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Health-Related Quality Of Life, Dance Exposure, and Injuries across a 16-Week Semester in Collegiate Dancers

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Abstract

OBJECTIVE: Dance is physically demanding with reported injury incidence rates(IR) ranging from 1.7-5.3 injuries/1000 dance exposure hours(DEhr). Dance participation (i.e. exposure) may affect injury rates as well as physical, mental, social, and overall well-being. Health-related quality of life(HRQoL) measures like the SF-20 encompass multiple domains important to well-being. However, little research has examined how HRQoL, dance exposure, and injury status are related in collegiate dancers. Our purposes were to 1) examine if HRQoL at the start of the semester (-pre) or DEhr could predict dancers' IR and 2) compare dancers' HRQoL between the start (HRQoL-pre) and end of one 16-week semester(HRQoL-post).

METHODS: We recorded dancers' injuries, DEHr, and HRQoL using the SF-20 at the start and end of the semester in 20 collegiate dancers(18.3±0.7 years,170.7±7.7 cm,70.2±18.9 kg) over a 16-week semester.

RESULTS: Fourteen dancers were injured(total 21 injuries; IR=2.9/1000 DEhr; 95% CI: 1.6-4.1). Neither HRQoL-pre (Nagelkerke r2 =0.07, $\chi 2=(1, N=20)=0.9$, p=0.3) nor dance exposure (Nagelkerke r2 =0.2, $\chi 2=(1, N=20)=2.9$, p=0.2) predicted IR. Dancers' HRQoL remained similar across the semester (F1, 16=.07, p=.8, effect size=.04).

CONCLUSION: Despite most dancers suffering an injury, their HRQoL remained unchanged over the study period. HRQoL-pre nor dance exposure influenced injury status. Dancers' active involvement in class despite being injured may have moderated impacts on their HRQoL. How dance exposure influences dancers' injury rates in larger cohorts and over longer time periods needs study. Overall, understanding relationships among injury, exposure, and HRQoL can help practitioners keep dancers healthy.

KEY WORDS: Dancing; Quality of Life; Risk Factors; Injury; SF-20

Introduction

Dancing is physically challenging. Like athletes, dancers require strength, flexibility, and endurance to dance successfully without getting injured. Dance also has an additional element of artistry [1]. Dancers' reported injury incidence rates (IR) range from 1.7-5.3 injuries/1000 dance exposure hours (DEhr) depending on level (e.g. collegiate, professional) and style (e.g. ballet, modern). Increased time of participation (i.e. exposure) is related to increase IR, while injury rates and exposure are positively related in pre-professional and professional modern and ballet dancers. Generally, dance exposure and injuries affect physical, mental, social, and overall well-being [2].

Clinicians are increasingly examining overall well-being using health-related quality of life (HRQoL) measures. These measures describe how patients perceive their own health, and can elucidate effects of a disease, illness, or injury on physical, mental, and social domains. Injury or disease negatively affects HRQoL, possibly secondary to pain and deficits in physical functioning. Researchers consistently note that non-injured athletes have generally better HRQoL than injured athletes. In collegiate dancers, Yau et al conducted a large retrospective epidemiological study and found that self-reported history of depression (i.e. mental domain), age at time of injury, and the number of injuries sustained prior to the semester of the current injury (i.e. physical domain) were injury predictors in female dancers. Similarly Noh et al observed that increased worry, lower self-confidence, and lesser ability to perform under pressure were related to increased injury frequency in ballet dancers [3-5].

HRQoL can be measured using different surveys. For example, the Short Form 20 (SF-20) is a survey that measures 6 domains (constructs) of health: physical functioning (6 items), role functioning (2 items), social functioning (1 item), and mental health (5 items), and general health perceptions (5 items), and bodily pain (1 item). The SF-20 has been used in the collegiate setting (athletes vs. non-athletes, injured vs. non-injured) and with adolescent athletes. Understanding HRQoL status may help clinicians identify their at-risk dancers at the start of the season, so that they can provide preventative interventions [6]. For example, if a dancer reports lower physical function at the start of the semester, clinicians can devise training programs to improve the dancers' physical function and prospectively reduce injury risk.

