Lifting or carrying groceries	☐ Yes, limited a lot	☐ Yes, limited a little	☐ No, not limited at all
Climbing several flights of stairs	☐ Yes, limited a lot	☐ Yes, limited a little	☐ No, not limited at all
Climbing one flight of stairs	☐ Yes, limited a lot	☐ Yes, limited a little	☐ No, not limited at all
Bending, kneeling or stooping	☐ Yes, limited a lot	☐ Yes, limited a little	☐ No, not limited at all
Walking more than one mile	☐ Yes, limited a lot	☐ Yes, limited a little	☐ No, not limited at all
Walking several blocks	☐ Yes, limited a lot	☐ Yes, limited a little	☐ No, not limited at all
Walking one block	☐ Yes, limited a lot	☐ Yes, limited a little	☐ No, not limited at all
Bathing or dressing yourself	☐ Yes, limited a lot	☐ Yes, limited a little	☐ No, not limited at all

Page 1

Draft

During the past 4 weeks, have you had any of the following problems with your work or other regular daily acitivies as a result of your PHYSICAL health?

Cut down the amount of time you spent on work or other activities?	☐ Yes	☐ No
Accomplished less than you would like?	☐ Yes	☐ No
Were limited in the kind of work or other activities?	☐ Yes	☐ No
Had difficulty performing work or other activities (for example, it took extra time)	☐ Yes	☐ No

During the past 4 weeks, have you had any of the following problems with your work or other regular daily acitivies as a result of your PHYSICAL health?

Cut down the amount of time you spent on work or other activities?	☐ Yes	☐ No
Accomplished less than you would like?	☐ Yes	☐ No
Didn't do work or other activities as carefully as usual	☐ Yes	☐ No

During the past 4 weeks, to what extent have your PHYSICAL or EMOTIONAL problems interfered with your normal social activities with family, friends, neighbors, or groups?

☐ Not at all ☐ Slightly ☐ Moderately ☐ Quite a bit ☐ Extremely

How much bodily pain have you had during the past 4 weeks?

☐ Not at all ☐ Slightly ☐ Moderately ☐ Quite a bit ☐ Extremely

During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

☐ Not at all ☐ Slightly ☐ Moderately ☐ Quite a bit ☐ Extremely

These questions are about how you feel and how things have been with you during the past 4 weeks. For each question please give one answer that comes closest to the way you have been feeling. How much time during the past 4 weeks:

	All of the time	Most of the time	A good bit of the time	Some of the time	A little of the time	None of the time
did you feel full of pep?	☐	☐	☐	☐	☐	☐
have you been a nervous person?	☐	☐	☐	☐	☐	☐
have you felt so down in the dumps nothing could cheer you up?	☐	☐	☐	☐	☐	☐
have you felt calm and peaceful?	☐	☐	☐	☐	☐	☐
did you have a lot of energy?	☐	☐	☐	☐	☐	☐
have you felt downhearted and blue?	☐	☐	☐	☐	☐	☐
did you feel worn out?	☐	☐	☐	☐	☐	☐
have you been a happy person?	☐	☐	☐	☐	☐	☐
did you feel tired?	☐	☐	☐	☐	☐	☐

