Journal of Athletic Training 2017;52(11):1035–1040
doi: 10.4085/1062-6050-52.10.14

www.natajournals.org

original research

Descriptive Values for Dancers on Baseline Concussion Tools

Lauren McIntyre, ATC*; Marc Campo, PhD, PT†

*Harkness Center for Dance Injuries, New York, NY; †Mercy College, Dobbs Ferry, NY

Context: Capturing baseline data before a concussion can be a valuable tool in individualized care. However, not all athletes, including dancers, have access to baseline testing. When baseline examinations were not performed, clinicians consult normative values. Dancers are unique athletes; therefore, describing values specific to dancers may assist those working with these athletes in making more informed decisions.

Objective: To describe values for key concussion measures of dancers. Our secondary aim was to examine whether differences existed between sexes and professional status. Finally, we explored factors that may affect dancers' scores.

Design: Cross-sectional study.

Setting: Professional dance companies and a collegiate dance conservatory.

Patients or Other Participants: A total of 238 dancers (university = 153, professional = 85; women = 171; men = 67; age = 21.1 ± 4.8 years).

Main Outcome Measure(s): We calculated the total symptom severity from the Sport Concussion Assessment Tool–3rd edition; the Standardized Assessment of Concussion score; the modified Balance Error Scoring System score; and the King-Devick score for each participant. Group differences were analyzed with Mann-Whitney or *t* tests, depending on the data distribution. We used bivariate correlations to explore the effects of other potential influencing factors.

Results: Participants demonstrated the following baseline outcomes: symptom severity = 16.6 ± 12.8; Standardized Assessment of Concussion = 27.5 ± 1.8; modified Balance Error Scoring System = 3.2 ± 3.1 errors; and King-Devick = 41.5 ± 8.2 seconds. A Mann-Whitney test revealed differences in King-Devick scores between female (40.8 ± 8.0 seconds) and male (43.4 ± 8.4 seconds) dancers ($P = .04$). An independent-samples *t* test also demonstrated a difference in modified Balance Error Scoring System scores between female (2.95 ± 3.1 errors) and male (3.8 ± 3.1 errors) dancers ($P = .02$). Age, hours of sleep, height, and history of concussion, depression, or injury did not display moderate or strong associations with any of the outcome measures.

Conclusions: Dancers' symptom severity scores appeared to be higher than the values reported for other athletes. Additional studies are needed to establish normative values and develop a model for predicting baseline scores.

Key Words: concussion baseline examinations, concussion-management modifiers, traumatic brain injuries

Key Points

- Many factors may affect baseline concussion scores in dancers. Establishing normative values for dancers is, therefore, a challenge.
- Dancers' baseline symptom severity scores appeared to be elevated in comparison with those of other athletes. Further research is needed to determine the factors responsible for the higher scores. This also means that a dancer's recovery should not be based on a symptom score of zero.
- A multidimensional approach is necessary to assess postconcussion impairments in dancers.

Dance is a physically demanding activity with an increasingly high rate of participation across the United States.[1,2] For example, almost half of all US public schools offer dance training,[3] and the US Department of Labor[4] projects that by the year 2022, professional employment as a dancer or choreographer will have grown by 13%. As might be expected in any challenging activity, injuries happen often in dance, and as participation increases, more individuals may be at risk.[5,6] Regarding the risk of concussion in dancers, there is a dearth of information. One self-reported survey of dancers in 2016 revealed that 23.5% of participants had experienced a dance-related concussion.[7] If a concussion is suspected, early identification is critical, because those who return to activity with an unrecognized concussion could experience prolonged symptoms or the risk of catastrophic injury.[8]