Overall, while some researchers have examined how constructs of HRQoL (i.e. mental domain) affect injury status in dancers, relatively little research exists on how a multi-dimensional HRQoL survey relates to IR in collegiate dancers. Also, little published information exists prospectively examining if dance exposure and HRQoL before the semester (-pre) influences IR, and if HRQoL fluctuates across time and injury status. Therefore, our purposes were to 1) examine if HRQoL at the start of the semester (-pre) or dance exposure could predict dancers' injury status and 2) compare dancers' HRQoL between the start (HRQoL-pre) and end of the semester (HRQoL-post).

Materials and Methods

Participants and Informed Consent

Twenty collegiate freshmen dancers (17 female, 3 males; 18.3 ± 0.7 years, 170.7 ± 7.7 cm, 70.2 ± 18.9 kg, 10.8 ± 4.8 years of dance experience) in a single convenience cohort participated in the study [7]. The local Institutional Review Board approved the study and all participants signed informed consent forms before taking part in the study.

Dance Exposure, Injury, and HRQoL

An in-house, certified athletic trainer recorded dance exposure hours (DEHr) over 16 weeks. DEhr was calculated by combining academic class hours, outside rehearsal and choreography hours, and performance schedules. We defined DEhr as one hour of dance participation (class, choreography, rehearsals, technical week, and performance). The program offers a Bachelor of Fine Arts degree focused on modern/contemporary dance performance and choreography [8]. Each year, dancers have more than 20 performance opportunities.

Injuries were defined based on prior literature for surveillance of dance injuries as 'any physical complaint sustained by a dancer resulting from company (sic) performance, rehearsal, or technique class and resulting in a dancer injury report and triage, irrespective of the need for medical attention or time-loss from dance activities. Injuries were further classified as non-time loss (NTL; <24 hours dance restriction) or time loss (TL; ≥ 24 hours restriction).

We administered the SF-20 survey to dancers using a web-based survey (Qualtrics, Provo, UT) at the start (HRQoL-pre) and end (HRQoL-post) of the 16-week semester [9]. Scores were coded and calibrated so that each of the six constructs was equally weighted. Each score was transformed to a scale from 0-100, with higher values indicating better health status. All dancers completed the HRQoL survey as part of their standard healthcare services.

Statistical Analyses

IR was calculated using the formula below. A logistic regression examined if HRQoL (-pre) or DEHr were associated with increased injury rates. Repeated-measures ANOVA compared dancers' HRQoL between the start and end of the semester. A separate repeated-measure ANOVA compared the HRQoL domains between the start and end of the semester. The assumptions of homogeneity were met in the results. A 0.05 a priori alpha level was set for all tests. SPSS 24.0 software (IBM Corp, Armonk, NY) was used to conduct all analyses [10].

$$\text{Formula: } IR = \frac{total\ number\ of\ injuries}{total\ DEHr} x\ 1000$$

Results

Fourteen dancers were injured and 6 remained injury-free, resulting in 21 overall injuries and a 2.9/1000 DEhr IR (95% CI: 1.6-4.1) (Figure 1 and Table I). Dancers suffered 5 TL injuries and lost approximately 18 ± 14.3 days. The ankle (18%), lower leg (14%), hip (14%), and neck (14%) were most commonly injured body locations. Most injuries were acute in nature. The 20 dancers had 7,362 dance exposure hours (Table II). Dancers took part in an average of 27.3 hours/week – for a total of 409 ± 37.9 hours of dance-related activity over the semester.

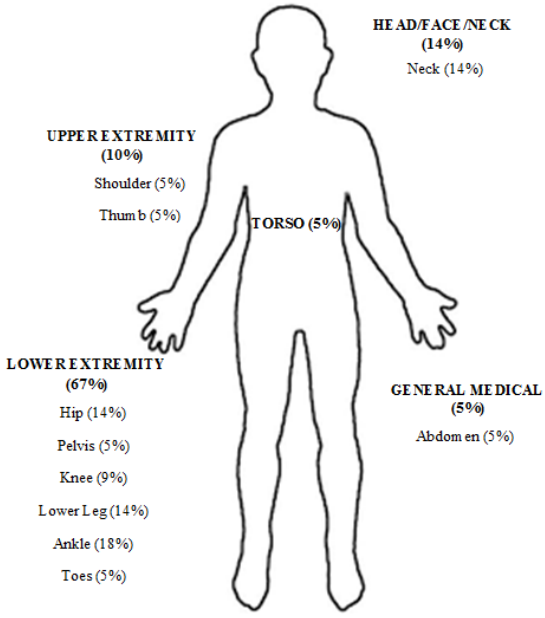

Figure 1: Injury locations in collegiate dancers over a 16-week semester.