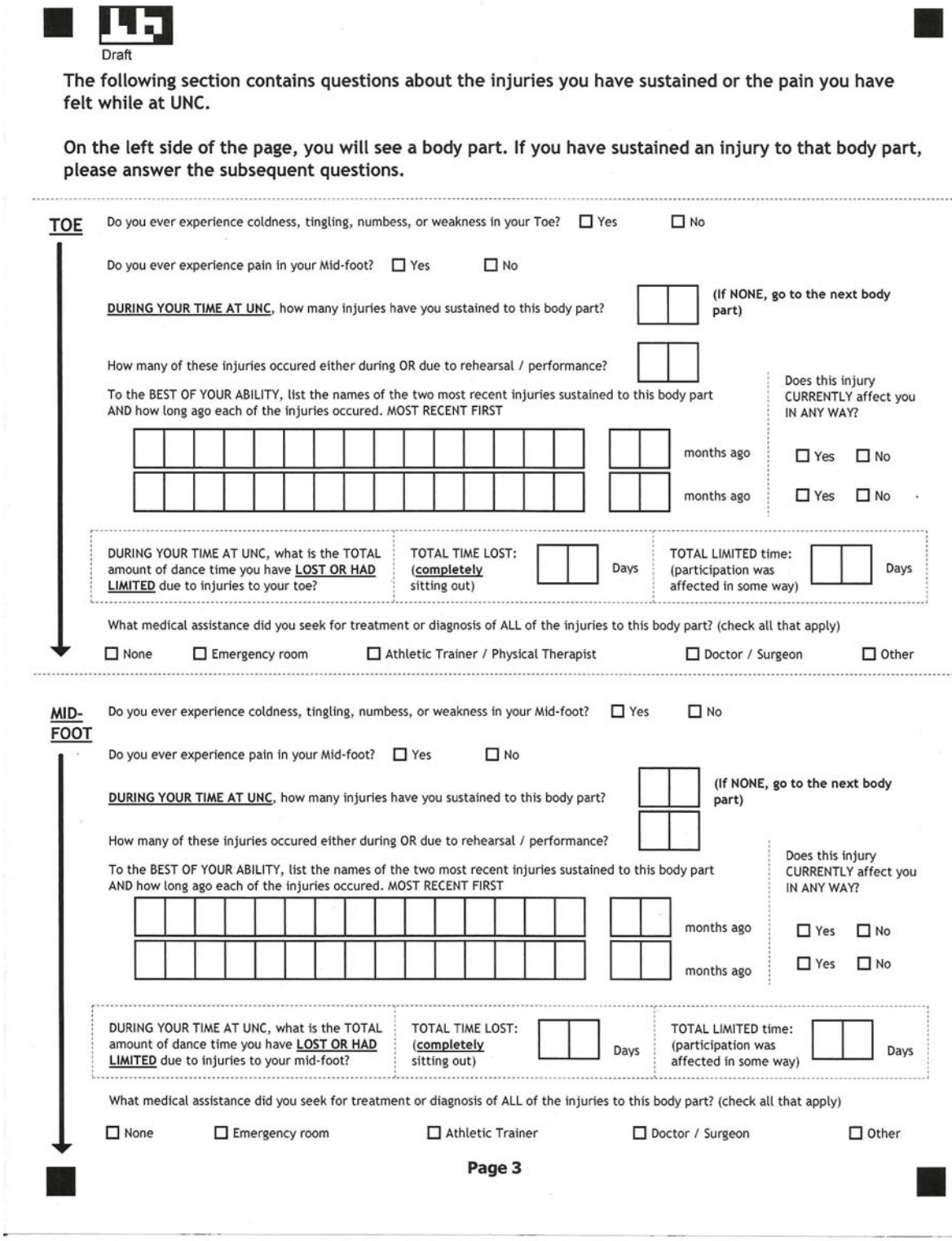
During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relateves, etc.)?

☐ All of the time ☐ Most of the time ☐ Some of the time ☐ A little of the time ☐ None of the time

How TRUE or FALSE is each of the following statements for you?

I seem to get sick a little easier than other people	☐ Definitely true	☐ Mostly true	☐ Don't know	☐ Mostly false	☐ Definitely false
I am as health as anybody I know	☐ Definitely true	☐ Mostly true	☐ Don't know	☐ Mostly false	☐ Definitely false
I expect my health to get worse	☐ Definitely true	☐ Mostly true	☐ Don't know	☐ Mostly false	☐ Definitely false

APPENDIX 1c: Performing Arts Medical Questionnaire; Injury history section



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The following section contains questions about the injuries you have sustained or the pain you have felt while at UNC.

On the left side of the page, you will see a body part. If you have sustained an injury to that body part, please answer the subsequent questions.

TOE

Do you ever experience coldness, tingling, numbess, or weakness in your Toe? ☐ Yes ☐ No

Do you ever experience pain in your Mid-foot? ☐ Yes ☐ No

DURING YOUR TIME AT UNC, how many injuries have you sustained to this body part? ☐☐ **(If NONE, go to the next body part)**

How many of these injuries occured either during OR due to rehearsal / performance? ☐☐

To the BEST OF YOUR ABILITY, list the names of the two most recent injuries sustained to this body part AND how long ago each of the injuries occured. MOST RECENT FIRST

Does this injury CURRENTLY affect you IN ANY WAY?

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ ☐☐ months ago ☐ Yes ☐ No

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ ☐☐ months ago ☐ Yes ☐ No

DURING YOUR TIME AT UNC, what is the TOTAL amount of dance time you have LOST OR HAD LIMITED due to injuries to your toe?

TOTAL TIME LOST: (completely sitting out) ☐☐ Days

TOTAL LIMITED time: (participation was affected in some way) ☐☐ Days

What medical assistance did you seek for treatment or diagnosis of ALL of the injuries to this body part? (check all that apply)

☐ None ☐ Emergency room ☐ Athletic Trainer / Physical Therapist ☐ Doctor / Surgeon ☐ Other

MID-FOOT

Do you ever experience coldness, tingling, numbess, or weakness in your Mid-foot? ☐ Yes ☐ No

Do you ever experience pain in your Mid-foot? ☐ Yes ☐ No

DURING YOUR TIME AT UNC, how many injuries have you sustained to this body part? ☐☐ **(If NONE, go to the next body part)**

How many of these injuries occured either during OR due to rehearsal / performance? ☐☐

To the BEST OF YOUR ABILITY, list the names of the two most recent injuries sustained to this body part AND how long ago each of the injuries occured. MOST RECENT FIRST

Does this injury CURRENTLY affect you IN ANY WAY?

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ ☐☐ months ago ☐ Yes ☐ No

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ ☐☐ months ago ☐ Yes ☐ No

DURING YOUR TIME AT UNC, what is the TOTAL amount of dance time you have LOST OR HAD LIMITED due to injuries to your mid-foot?