Due to the intricacy of concussion evaluation, individual baseline measurements are often used to assist in determining whether postinjury changes are the result of a concussion instead of a premorbid condition or individual variability.[9] However, this is only effective if the baseline assessment is accurate, because using an invalid baseline score may cause clinicians to unnecessarily keep an athlete from activity or possibly return an athlete to activity prematurely.[10] Many factors influence the accuracy of baseline examinations, but controlling for all these factors may prove to be time intensive, logistically difficult, or cost prohibitive.[10–12] For example, despite the knowledge that testing smaller groups may provide more valid test scores, many athletic departments are forced to conduct their baseline examinations in large groups as a result of limited time or staff availability.[10] Furthermore, dancers may not

have access to a medical team that conducts yearly screenings and therefore have no opportunity to undergo individual baseline testing.[7,13]

When baseline testing is not possible, it has been suggested that clinicians use normative values to assist in concussion identification and management.[10,14] In fact, clinicians in other areas commonly use normative values for diagnosis or rehabilitation.[10] Yet 1 normative value per concussion test may not suffice. Authors have shown that baseline scores can be influenced by numerous factors such as sex, Scholastic Aptitude Test score, educational level, concussion history, and sport played.[15,16] To our knowledge, no authors have described concussion baseline values specific to dancers; these measurements may be valuable because dancers constitute a unique athletic population. Dance training is based on cultural traditions, and the goals of dance are focused on artistry and creating an emotional or intellectual effect on an audience.[5,13] Dancers have a unique physical profile of hypermobility and hyperflexibility, and many dancers are underweight due to the nature of dance as a "thinness sport." In addition, because dance training is not regulated by the principle of periodization, dancers are frequently overtrained and fatigued.[5] Psychologically, dancers often report feelings of performance anxiety, fear of failure, and hopelessness. Liederbach[5] found that 43% of surveyed dancers in a university dance program had symptoms of depression. These factors may result in dancers having different baseline values than other athletes.

Given that dancers may not have access to baseline assessments,[7,13] the investigation of descriptive scores would be valuable to the dance community. Our aim was to describe concussion-testing baseline values for university and professional dancers as well as to investigate score differences in areas where the literature has previously suggested an influence, specifically sex and concussion history. We also explored other factors that may affect dancers' baseline scores.

METHODS

Participants

A total of 239 dancers were enrolled in the study. We recruited dancers from freshmen classes at a collegiate conservatory of dance and companies for whom we provided ongoing, contracted onsite care. Institutional review board approval was acquired before the start of this study, and the participants provided informed consent.

Design

This study used a cross-sectional design. We conducted the concussion baseline tests as part of comprehensive, preseason screenings in the summers of 2013, 2014, and 2015. Each year involved a new group of participants. Data were entered into a secured electronic injury-tracking system, the International Performing Arts Injury Reporting System.[17,18] The following measures were used to collect data: a self-reported medical and orthopaedic history questionnaire with demographic information; the Sport Concussion Assessment Tool–3rd edition (SCAT3), which includes a symptom checklist (we slightly modified the instructions based on a protocol by Schmidt et al[10]); the Standardized Assessment of Concussion (SAC), a brief cognitive screen; and the modified Balance Error Scoring System (mBESS). The SCAT3 components have demonstrated adequate reliability and validity, though researchers[19,20] have found conflicting results regarding the psychometric properties of the SAC and mBESS. We also conducted the King-Devick test (KD), which has been shown to be a valid sideline assessment tool and has demonstrated a high degree of test-retest reliability in multiple studies.[21] From the self-reported medical history, we obtained the average hours of sleep per night, any history of depression, any history of concussion, and the total number of prior orthopaedic injuries. The concussion screening was conducted as a one-on-one interview with a trained investigator in an isolated area. The time of the concussion screen was recorded, as were the participant's hours of sleep the night before.

Graded Symptom Checklist

For the symptom checklist, we asked dancers to subjectively rate a list of 22 symptoms on a scale from 0 to 6, with 6 being *severe*.[22] They were asked to only report symptoms if they experienced them 3 days out of the week and most weeks of the year (based on a protocol by Schmidt et al[10]). We used the severity score, which is calculated by adding the scores from each individual symptom to create a total score.