		Frequency	Percent	Incidence
Type of Injury	Strain	5	24	0.7(0.1-1.3)
	Tendinopathy	3	14	0.4(-0.1-0.9)
	Sprain	4	19	0.5(0.0-1.1)
	Pain Other	4	19	0.5(0.0-1.1)
	Dysfunction	5	24	0.7(0.1-1.3)
Nature of Injury	Acute	15	71	2.0(1.0-3.1)
	Chronic	6	29	0.8(0.2-1.5)

Severity of Injury	Time Loss	5	24	0.7(0.1-1.3)
	Non-Time Loss	16	76	2.2(1.1-3.2)
Total		21	100	

Table I: Type and nature of injuries over a 16-week semester in collegiate dancers.

Location	Total Hours
Class	225 ± 1.0
Rehearsal	176.1 ± 36.4
Performance	7.9 ± 3.1
Total	409 ± 37.9

Table II: Dance Exposure (DEhr, Hours, M ± SD) over a 16-week semester in collegiate.

The regression analyses revealed that neither HRQoL-pre (Nagelkerke r2 = 0.07, $\chi 2$ = (1, N=20) = .95, p = 0.3) nor dance exposure (Nagelkerke r2 = 0.2, $\chi 2$ = (1, N=20) = 2.9, p = 0.2) predicted IR. Dancers' HRQoL remained similar across the semester (F1, 16=.07, p=.8, effect size=.04) (Table III).

Domain		HRQoL	F	p	Effect Size
Physical	Pre	95.6±14.2			
	Post	94.1±14.7			
	Overall	96.4±8.5	0.1	0.8	0.06
Role	Pre	98.5±6.1			
	Post	91.2±21.5			
	Overall	95.8±9.6	2.1	0.17	0.11
Social	Pre	97.6±6.6			
	Post	97.6±6.6			
	Overall	98.6±3.6	0.01	1	0.001
Mental	Pre	62.7±9.2			
	Post	66.6±8.0			
	Overall	66.1±7.5	3.1	0.1	0.17
General	Pre	75.3±19.4			
	Post	83.2±11.3			
	Overall	79.1±13.4	1.9	0.18	0.11
Pain	Pre	61.2±21.8			
	Post	62.4±18.6			
	Overall	58.7±16.0	0.03	0.88	0.01

Table IV: Health-Related Quality of Life at the start (HRQoL-pre) and end (HRQoL -post) from the SF-20 survey over a 16-week semester and collegiate dancers.

Discussion

Primary Findings

The dancers in the current study took part in almost 28 hours of weekly dance-related activity. Dancers' HRQoL remained unchanged over the semester. Although most dancers did suffer an injury over the study, neither dance exposure nor their HRQoL at the start of the semester predicted injury. In the following sections, we discuss these findings and possible reasons for these observations with comparisons to prior literature and future directions

Injury incidence rates

The IR of 2.9 injuries/1000 DEhr in the current study is in the mid-range for collegiate contemporary and ballet dancers (Range: 1.4–3.3 injuries/1000 DEhr), but lower than prior reports in professional ballet and modern dancers (4.4 and 5.4 injuries/1000 DEhr respectively), and in collegiate contemporary and Irish dancers (10.6 and 8.4 injuries/1000 DEhr respectively). Additionally, the dancers in the current study suffered 5 TL injuries and lost approximately 18±14.3 days, with an IR 1.0 injuries/1000 DEhr. This finding is also in the midrange of previous reports of 0.6–1.3 TL-injuries/1000 DEhr in collegiate dancers. However, our TL IR are higher than previous reports in professional modern dancers (0.20–0.22 TL-injuries/1000 DEhr). A possible reason for these discrepancies might be because of differing TL definitions. Thus, it is important to use consistent injury and TL definitions to better understand the impact of injury on dancers at various performance levels.