TOTAL TIME LOST: (completely sitting out) ☐☐ Days

TOTAL LIMITED time: (participation was affected in some way) ☐☐ Days

What medical assistance did you seek for treatment or diagnosis of ALL of the injuries to this body part? (check all that apply)

☐ None ☐ Emergency room ☐ Athletic Trainer ☐ Doctor / Surgeon ☐ Other

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Draft

ANKLE

Do you ever experience coldness, tingling, numbess, or weakness in your Ankle? ☐ Yes ☐ No

Do you ever experience pain in your Ankle? ☐ Yes ☐ No

DURING YOUR TIME AT UNC, how many injuries have you sustained to this body part? ☐☐ **(If NONE, go to the next body part)**

How many of these injuries occured either during OR due to rehearsal / performance? ☐☐

To the BEST OF YOUR ABILITY, list the names of the two most recent injuries sustained to this body part AND how long ago each of the injuries occured. MOST RECENT FIRST

Does this injury CURRENTLY affect you IN ANY WAY?

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ ☐☐ months ago ☐ Yes ☐ No

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ ☐☐ months ago ☐ Yes ☐ No

DURING YOUR TIME AT UNC, what is the TOTAL amount of dance time you have LOST OR HAD LIMITED due to injuries to your ankle?	TOTAL TIME LOST: (completely sitting out) ☐☐ Days	TOTAL LIMITED time: (participation was affected in some way) ☐☐ Days

What medical assistance did you seek for treatment or diagnosis of ALL of the injuries to this body part? (check all that apply)

☐ None ☐ Emergency room ☐ Athletic Trainer / Physical Therapist ☐ Doctor / Surgeon ☐ Other

LOWER-LEG / SHIN

Do you ever experience coldness, tingling, numbess, or weakness in your Lower-leg / Shin? ☐ Yes ☐ No

Do you ever experience pain in your Lower-leg / Shin? ☐ Yes ☐ No

DURING YOUR TIME AT UNC, how many injuries have you sustained to this body part? ☐☐ **(If NONE, go to the next body part)**

How many of these injuries occured either during OR due to rehearsal / performance? ☐☐

To the BEST OF YOUR ABILITY, list the names of the two most recent injuries sustained to this body part AND how long ago each of the injuries occured. MOST RECENT FIRST

Does this injury CURRENTLY affect you IN ANY WAY?

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ ☐☐ months ago ☐ Yes ☐ No

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ ☐☐ months ago ☐ Yes ☐ No

DURING YOUR TIME AT UNC, what is the TOTAL amount of dance time you have LOST OR HAD LIMITED due to injuries to your lower-leg/shin?	TOTAL TIME LOST: (completely sitting out) ☐☐ Days	TOTAL LIMITED time: (participation was affected in some way) ☐☐ Days

What medical assistance did you seek for treatment or diagnosis of ALL of the injuries to this body part? (check all that apply)

☐ None ☐ Emergency room ☐ Athletic Trainer ☐ Doctor / Surgeon ☐ Other

Draft

KNEE

Do you ever experience coldness, tingling, numbess, or weakness in your Knee? ☐ Yes ☐ No

Do you ever experience pain in your Knee? ☐ Yes ☐ No

DURING YOUR TIME AT UNC, how many injuries have you sustained to this body part? ☐☐ **(If NONE, go to the next body part)**

How many of these injuries occured either during OR due to rehearsal / performance? ☐☐

To the BEST OF YOUR ABILITY, list the names of the two most recent injuries sustained to this body part AND how long ago each of the injuries occured. MOST RECENT FIRST

Does this injury CURRENTLY affect you IN ANY WAY?

☐☐ months ago ☐ Yes ☐ No

☐☐ months ago ☐ Yes ☐ No

DURING YOUR TIME AT UNC, what is the TOTAL amount of dance time you have LOST OR HAD LIMITED due to injuries to your knee?	TOTAL TIME LOST: (completely sitting out) ☐☐ Days	TOTAL LIMITED time: (participation was affected in some way) ☐☐ Days

What medical assistance did you seek for treatment or diagnosis of ALL of the injuries to this body part? (check all that apply)

☐ None ☐ Emergency room ☐ Athletic Trainer / Physical Therapist ☐ Doctor / Surgeon ☐ Other

UPPER-LEG / THIGH

Do you ever experience coldness, tingling, numbess, or weakness in your Upper-Leg / Thigh? ☐ Yes ☐ No

Do you ever experience pain in your Upper-Leg / Thigh? ☐ Yes ☐ No

DURING YOUR TIME AT UNC, how many injuries have you sustained to this body part? ☐☐ **(If NONE, go to the next body part)**

How many of these injuries occured either during OR due to rehearsal / performance? ☐☐

To the BEST OF YOUR ABILITY, list the names of the two most recent injuries sustained to this body part AND how long ago each of the injuries occured. MOST RECENT FIRST

Does this injury CURRENTLY affect you IN ANY WAY?