Standardized Assessment of Concussion

The SAC is a cognitive test that evaluates 4 areas: orientation, immediate memory, concentration, and delayed recall.[23] We reassured participants that this test was not a measurement of intelligence. We encouraged participants to give their best effort. The maximum potential score is 30 points.

Modified Balance Error Scoring System

The mBESS is a 3-stance balance test (double legged, single legged, tandem) performed without the foam-surface condition of the full BESS test.[23,24] Each position is held for 20 seconds on a firm surface, and errors are calculated based on established criteria, with a maximum of 10 possible errors per stance.[25]

King-Devick Test

The KD is a rapid number-naming test, composed of 3 cards with printed numbers, that requires saccadic eye movement, concentration, and language to complete satisfactorily.[21] We instructed the dancers to read the numbers aloud from left to right as accurately and quickly as possible. A demonstration card was shown and used before testing.[21] The time to read each card was recorded, and the sum of all 3 test cards was recorded as the test score. Any errors were also recorded. Two trials were conducted, and the faster of the 2 trials was recorded as the baseline value.[21]

Data Analysis

We performed the statistical analysis using SPSS (version 20; IBM Corp, Armonk, NY). The α level was set a priori at

Table 1. Demographic Information for Participants

Characteristic	Dancers	
	Professional	Collegiate
n	85	153
Female, n (%)	44 (52)	127 (83)
Male, n (%)	41 (48)	26 (17)
Age, y, mean ± SD	26.4 ± 4.6	18.2 ± 0.8
Hours of sleep night before testing, mean ± SD	6.9 ± 1.6	7.5 ± 1.8
Typical hours of sleep per night, mean ± SD	7.1 ± 1.0	7.2 ± 1.0
Height, mean ± SD, cm	170 ± 6.7	166 ± 8.0
History of concussion, n (%)	7 (8)	6 (4)
History of depression, n (%)	4 (5)	4 (3)
History of orthopaedic injury, n (%)	84 (99)	142 (93)

.05. The distributions of test scores were evaluated graphically and statistically. All test-score variables except those for the KD followed nonnormal distributions. Differences between sexes and professional status groups and in concussion history were analyzed using a Mann-Whitney or *t* test, depending on the normality of the data distribution. These factors have been associated with performance scores in the literature and therefore may require the reporting of subgroup norms. To explore the effect of other factors that may have influenced the scores, we examined bivariate correlations between age, hours of sleep, height, time of day, history of depression, history of orthopaedic injury, and the 4 outcome measures. The Pearson *r* was used for normally distributed outcomes and the Spearman ρ was used for outcomes that demonstrated significant skewness.

One participant was excluded from the analysis because a majority of that individual's information was missing. Eight participants were missing 1 value (of 22) from the symptom inventory. We replaced these values with the series mean. The KD score was missing for 18 participants. Missing data were handled with pairwise deletion for *t* tests and correlations.

RESULTS

Demographics

The demographics for this study are described in Table 1. Ages ranged between 17 and 39 years (age = 21.1 ± 4.8 years). Of the 238 participants, 153 (64.3%) were enrolled in a collegiate conservatory of dance, whereas 85 (35.7%) were members of professional companies. Thirteen participants (5.5%) self-reported a history of concussion. Of these, 3 reported sustaining 2 concussions and 1 had sustained multiple concussions from playing football before dancing. All dancers had more than 1 year of recovery between the concussion and screening, except for 1 participant who had sustained a concussion 6 months earlier.

Baseline Scores

Baseline values, without accounting for any influential factors, are presented in Table 2.

Group Differences

No differences were present between university and professional dancers or between concussion-history groups for any of the outcome measures. Independent-samples *t* tests revealed differences in KD scores between women (40.8 ± 8.0 seconds) and men (43.4 ± 8.4 seconds; $P = .04$). A Mann-Whitney *U* test demonstrated a difference in mBESS scores between women (2.95 ± 3.1 errors) and men (3.8 ± 3.1 errors; $P = .02$). These values are shown in Table 2.