Location and Nature of Injury

Our findings that most of the dancers' injuries occurred in the lower extremity (67%) are consistent with most prior studies. The lower extremity may be injured more frequently because of repetitive jumps, turns, and leaps. The ankle is commonly injured because of the stress put upon the structure by different types of footwear and choreography. However, depending upon the dance genre, the injury distribution may differ. For example, our dancers mostly perform contemporary and ballet. Injuries in contemporary dance may differ from injuries seen in hip-hop or break-dancing because of the difference in movement and choreography. In contrast with most other prior work, most of our dancers' injuries were acute in nature (71%) and similar to the numbers that Ekegren et al reported (72%) in pre-professional ballet dancers. We do not have a specific explanation for this observation except for the short time frame and small cohort size and suggest further research.

Dance Exposure

The overall dance exposure we found in the current dancers (mean~27 hours/week over 16 weeks) is higher that noted in recent examinations of student dancers (mean~18.3 hours/week). Some prior authors note that the total dance exposure hours are negatively associated with injuries over a one-year period. In contrast, DEHr did not predict injury status in the current study. One possible reason for this discrepancy may be that the current dancers in our rigorous dance program may be fit enough to take part in around 30 hours of dance-related activity hours without negatively affecting the body. Other possible reasons could include the relatively small sample size and study time frame. While the current study timeframe of 16 weeks, is similar to some prior published work (one semester to 5 months), future researchers should study exposure over longer time periods (e.g. several weeks, months, years) and in larger cohorts to determine if exposure cumulatively influences injury risk.

HRQoL and Injury

We found that HRQoL at the start of the semester or dance exposure did not influence injury status. In contrast, some prior researchers have found that psychosocial factors influence IR in dancers. A partial reason for this discrepancy may be the study time frames mentioned earlier. Specifically, previous researchers who found psychosocial risk factors to influence IR have investigated these factors for periods ranging from 10 months–7 years. Although the length of the study period is important, other factors might also play a part in influencing relationships between HRQoL and injury.

For example, White et al found that pain, impaired motion, and stress were some of the greatest contributors to decreased disablement in their collegiate dancers during one semester of dance. Similarly, Yau et al. suggested that a history of depression might be related to future injury because of depression's relationship with lack of sleep. Inadequate sleep does not allow the body to recover completely, which may impair the dancers' cognitive function and decision-making and decrease performance. Furthermore, Ivarsson et al found that increased levels of negative life-event stress and strong stress responsivity had the strongest relationships with injury risk. Extended periods of high stress can affect the brain's neurological networks, which may decrease an athlete's or dancers' decision-making ability and increase injury risk. Still, psychological interventions such as psychological skills training, cognitive-based therapy, and mindfulness may help reduce the impact of risk factors. Overall, we still believe that examining HRQoL scores at the start of the semester may be valuable for clinicians in regard to potential injury incidence. However, more research is needed to investigate this relationship.

We found that HRQoL was similar between non-injured and injured dancers. In contrast, some authors have noted that non-injured athletes have higher HRQoL than injured athletes. Others report that injury negatively affects the athlete's overall individual health. 12 several reasons may partially explain the discrepancies. First, in the current study, even if dancers were injured, they still 'took part' in dance class. Thus, while they did not actively dance, they took notes and were present in class, and they may have felt that they were still 'in' class, reducing their feelings of isolation and mitigated negative impacts on their subjective HRQoL. In support of this explanation, prior investigators have found that if the injuries did not involve extensive time-loss, being injured did not negatively affect mental state in adolescent athletes. A second reason may be the times when we administered the survey. We examined HRQoL-pre in week 1 and HRQoL-post in week 16 of the semester. Hypothetically, if a dancer who was healthy during week 1, got injured during the semester (i.e. week 2), but recovered within 2 weeks (i.e. week 4), her HRQoL-post during week 16, would appear to be similar to the HRQoL-pre (week 1) despite it possibly being lower when she was actually injured (weeks 2-4).

Further, in a collegiate environment, the mid and end-semester times can be more stressful for collegiate students, as they are preparing for examinations and/or rehearsing hours for performances, and may be both physically and mentally exhausted. Thus, HRQoL values at these times may differ irrespective of injury status. HRQoL scores could have also fluctuated due to the other factors e.g. taking part in rehabilitation sessions, satisfaction from participating in class,

rehearsal or performance, or reaching a personal goal during the semester.