☐☐ months ago ☐ Yes ☐ No

☐☐ months ago ☐ Yes ☐ No

DURING YOUR TIME AT UNC, what is the TOTAL amount of dance time you have LOST OR HAD LIMITED due to injuries to your upper-leg?	TOTAL TIME LOST: (completely sitting out) ☐☐ Days	TOTAL LIMITED time: (participation was affected in some way) ☐☐ Days

What medical assistance did you seek for treatment or diagnosis of ALL of the injuries to this body part? (check all that apply)

☐ None ☐ Emergency room ☐ Athletic Trainer ☐ Doctor / Surgeon ☐ Other

Draft

HIP / PELVIS

Do you ever experience coldness, tingling, numbess, or weakness in your Hip / Pelvis? ☐ Yes ☐ No

Do you ever experience pain in your Hip / Pelvis? ☐ Yes ☐ No

DURING YOUR TIME AT UNC, how many injuries have you sustained to this body part? ☐☐ **(If NONE, go to the next body part)**

How many of these injuries occured either during OR due to rehearsal / performance? ☐☐

To the BEST OF YOUR ABILITY, list the names of the two most recent injuries sustained to this body part AND how long ago each of the injuries occured. MOST RECENT FIRST

Does this injury CURRENTLY affect you IN ANY WAY?

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ ☐☐ months ago ☐ Yes ☐ No

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ ☐☐ months ago ☐ Yes ☐ No

DURING YOUR TIME AT UNC, what is the TOTAL amount of dance time you have LOST OR HAD LIMITED due to injuries to your hip / pelvis?	TOTAL TIME LOST: (completely sitting out) ☐☐ Days	TOTAL LIMITED time: (participation was affected in some way) ☐☐ Days

What medical assistance did you seek for treatment or diagnosis of ALL of the injuries to this body part? (check all that apply)

☐ None ☐ Emergency room ☐ Athletic Trainer / Physical Therapist ☐ Doctor / Surgeon ☐ Other

LOWER BACK

Do you ever experience coldness, tingling, numbess, or weakness in your Low Back? ☐ Yes ☐ No

Do you ever experience pain in your Low Back? ☐ Yes ☐ No

DURING YOUR TIME AT UNC, how many injuries have you sustained to this body part? ☐☐ **(If NONE, go to the next body part)**

How many of these injuries occured either during OR due to rehearsal / performance? ☐☐

To the BEST OF YOUR ABILITY, list the names of the two most recent injuries sustained to this body part AND how long ago each of the injuries occured. MOST RECENT FIRST

Does this injury CURRENTLY affect you IN ANY WAY?

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ ☐☐ months ago ☐ Yes ☐ No

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ ☐☐ months ago ☐ Yes ☐ No

DURING YOUR TIME AT UNC, what is the TOTAL amount of dance time you have LOST OR HAD LIMITED due to injuries to your low back?	TOTAL TIME LOST: (completely sitting out) ☐☐ Days	TOTAL LIMITED time: (participation was affected in some way) ☐☐ Days

What medical assistance did you seek for treatment or diagnosis of ALL of the injuries to this body part? (check all that apply)

☐ None ☐ Emergency room ☐ Athletic Trainer ☐ Doctor / Surgeon ☐ Other

UPPER BACK

Do you ever experience coldness, tingling, numbess, or weakness in your Upper Back? ☐ Yes ☐ No

Do you ever experience pain in your Upper Back? ☐ Yes ☐ No

DURING YOUR TIME AT UNC, how many injuries have you sustained to this body part? ☐☐ **(If NONE, go to the next body part)**

How many of these injuries occured either during OR due to rehearsal / performance? ☐☐

To the BEST OF YOUR ABILITY, list the names of the two most recent injuries sustained to this body part AND how long ago each of the injuries occured. MOST RECENT FIRST

Does this injury CURRENTLY affect you IN ANY WAY?

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ ☐☐ months ago ☐ Yes ☐ No

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ ☐☐ months ago ☐ Yes ☐ No

DURING YOUR TIME AT UNC, what is the TOTAL amount of dance time you have LOST OR HAD LIMITED due to injuries to your upper back?	TOTAL TIME LOST: (completely sitting out) ☐☐ Days	TOTAL LIMITED time: (participation was affected in some way) ☐☐ Days

What medical assistance did you seek for treatment or diagnosis of ALL of the injuries to this body part? (check all that apply)

☐ None ☐ Emergency room ☐ Athletic Trainer / Physical Therapist ☐ Doctor / Surgeon ☐ Other

SHOULDER

Do you ever experience coldness, tingling, numbess, or weakness in your Shoulder? ☐ Yes ☐ No

Do you ever experience pain in your Shoulder? ☐ Yes ☐ No

DURING YOUR TIME AT UNC, how many injuries have you sustained to this body part? ☐☐ **(If NONE, go to the next body part)**

How many of these injuries occured either during OR due to rehearsal / performance? ☐☐

To the BEST OF YOUR ABILITY, list the names of the two most recent injuries sustained to this body part AND how long ago each of the injuries occured. MOST RECENT FIRST

Does this injury CURRENTLY affect you IN ANY WAY?