Correlations

The correlations between outcome measures and potential influencing factors are presented in Table 3. Some effects were not seen in university dancers alone: specifically the association between age and symptom scores. Significant correlations were noted between some of the potentially confounding factors and the outcomes. However, none of the factors were more than weakly correlated with any of the outcomes.

DISCUSSION

Baseline Scores

The mean SAC, KD, and mBESS scores were similar to findings in the sports literature.[21,26–29] However, only 10 dancers (4.2%) had baseline symptom severity scores of zero, and in general, our scores were higher than the values reported in other athletes.[10,27,30] For example, 2 other groups[10,31] who used the same modified symptom severity tool on collegiate athletes found lower mean symptom severity scores (2.7 ± 4.5 and 1.5 ± 2.0, respectively).

Elevated baseline symptom scores may be due to dancers' personalities. To have successful careers, dancers and athletes must manage expectations of perfection and exhaustive training regimens.[32,33] Perfectionism as a

Table 2. Description of Baseline Scores

Test	n	Dancers			*P* Value
		Male	Female	Total	
Symptom Severity Score, mean ± SD (range)	238	16.1 ± 12.1 (0–50)	16.6 ± 13.1 (0–63)	16.6 ± 12.8 (0–63)	.97[a]
Standardized Assessment of Concussion, mean ± SD (range)	238	27.4 ± 1.8 (21–30)	27.5 ± 1.8 (20–30)	27.5 ± 1.8 (20–30)	.54[a]
Modified Balance Error Scoring System, errors, mean ± SD (range)	238	3.8 ± 3.1 (0–13)	2.95 ± 3.1 (0–20)	3.2 ± 3.1 (0–20)	.02[a]
King-Devick Test, s, mean ± SD (range)	220	43.4 ± 8.4 (24–65)	40.8 ± 8.0 (22–68)	41.5 ± 8.2 (22–68)	.03[b]

[a] Mann-Whitney *U* test.
[b] Independent-samples *t* test.

Table 3. Correlations Between Potential Confounders and Outcomes

	Symptom Severity Score		Standardized Assessment of Concussion		Modified Balance Error Scoring System		King-Devick Test	
	r_s	n	r_s	n	r_s	n	r	n
Age	0.17[a]	232	0.09	232	0.14[a]	232	−0.04	214
Hours of sleep night before	−0.22[a]	232	0.09	232	0.01	232	−0.09	220
Typical hours of sleep	−0.13	219	0.07	219	−0.03	219	−0.04	201
Time of day	−0.06	228	0.16[a]	228	−0.01	228	0.04	216
Height	−0.05	222	0.06	222	0.22[a]	222	0.17[a]	204
History of depression	0.15[a]	226	−0.10	226	0.01	226	−0.03	208
History of orthopaedic injuries	0.10	226	0.03	226	−0.06	226	−0.13	208

Abbreviations: r, Pearson correlation; r_s, Spearman ρ.

[a] Indicates significance at $P < .05$.

transient state allows dancers and athletes to achieve excellence, but as a constant disposition or trait, it carries the potential to thwart growth due to an intense fear of mistakes and a sense of decreased self-worth.[33–35] Many researchers[6,32–34] have shown that dancers struggle with this paradox of perfection, resulting in injury, depression, overachieving, and other psychological conditions.

Authors[33,34,36] have speculated that dancers' struggles with perfectionism may be due to the nature of dance itself. The discipline of dance, including an emphasis on leanness and aesthetics, immense pressure to achieve a perfect physical form, and a belief that success comes from constant perseverance without rest creates an environment of intense self-criticism.[33,34,36] For example, Kronvall Parkinson et al[34] compared elite basketball players, gymnasts, and ballet dancers and found that the ballet dancers experienced higher levels of negative perfectionism than the other groups, as well as more concern about mistakes than the gymnasts.