HRQoL measures

As mentioned earlier, the SF-20 score is an overall composite score across 6 related-but-separate domains. Previous authors have found that being injured affects the physical component of HRQoL. Furthermore, despite fully participating in dance-related activities, 71% of university dance students demonstrated clinically relevant levels of disablement including pain, impaired motion, and stress. To examine whether dancers differed across these domains in the current study, we conducted secondary pre-post ANOVAs am, but did not find any differences within these domains. These findings may suggest that the timing of the HRQoL may have played a larger role in the current results than the smoothing out of possible differences across domains. Future researchers should thus examine how different injuries differentially alter HRQoL before the injury and across the recovery process.

We used the SF-20 as our HRQoL measure in this study. We do understand that there are other HRQoL measures that are also reliable and valid (e.g. the SF-36 and the Profile of Mood States (POMS)). However, these measures have their own drawbacks. For example, the PedsQL Scale is specific for pediatric populations, the POMS measures mood, the SF-36 has 36 questions (too long) and the SF-8 requires license fees to use. Additionally, the Disablement in the Physically Active Scale (DPAS) could be used to measure impairments, functional limitations, and disability in a physically active population. In a recent systematic review of HRQoL measurements used in dance, there was no single instrument that was used to measure HRQoL in dancers. Additionally, mental health was the only similar construct investigated in the eight different measures. We chose to use the SF-20, as it may offer an acceptable combination of being (1) comprehensive (i.e. examining multiple domains of health status including mental health), (2) easy to administer (i.e. relatively short and online), and (3) not cost prohibitive (i.e. was free to use). Overall, we recognize these other measures and suggest future work to study which measures and domains are appropriate to examine dancers' HRQoL.

Strengths, limitations, and future recommendations

One of the strengths of this study is that because our dancers had access to a full-time athletic trainer, we are confident about our HRQoL and injury data. Study strength is the prospective study design. We also used both patient (HRQoL) and clinician reported outcomes (injuries) to understand how these are related in the same cohort of collegiate dancers. Still, we do acknowledge study limitations including the relatively short time frame and small sample size. We also did not conduct an a-priori sample size analyses as our sample was a single convenience cohort, and our outcome measures were part of standard practice of healthcare at the institution. While some prior authors do suggest using 50 participants when conducting prediction models, other authors note that 10 events per variable (number of dancers in the current study) as acceptable numbers for prediction modeling in medical literature. Given our sample size of 20 dancers, we used only 2 predictors. Additional studies should examine if HRQoL fluctuates across longer time periods, larger samples and other participation levels (i.e. recreational, competitive, and professional). Our definition of injury – chosen based on prior research – influenced our overall injury numbers. For example, Allen et al. used an equal to or greater than 24-hour time-loss definition when examining injuries in professional ballet dancers. We chose to be more inclusive in our injury definition as we wanted to study the overall healthcare burden of dance injury. So, even if there is no time loss, the clinician may have provided healthcare to help the dancer keep dancing. Thus, using only time-loss to define injury would have artificially deflated our injury numbers. Still, we understand that how to define injury across dancers and physically active people is an area for future work. Additionally, we looked at HRQoL at the start and end of an academic semester as it seems that on average dancers have lost 28.2 – 30.2 days per injury. Thus, we suggest examining HRQoL multiple times during the injury recovery process. We recommend more prospective and multi-centered research to examine these relationships in dancers.

Clinical relevance

A clinical relevance of this study includes observations that collegiate dancers dance for ~27 hours/week and get injured over the course of a 16-week semester. Nevertheless, dancers' HRQoL stayed the same at the start and end of the semester. Thus, when tracking patient progress, clinicians should recognize the importance of exact time when they assess patients, as the actual assessment timing itself may influence results. As a recommendation, we suggest administering HRQoL surveys: 1) immediately following injury, (2) seven days post-injury, (3) 21 days post-injury, and/or (4) when returning to activity, so that clinicians can understand how HRQoL may fluctuate during the injury recovery process.

Conclusions

Despite most of our dancers suffering an injury and dancing ~27 hours weekly, their HRQoL stayed unchanged over the semester. Additionally, HRQoL (-pre) or dance exposure did not influence injury status. Dancers' active involvement in class despite being injured may have moderated negative impacts on their HRQoL. The amount of dance exposure that is adequate to maintain performance but not increase injury incidence requires study. Researchers should examine if creating dancer and performing artists' specific HRQoL instruments that encompass important domains for these populations is needed, and how HRQoL influences overall injury incidence rates and performance in dancers and performing artists. Overall, understanding relationships among injury, exposure, and HRQoL can help practitioners keep dancers healthy.

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