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ ☐☐ months ago ☐ Yes ☐ No

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ ☐☐ months ago ☐ Yes ☐ No

DURING YOUR TIME AT UNC, what is the TOTAL amount of dance time you have LOST OR HAD LIMITED due to injuries to your Shoulder?	TOTAL TIME LOST: (completely sitting out) ☐☐ Days	TOTAL LIMITED time: (participation was affected in some way) ☐☐ Days

What medical assistance did you seek for treatment or diagnosis of ALL of the injuries to this body part? (check all that apply)

☐ None ☐ Emergency room ☐ Athletic Trainer ☐ Doctor / Surgeon ☐ Other

Draft

UPPER ARM

Do you ever experience coldness, tingling, numbess, or weakness in your Upper Arm? ☐ Yes ☐ No

Do you ever experience pain in your Upper Arm? ☐ Yes ☐ No

DURING YOUR TIME AT UNC, how many injuries have you sustained to this body part? ☐☐ **(If NONE, go to the next body part)**

How many of these injuries occured either during OR due to rehearsal / performance? ☐☐

To the BEST OF YOUR ABILITY, list the names of the two most recent injuries sustained to this body part AND how long ago each of the injuries occured. MOST RECENT FIRST

Does this injury CURRENTLY affect you IN ANY WAY?

☐☐ months ago ☐ Yes ☐ No

☐☐ months ago ☐ Yes ☐ No

DURING YOUR TIME AT UNC, what is the TOTAL amount of dance time you have LOST OR HAD LIMITED due to injuries to your upper arm?	TOTAL TIME LOST: (completely sitting out) ☐☐ Days	TOTAL LIMITED time: (participation was affected in some way) ☐☐ Days

What medical assistance did you seek for treatment or diagnosis of ALL of the injuries to this body part? (check all that apply)

☐ None ☐ Emergency room ☐ Athletic Trainer / Physical Therapist ☐ Doctor / Surgeon ☐ Other

ELBOW

Do you ever experience coldness, tingling, numbess, or weakness in your Elbow? ☐ Yes ☐ No

Do you ever experience pain in your Elbow? ☐ Yes ☐ No

DURING YOUR TIME AT UNC, how many injuries have you sustained to this body part? ☐☐ **(If NONE, go to the next body part)**

How many of these injuries occured either during OR due to rehearsal / performance? ☐☐

To the BEST OF YOUR ABILITY, list the names of the two most recent injuries sustained to this body part AND how long ago each of the injuries occured. MOST RECENT FIRST

Does this injury CURRENTLY affect you IN ANY WAY?

☐☐ months ago ☐ Yes ☐ No

☐☐ months ago ☐ Yes ☐ No

DURING YOUR TIME AT UNC, what is the TOTAL amount of dance time you have LOST OR HAD LIMITED due to injuries to your elbow?	TOTAL TIME LOST: (completely sitting out) ☐☐ Days	TOTAL LIMITED time: (participation was affected in some way) ☐☐ Days

What medical assistance did you seek for treatment or diagnosis of ALL of the injuries to this body part? (check all that apply)

☐ None ☐ Emergency room ☐ Athletic Trainer ☐ Doctor / Surgeon ☐ Other

Draft

FOREARM

Do you ever experience coldness, tingling, numbess, or weakness in your Forearm? ☐ Yes ☐ No

Do you ever experience pain in your Forearm? ☐ Yes ☐ No

DURING YOUR TIME AT UNC, how many injuries have you sustained to this body part? ☐☐ **(If NONE, go to the next body part)**

How many of these injuries occured either during OR due to rehearsal / performance? ☐☐

To the BEST OF YOUR ABILITY, list the names of the two most recent injuries sustained to this body part AND how long ago each of the injuries occured. MOST RECENT FIRST

Does this injury CURRENTLY affect you IN ANY WAY?

☐☐ months ago ☐ Yes ☐ No

☐☐ months ago ☐ Yes ☐ No

DURING YOUR TIME AT UNC, what is the TOTAL amount of dance time you have LOST OR HAD LIMITED due to injuries to your forearm?	TOTAL TIME LOST: (completely sitting out) ☐☐ Days	TOTAL LIMITED time: (participation was affected in some way) ☐☐ Days

What medical assistance did you seek for treatment or diagnosis of ALL of the injuries to this body part? (check all that apply)

☐ None ☐ Emergency room ☐ Athletic Trainer / Physical Therapist ☐ Doctor / Surgeon ☐ Other

WRIST / HAND / FINGER

Do you ever experience coldness, tingling, numbess, or weakness in your Wrist, Hand, or Finger? ☐ Yes ☐ No

Do you ever experience pain in your Wrist, Hand, or Finger? ☐ Yes ☐ No

DURING YOUR TIME AT UNC, how many injuries have you sustained to this body part? ☐☐ **(If NONE, go to the next body part)**

How many of these injuries occured either during OR due to rehearsal / performance? ☐☐

To the BEST OF YOUR ABILITY, list the names of the two most recent injuries sustained to this body part AND how long ago each of the injuries occured. MOST RECENT FIRST

Does this injury CURRENTLY affect you IN ANY WAY?