The aforementioned associated conditions of perfectionism (eg, depression, neuroticism, overachieving) have been related to increased baseline concussion-symptom scores.[37] In addition, dancers with perfectionistic characteristics are more likely to experience aches, pains, and headaches than dancers with high but realistic expectations.[35] This habit of strict and continuous self-evaluation could, by itself, lead to increased baseline symptom reporting; however, considering the magnitude of the difference between our dancers' baseline symptom score values and those found for other athletes, further research is needed to determine the factors responsible for the higher scores. Regardless, dancers' baseline symptom scores should not be assumed to be zero; thus, recovery from concussion in a dancer should not be determined by a zero symptom score.

Group Differences

Differences were noted between sexes in the mBESS and KD scores, with women performing better on both measures. No differences were evident between professional and university-level dancers or concussion-history groups.

Results vary as to whether an athlete's sex is related to performance on the full BESS.[16,26,29] Furthermore, limited information is available on the psychometric properties of the mBESS, and the full BESS has a wide range of reliability values.[24,38] Clinicians must understand this when using it. The same rater should administer the BESS each time,[38] so there may be limited utility in the normative values presented in this article.

We are the first to report sex differences on a baseline KD test. Future investigators should determine whether this is because athletes' baseline data are not being analyzed by sex or a true difference only within the dancer population.

Though sex has been suggested as another modifying factor in baseline symptom reporting,[12,31] we did not find any differences in symptom severity scores between women and men ($P = .91$). However, given the small percentage of men, a larger sample might have allowed us to examine these differences more effectively.

Influencing Factors

We found only weak correlations between some of the influencing factors and some of the outcome scores.

Depression

A weak correlation occurred between a history of depression and increased baseline symptom severity scores. Other authors[12] have found stronger correlations between active depression and baseline concussion symptoms. Covassin et al[12] used the Beck Depression Inventory II score to categorize athletes into minimal, moderate, or severe depression groups. They compared baseline symptom scores among depression groups and found that those with severe depression reported more symptoms compared with the minimal and moderate depression groups. Although we observed only a weak relationship, health care providers should still ask individuals whether they have been diagnosed with or are being treated for depression, because this may be a modifier for concussion management.

Sleep

We noted a weak correlation between sleep the night before and symptom severity score. Other researchers[11,39] have also investigated the effects of sleep on concussion baseline testing. Sufrinko et al[39] grouped high school athletes into 3 categories based on the amount of sleep the night before baseline testing: *sleep restriction* (≤5 hours of sleep), *typical sleep* (5.5–8.5 hours), or *optimal sleep* (≥ 9 hours). Those who had less sleep the night before had higher symptom scores. McClure et al[11] evaluated baseline performance of collegiate and high school athletes in different sleep-duration groups and also showed that those with less sleep reported more symptoms. Given that dancers

and athletes have very demanding schedules that may result in inconsistent and insufficient sleep durations, clinicians should inquire about sleep habits before baseline testing.[11,40]

Height

We found a weak correlation between taller dancers and worse mBESS performance. This is similar to the findings of Zimmer et al[29] on the full BESS test.

We also demonstrated a weak correlation between taller dancers and worse KD performance. The relationship between these variables is unclear. Other authors[41] have observed relationships between height and eye conditions as well as eyeball-shape differences in taller individuals, but much of this research is geared toward myopia and not saccadic eye movements.

Time of Day

Higher SAC scores occurred later in the day; however, participants were tested only once and not at multiple times during the day. Future authors should assess the effect of test timing in dancers.

Age

A weak correlation existed between older dancers and increased baseline symptom scores. Minimal literature has addressed our current participants' age range (17–39 years) and its relation to baseline symptom severity. Covassin et al[12] found differences between the types of symptoms experienced by collegiate versus high school athletes but not a difference in total symptom scores. Snyder and Bauer[26] looked at the SCAT2 in children and adolescents aged 9 to 18 years and noted that younger participants had more physical symptoms. Conversely, Jinguji et al[28] showed that older high school athletes reported more symptoms.

In our dancers, age was weakly correlated with mBESS performance, such that older dancers had more errors. Iverson and Koehle[42] found a similar correlation with the full BESS but in a much larger age range (20–69 years). The decline of postural stability with age is well documented but generally starts in midlife,[42] which is not within the age range of our participants.

LIMITATIONS

Though our dancers were encouraged to give their best effort, we did not perform formal effort testing during these screenings. Motivation is known to influence baseline scores.[10,15] In addition, we conducted only 1 trial of the mBESS. This procedure was uniform for all of the participants in this study, but other authors[38] suggested that when establishing normative values for the full BESS, 3 trials may be necessary to offset practice effects. We will assess this effect in future work. Finally, because ours is the first study of baseline scores in this population, the results should be interpreted with caution. In our examination of influencing factors, we did not adjust for multiple comparisons because this was an exploratory analysis. Larger studies are needed so that full multivariate models can be used to determine more precisely the contributions of confounding factors to baseline scores. Factors that influenced the baseline scores may have been confounded by other measured and unmeasured variables. For example, though attention-deficit/hyperactivity disorder and learning disabilities can influence baseline measures,[8] we did not collect any information on these conditions from the participants in this study.

CONCLUSIONS

Concussion baseline testing is just 1 component of a concussion-management plan that includes education, assessment, and guidelines for return to activity (D. Runkle, written communication, April 2010). Our results emphasize that dancers' baseline symptom scores should not be assumed to be zero, nor should recovery from concussion in a dancer be based on a zero symptom score. Many factors affect baseline scores in dancers; therefore, clinicians should take a multidimensional approach to assessing impairments postinjury. In addition, the complex interplay of variables affecting baseline scores makes it difficult to establish all-encompassing normative values. For this reason, clinicians may need to obtain individual baseline scores for their dancers. Future authors should establish normative values, continue to investigate other potential influencers on baseline scores in dancers, and develop a regression model for predicting baseline scores based on these influencers.

ACKNOWLEDGMENTS

We acknowledge the assistance of Marijeanne Liederbach, PhD, PT, ATC, CSCS, and Leigh Schanfein, MS, of the Harkness Center for Dance Injuries at the NYU Langone Health, as well as Hunter Loewen for her input.

REFERENCES

1. Koutedakis Y, Jamurtas A. The dancer as a performing athlete: physiological considerations. *Sports Med*. 2004;34(10):651–661.
2. O'Neill JR, Pate RR, Liese AD. Descriptive epidemiology of dance participation in adolescents. *Res Q Exerc Sport*. 2011;82(3):373–380.
3. Education statistics. National Dance Education Organization Web site. http://www.ndeo.org/content.aspx?page_id=22&club_id=893257&module_id=55774. Accessed June 5, 2017.
4. Occupational outlook handbook: dancers and choreographers. US Department of Labor Bureau of Labor Statistics Web site. http://www.bls.gov/ooh/entertainment-and-sports/dancers-and-choreographers.htm. Accessed June 5, 2017.
5. Liederbach M. Dance medicine: strategies for the prevention and care of injury to dancers. Epidemiology of dance injuries: biopsychosocial considerations in the management of dancer health. American Physical Therapy Association Web site. http://www.orthopt.org/content/s/18-3-dance-medicine-strategies-for-the-prevention-and-care-of-injuries-to-dancers2. Accessed June 5, 2017.
6. Krasnow D, Mainwaring L, Kerr G. Injury, stress, and perfectionism in young dancers and gymnasts. *J Dance Med Sci*. 1999;3(2):51–58.
7. McIntyre L, Liederbach M. Concussion knowledge and behaviors in a sample of the dance community. *J Dance Med Sci*. 2016;20(2):79–88.
8. Harmon KG, Drezner JA, Gammons M, et al. American Medical Society for Sports Medicine position statement: concussion in sport. *Br J Sports Med*. 2013;47(1):15–26.
9. Echemendia RJ, Bruce JM, Bailey CM, Sanders JF, Arnett P, Vargas G. The utility of post-concussion neuropsychological data in identifying cognitive change following sports-related MTBI in the absence of baseline data. *Clin Neuropsychol*. 2012;26(7):1077–1091.