☐☐ months ago ☐ Yes ☐ No

☐☐ months ago ☐ Yes ☐ No

DURING YOUR TIME AT UNC, what is the TOTAL amount of dance time you have LOST OR HAD LIMITED due to injuries to these body parts?	TOTAL TIME LOST: (completely sitting out) ☐☐ Days	TOTAL LIMITED time: (participation was affected in some way) ☐☐ Days

What medical assistance did you seek for treatment or diagnosis of ALL of the injuries to this body part? (check all that apply)

☐ None ☐ Emergency room ☐ Athletic Trainer ☐ Doctor / Surgeon ☐ Other

NECK

Do you ever experience coldness, tingling, numbess, or weakness in your Neck? ☐ Yes ☐ No

Do you ever experience pain in your Neck? ☐ Yes ☐ No

DURING YOUR TIME AT UNC, how many injuries have you sustained to this body part? ☐☐ **(If NONE, go to the next body part)**

How many of these injuries occured either during OR due to rehearsal / performance? ☐☐

To the BEST OF YOUR ABILITY, list the names of the two most recent injuries sustained to this body part AND how long ago each of the injuries occured. MOST RECENT FIRST

		Does this injury CURRENTLY affect you IN ANY WAY?
☐☐☐☐☐☐☐☐☐☐☐☐☐☐	☐☐ months ago	☐ Yes ☐ No
☐☐☐☐☐☐☐☐☐☐☐☐☐☐	☐☐ months ago	☐ Yes ☐ No

DURING YOUR TIME AT UNC, what is the TOTAL amount of dance time you have **LOST OR HAD LIMITED** due to injuries to your neck?	TOTAL TIME LOST: (**completely** sitting out) ☐☐ Days	TOTAL LIMITED time: (participation was affected in some way) ☐☐ Days

What medical assistance did you seek for treatment or diagnosis of ALL of the injuries to this body part? (check all that apply)

☐ None ☐ Emergency room ☐ Athletic Trainer / Physical Therapist ☐ Doctor / Surgeon ☐ Other

HEAD / FACE

Do you ever experience coldness, tingling, numbess, or weakness in your Head / Face? ☐ Yes ☐ No

Do you ever experience pain in your Head / Face? ☐ Yes ☐ No

DURING YOUR TIME AT UNC, how many injuries have you sustained to this body part? ☐☐ **(If NONE, go to the next body part)**

How many of these injuries occured either during OR due to rehearsal / performance? ☐☐

To the BEST OF YOUR ABILITY, list the names of the two most recent injuries sustained to this body part AND how long ago each of the injuries occured. MOST RECENT FIRST

		Does this injury CURRENTLY affect you IN ANY WAY?
☐☐☐☐☐☐☐☐☐☐☐☐☐☐	☐☐ months ago	☐ Yes ☐ No
☐☐☐☐☐☐☐☐☐☐☐☐☐☐	☐☐ months ago	☐ Yes ☐ No

DURING YOUR TIME AT UNC, what is the TOTAL amount of dance time you have **LOST OR HAD LIMITED** due to injuries to your head / face?	TOTAL TIME LOST: (**completely** sitting out) ☐☐ Days	TOTAL LIMITED time: (participation was affected in some way) ☐☐ Days

What medical assistance did you seek for treatment or diagnosis of ALL of the injuries to this body part? (check all that apply)

☐ None ☐ Emergency room ☐ Athletic Trainer ☐ Doctor / Surgeon ☐ Other

APPENDIX 1d: Performing Arts Medical Questionnaire; Dance specific questions

Draft

In what way would you classify yourself? (mark all that apply)

- ☐ Undergraduate student
- ☐ Graduate student
- ☐ Faculty / Staff
- ☐ Other: (specify)

In how many dance organizations are you involved? ☐☐ (total number of organizations)

In what way would you categorize your PRIMARY dance style?

☐ Ballet ☐ Modern ☐ Jazz ☐ Tap ☐ Hip Hop ☐ Contemporary ☐ Other:

In what way would you categorize your SECONDARY dance style?

☐ Ballet ☐ Modern ☐ Jazz ☐ Tap ☐ Hip Hop ☐ Contemporary ☐ Other:

Please list the TOTAL number of years of FORMAL training you have received in each of the specific dance styles listed below. If you have not received formal training in the specific dance style you may write "0" or simply leave it blank.

Ballet	☐☐ total years	Lyrical	☐☐ total years	Other (specify below)	☐☐ total years
Modern	☐☐ total years	Clogging	☐☐ total years		
Jazz	☐☐ total years	Ballroom	☐☐ total years	Other (specify below)	☐☐ total years
Tap	☐☐ total years	Country/Line	☐☐ total years		
Hip Hop	☐☐ total years	Other (specify below)	☐☐ total years	Other (specify below)	☐☐ total years
Contemporary	☐☐ total years				

On average, how many TOTAL hours per week do you spend dancing with your UNC dance organization(s)? ☐☐ hours

On average, how many TOTAL hours per week do you spend dancing OUTSIDE of your UNC dance organization? (for example, taking classes, participating in dance groups outside of UNC, etc.) ☐☐ hours

On what floor surface(s) do you dance? (check all that apply)

☐ Cement ☐ Stone ☐ Hardwood floor not meant for dancing ☐ Floor designed for dancing ☐ Other: (specify)

In your opinion, have you sustained any injuries DIRECTLY due to the floor surface on which you dance?

☐ I have not sustained any injuries ☐ Yes ☐ No ☐ I do not know

How would you rate your posture/form while dancing? ☐ Excellent ☐ Good ☐ Average ☐ Poor ☐ Very poor

How many minutes does a warm-up typically last? ☐☐ total minutes

APPENDIX 2: Manuscript for submission to the Journal of Dance Medicine & Science

ABSTRACT: Dancers are a unique blend of artist and athlete particularly susceptible to musculoskeletal injuries and pain. It is important to consider the personal perception of health status when treating any athlete. When considering the dancer, however, these perceptions may be especially important. One of the most widely used measures of perceived health status is the Short Form-36® Health Survey. Seventy-seven college dance students (aged 18-24) completed a survey containing the SF-36®, injury history and dance specific questions. The goal of this study was to determine the correlation between total time loss due to injury (in days) and current perceived health status in collegiate dance students. No significant correlation was found when examining time loss due to injury to the Physical (N = 77, r = -.080, p = .488) and Mental (N = 76, r = -.041, p = .727) SF-36® scales. However, the relationship between mental health status normative values and measured values was statistically significant (t = -2.033, df = 71, p = .046). The results from our study suggest that the SF-36® health survey should be administered during a pre-season injury screen to create a baseline value for individual dancers. Progress could then be measured in a way that was difficult to previously measure in this population, specifically, the mental aspect of injury rehabilitation.

INTRODUCTION: Dancers are a unique blend of artist and athlete particularly susceptible to musculoskeletal injuries and pain.[1] The health problems of dancers are deserving of study for several reasons. First, because dancers begin their training at a young age, there is potential for a great negative impact on their future health.[1] Second, the stress of dancing is significant enough to decrease a dancer's career length as compared to additional performing art fields, such as music.[2] Third, the combination of physical and artistic demands may lead

to various health issues especially relevant to dancers such as musculoskeletal, metabolic, and nutritional disorders, all of which may significantly impact their health-related quality of life.[1, 3-6] Fourth, performance standards at the advanced levels are all but impossible to reach, leading to tremendous emotional stress.[2] Fifth, despite the amount of physical strain placed on the dancer's body, injuries are commonly reported late or not at all.[2, 7] Finally, dancers, as an occupational group, have received little attention overall in the health literature.[1, 5]

One of the most widely used measures of perceived quality of life and mental status is the Short Form 36 Health Survey (SF-36®).[29-32] The SF-36® is a 36 item questionnaire which measures physical and emotional functioning on eight scales including physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, and mental health **(Figure 1)**.[33] The SF-36® health survey has been used previously to study dancers and has been shown to be responsive to musculoskeletal injury and recovery time in the dance population.[34, 35]

The SF-36® health survey was constructed to provide a basis for comparison across varying disease states and otherwise incomparable disease management strategies.[36] As of 1997, greater than 700 sources had documented the use of the SF-36® health survey in numerous languages and using subjects with varying levels of disease states.[36] Due to the large library of previous research available, population normative perceived health status data have been established in virtually every age group. In fact, dancers have previously been shown to score significantly lower than the SF-36® population-matched normative values in regard to perception of bodily pain.[35] As a result of the limited empirical research related to injury and quality of life in collegiate-aged dancers

The purpose of this study is to determine the correlation between SF-36® scores of the collegiate dance student and age matched normative values.

MATERIAL & METHODS:

Seventy-seven (77) collegiate aged (18-24) student dancers at UNC-CH completed the survey instrument. This included students enrolled in dance classes and students who participated in at least one student run dance organization. Current health of the subject did not matter in regards to subject sampling. Sex, ethnicity, race, and age data were collected strictly for demographic purposes.