10. Schmidt JD, Register-Mihalik JK, Mihalik JP, Kerr ZY, Guskiewicz KM. Identifying impairments after concussion: normative data versus individualized baselines. *Med Sci Sports Exerc*. 2012;44(9):1621–1628.
11. McClure DJ, Zuckerman SL, Kutscher SJ, Gregory AJ, Solomon GS. Baseline neurocognitive testing in sports-related concussions: the importance of a prior night's sleep. *Am J Sports Med*. 2014;42(2):472–478.
12. Covassin T, Elbin RJ, Larson E, Kontos AP. Sex and age differences in depression and baseline sport-related concussion neurocognitive performance and symptoms. *Clin J Sport Med*. 2012;22(2):98–104.
13. Schon LC, Biddinger KR, Greenwood P. Dance screen programs and development of dance clinics. *Clin Sports Med*. 1994;13(4):865–882.
14. Broglio SP, Cantu RC, Gioia GA, et al. National Athletic Trainers' Association position statement: management of sport concussion. *J Athl Train*. 2014;49(2):245–265.
15. Brown CN, Guskiewicz KM, Bleiberg J. Athlete characteristics and outcome scores for computerized neuropsychological assessment: a preliminary analysis. *J Athl Train*. 2007;42(4):515–523.
16. Valovich McLeod TC, Bay RC, Lam KC, Chhabra A. Representative baseline values on the Sport Concussion Assessment Tool 2 (SCAT2) in adolescent athletes vary by gender, grade, and concussion history. *Am J Sports Med*. 2012;40(4):927–933.
17. Liederbach M. IPAIRS: an injury tracking system for dance. Paper presented at Proceedings of the Annual Conference of the International Association for Dance Medicine and Science; October, 1995; Tel Aviv, Israel.
18. Liederbach M, Richardson M. The importance of standardized injury reporting in dance. *J Dance Med Sci*. 2007;11(2):45–48.
19. Chin EY, Nelson LD, Barr WB, McCrory P, McCrea MA. Reliability and validity of the Sport Concussion Assessment Tool-3 (SCAT3) in high school and collegiate athletes. *Am J Sports Med*. 2016;44(9):2276–2285.
20. Institute of Medicine and National Research Council. *Sports-Related Concussion in Youth: Improving the Science, Changing the Culture*. Washington, DC: National Academies Press; 2014.
21. Alsalaheen B, Haines J, Yorke A, Diebold J. King-Devick test reference values and associations with balance measures in high school American football players. *Scand J Med Sci Sports*. 2016;26(2):235–239.
22. McCrory P, Meeuwisse W, Johnston K, et al. Consensus statement on concussion in sport. 3rd International Conference on Concussion in Sport held in Zurich, November 2008. *Clin J Sport Med*. 2009;19(3):185–200.
23. Glaviano NR, Benson S, Goodkin HP, Broshek DK, Saliba S. Baseline SCAT2 assessment of healthy youth student-athletes: preliminary evidence for the use of the Child-SCAT3 in children younger than 13 years. *Clin J Sport Med*. 2015;25(4):373–379.
24. Brown HJ, Siegmund GP, Guskiewicz KM, Van Den Doel K, Cretu E, Blouin JS. Development and validation of an objective balance error scoring system. *Med Sci Sports Exerc*. 2014;46(8):1610–1616.
25. Guskiewicz KM. Balance assessment in the management of sport-related concussion. *Clin Sports Med*. 2011;30(1):89–102, ix.
26. Snyder AR, Bauer RM; Health IMPACTS for Florida Network. A normative study of the sport concussion assessment tool (SCAT2) in children and adolescents. *Clin Neuropsychol*. 2014;28(7):1091–1103.