The instructors of UNC-CH dance classes were contacted via email regarding participation in this study in September-October 2009. Additionally, the president of various student run dance organizations were contacted in the same manner. After permission was granted, a member of the research team visited the dance classes and dance organizations at an arranged date near the end of the 2009 Fall semester (November 2009) to inform potential participants of what was required should they agree to participate. PAMQ packets were then handed to the subjects who agree to participate. Each questionnaire packet included an introduction letter, a fact sheet, the PAMQ, a sealable envelope, an ink pen, and a UNC-CH campus mail envelope. Subjects who volunteered to participate were asked to complete the questionnaire on their own time so there was no conflict with class or rehearsal time. The introduction letter had directions to seal the PAMQ into the provided envelope and place the envelope, with the ink pen, into the provided campus mail envelope. Subjects were then asked to place the campus mail envelope into a campus mailbox so that it may be returned to the research facility. Completing the survey instrument and returning the PAMQ packet replaced the participant signing a consent form. All completed surveys were scanned into

TeleForm (Cardiff, Vista, CA) for review. Once the data were reviewed by a member of the research team, it was then imported into Excel 2007 (Microsoft, Redmond, WA) and later SPSS Version 16.0 (SPSS Inc., Chicago, IL) for data analysis.

RESULTS: Two one-sample t-tests were used to determine how physical and mental health status differs in collegiate dancers compared to sex matched normative values. Because the normative values for males and females differ from each other, and only four males responded to the survey, male subjects were removed from the data set. These values were compared to the normative values for females only instead of the age-matched normative values as previously discussed. The relationship between physical health status normative values and measured values was not significant ($t = 1.545$, $df = 72$, $p = 1.127$). Conversely, the relationship between mental health status normative values and measured values was statistically significant ($t = -2.033$, $df = 71$, $p = .046$). These results may be found in **Table 29.**

Eight one-sample t-tests were used to determine how physical and mental health status differs in collegiate dancers compared to sex matched normative values. Of the eight subscales, Physical Functioning ($t = 7.100$, $df = 72$, $p < .001$), Role – Physical ($t = 1.991$, $df = 72$, $p = .050$), Bodily Pain ($t = -2.549$, $df = 72$, $p = .013$), Vitality ($t = -6.165$, $df = 72$, $p < .001$), and Mental Health ($t = -2.459$, $df = 72$, $p = .016$) were statistically significant when compared to normative values. These results may be found in **Table 29**.

DISCUSSION: The mental and physical health status scales showed positive correlation. When physical health status decreases, it is easy to assume that mental health status would also decrease and visa-versa. However, it is unknown to what degree the two scales are meant to be correlated, but it seems that the developing body of the SF-36® would not make

the survey twice longer than necessary, by including two sections which were correlated. One of the original goals when developing the SF-36® was to develop a short survey.[33]

In dancers, this correlation may be important because it shows that a decrease in physical ability to dance plays a significant role in mental status. While this relationship has been investigated previously in dancers,[34] it has rarely been objectively measured using the SF-36®.[34, 147, 148] In one case,[147] the SF-36® was used to determine return to activity after a surgical repair of the extensor hallucis longus tendon. In another case,[148] this measure was used to determine return to activity after a seasmoid fracture. Both of these case studies failed to evaluate the different factors associated with quality of life measurements but were primarily focused on return to full activity. In another study,[34] the SF-36® was compared to the "Dance Functional Outcome Score," a return to play questionnaire which is currently in it's development. Again, this study did not analyze specifically the factors associated with SF-36® quality of life scores among dancers but simply examined the difference between the two scales. Our study is unique to these previous studies because we focused on the factors associated with varying quality of life measurements in dancers.

A correlation between the physical and mental scales may be important to future researchers because it shows that dancers may be unable to separate physical stress and mental stress. As a college student, this separation is important to maintain a reasonable quality of life. The subjects are not receiving credit for their participation in dance but simply because they have a passion for dance.

Previous research[149] has demonstrated that each of the eight SF-36® subscales differ in collegiate varsity athletes compared to age matched normative values. Dancers are a population who frequently utilize athletic ability to perform complex movements in a

controlled manner. However, in our study, dancers showed significant differences in five of the eight subscales, physical functioning, role – physical, bodily pain, vitality, and mental health.

CONCLUSION: From our study, we believe that we have successfully shown that mental health status of the university dancer may be unique to sex-matched normative values. This is significant clinically because we believe there has not previously been a consistently validated and accurate measure of mental health status. Because mental status is such an important factor when considering the performing artist, it may be clinically pertinent to obtain these objective measurements. The SF-36® health survey takes only a few minutes to complete and could easily be administered to an injured athlete.

The relationship between physical and mental health status may be important because it demonstrates that dancers have a difficult time separating physical and mental stressors. At a collegiate level, this separation may be important because dance is simply an accessory activity to many of the students at UNC-CH.

The results from our study suggest that the SF-36® health survey should be administered during a pre-season injury screen to create a baseline value for individual dancers because, as a group, dancers show significantly different results than sex-matched normative values. Our study suggests that these baseline values will be difficult to correlate with any characteristics of injury in this specific dance population. However, if the survey is administered every four weeks after an injury, return to baseline progress could be measured in a way that was difficult to previously measure in this population, specifically, the mental aspect of injury rehabilitation.

From our study, physical and mental health status correlated in an unexpected way. It is necessary for a practitioner to understand that dancers may have trouble disconnecting the physical and mental aspect of dance. The collegiate dancer may be unable to demonstrate that physical stress does not necessarily need to alter mental stress, and visa-versa.

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