27. Hänninen T, Tuominen M, Parkkari J, et al. Sport Concussion Assessment Tool–3rd edition—normative reference values for professional ice hockey players. *J Sci Med Sport*. 2016;19(8):636–641.
28. Jinguji TM, Bompadre V, Harmon KG, et al. Sport Concussion Assessment Tool-2: baseline values for high school athletes. *Br J Sports Med*. 2012;46(5):365–370.
29. Zimmer A, Piecora K, Schuster D, Webbe F. Sport and team differences on baseline measures of sport-related concussion. *J Athl Train*. 2013;48(5):659–667.
30. Schatz P, Robertshaw S. Comparing post-concussive neurocognitive test data to normative data presents risks for under-classifying "above average" athletes. *Arch Clin Neuropsychol*. 2014;29(7):625–632.
31. McCaffrey MA, Mihalik JP, Crowell DH, Shields EW, Guskiewicz KM. Measurement of head impacts in collegiate football players: clinical measures of concussion after high- and low-magnitude impacts. *Neurosurgery*. 2007;61(6):1236–1243.
32. Hamilton LH, Hamilton WG, Meltzer JD, Marshall P, Molnar M. Personality, stress, and injuries in professional ballet dancers. *Am J Sports Med*. 1989;17(2):263–267.
33. Eusanio J, Thomson P, Jaque SV. Perfectionism, shame, and self-concept in dancers: a mediation analysis. *J Dance Med Sci*. 2014;18(3):106–114.
34. Kronvall Parkinson M, Hanrahan SJ, Stanimirovic R, Sharp L. The effects of perfectionism and physical self-concept on pre-performance anxiety in elite female gymnasts, basketball players, and ballet dancers. Paper presented at: 17th Annual Meeting of the International Association for Dance Medicine & Science; October 25–27, 2007; Canberra, Australia.
35. Diamond T. Perfection, obsession and dance. Paper presented at: 17th Annual Meeting of the International Association for Dance Medicine & Science; October 25–27, 2007; Canberra, Australia.
36. Padham M, Aujla I. The relationship between passion and the psychological well-being of professional dancers. *J Dance Med Sci*. 2014;18(1):37–44.
37. Merritt VC, Rabinowitz AR, Arnett PA. Personality factors and symptom reporting at baseline in collegiate athletes. *Dev Neuropsychol*. 2015;40(1):45–50.
38. Bell DR, Guskiewicz KM, Clark MA, Padua DA. Systematic review of the balance error scoring system. *Sports Health*. 2011;3(3):287–295.
39. Sufrinko A, Johnson EW, Henry LC. The influence of sleep duration and sleep-related symptoms on baseline neurocognitive performance among male and female high school athletes. *Neuropsychology*. 2016;30(4):484–491.
40. Sargent C, Lastella M, Halson SL, Roach GD. The impact of training schedules on the sleep and fatigue of elite athletes. *Chronobiol Int*. 2014;31(10):1160–1168.
41. Saw SM, Chua WH, Hong CY, et al. Height and its relationship to refraction and biometry parameters in Singapore Chinese children. *Invest Ophthalmol Vis Sci*. 2002;43(5):1408–1413.
42. Iverson GL, Koehle MS. Normative data for the Balance Error Scoring System in adults. *Rehabil Res Pract*. 2013:846418. doi:10.1155/2013/846418.

Address correspondence to Lauren McIntyre, ATC, Harkness Center for Dance Injuries, 614 2nd Avenue, Floor 2, Suite G, New York, NY 10016. Address e-mail to lauren.mcintyre@nyumc.org.