
Wellness Monitoring for Professional Ballet Dancers

A Pilot Study

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Abstract

Self-report wellness measures are used extensively in elite sport as valid indicators of the adaptive responses to training and performance of an athlete. Wellness parameters such as quality and quantity of sleep, muscle soreness, fatigue, and stress are monitored in professional sport via Athlete Management Systems (AMS) and self-report monitoring applications (App). However, the use of a monitoring App specifically for professional classical ballet dancers has not been tested. This study piloted a self-report App to measure wellness constructs in a professional ballet company. Three male and two female dancers volunteered to take part in the mixed-method study, entering daily wellness data, frequency of work-related activities, and injury status into an App on their smart phones. Via a focus group interview session, perceptions of wellness and experiences using the App were found to be favorable, with dancers reporting that the App enhanced awareness of their well-being. To further develop monitoring tools in professional ballet companies, it is recommended that the App be made specific to the wellness needs of dancers.

Training imposes stress on athletes, often shifting their physical and psychological well-being along a continuum that progresses from acute fatigue to overreaching, and ultimately overtraining syndrome.¹ Such disturbances may also be reflected in an increased risk of injury.²⁻⁴ In dance-specific research, positive correlations have been reported between stress, maladaptive coping behaviors, and injury.⁵⁻⁸ At any given point in time, strain on the body from the physical stress of training may combine with other psychosocial stressors to exert a negative influence on physical state, mental state, and as a consequence, ability to perform.⁹ Exhaustion is the central symptom related to stress and associated with intense training and competitive demands.^{10,11} Many dancers have perceived fatigue and overwork to be a major contributing factor to their injuries.¹² Once fatigued, the ability to perform movements requiring complex skill is compromised. This

can lead to poor technique, faulty alignment, inefficient biomechanics, and resultant stress placed on the muscles and joints that can only be tolerated to a limited extent before injury occurs.¹³

An Athlete Self-Report Measure (ASRM) that records daily wellness can provide valuable insight into the adaptive responses of athletes when training and competing.¹⁴ The use of self-report measures in wellness research is widespread, with 84% of surveyed high-performance sports in Australia and New Zealand incorporating a wellness self-report measure as part of their monitoring strategy.^{15,16} The act of completing a self-report data form has been suggested to increase athletes self-awareness and ownership of their training, such as taking the initiative to seek information and assistance from staff, forming better habits, and being “less likely to sit on pain and injury,” which may, in turn, lead to better training and performance-related behaviors.^{1,17,18}

Athlete monitoring Apps have been implemented in many professional sports^{14,15,19,20} and have provided coaches and medical staff with data that may assist with prescribing and adjusting training load, thus optimizing adaptation and performance while reducing the risk of overtraining, injury, and illness.^{15,16} While there is a growing body of research around dancer wellness programs and monitoring,^{21,22} the use of a monitor-

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ing App specifically for professional classical ballet dancers has not been tried. To increase feasibility of tracking in professional ballet, the current study aimed to expand upon dancer wellness monitoring initiatives using a ballet-specific wellness App.

Methods

Participants

Five professional ballet dancers (three male) employed at a national ballet company participated in a 1-month pilot study using a wellness App. Participants were aged between 24 and 30 years, and the length of their professional careers ranged from 4 to 10 years. Ranks in the company included senior artist (one), soloist (two), coryphee (one), and corps de ballet (one).

Measurement Instruments

Participants completed a wellness questionnaire and an activity questionnaire (ballet specific work-related activities such as coaching class, technique class, rehearsal, and strength and conditioning) daily through the wellness App. They were instructed to complete the questionnaires consecutively, wellness in the morning before class and activity at the end of day.

Wellness Questionnaire

Similar to sporting AMS structure, participants identified areas of soreness on a visual body map and scored their pain on a 10-point Likert scale where 1 = no pain, 5 = quite sore, and 10 = extremely sore. They entered wellness scores for fatigue, sleep quality, stress, and overall wellness from a visual “traffic light” colored scale between 0 and 10, where 10 indicated a higher quality of wellness. Wellness variables were selected in accordance with the Hooper Index for well-being variables.²³ The wellness questionnaire took 1 to 2 minutes to complete.

Activity Questionnaire

Participants recorded their activities each evening via the App, which included the type of training activity, such as coaching class (a ballet class designed for dancers who are

rehabilitating from injury), technique class, rehearsal, and strength and conditioning. More than one activity could be selected. If no activity was recorded, a reason could be selected from a list including day off, injured or rehabilitating, or sick leave. Participants recorded if they performed during the day, if they were on tour, and if it was a double show day. Finally, they were required to complete the Oslo Sports Trauma Research Centre (OSTRC) questionnaire,²⁴ which measures the severity of a physical complaint, reflects athletes’ self-assessment of their pain, and summarizes the impact that the problem has had on their participation, training volume, and sports performance (Table 1). Body areas were selected from a body map to represent areas that most limited training. The OSTRC was in no way altered to make it specific to ballet or dance. Previous studies have administered the OSTRC weekly to review symptom progression²⁴; this

study, on the other hand, required participants to complete it daily.

Procedures

Ethics approval was granted by the authors’ university ethics committee, and participants provided written consent. A tutorial and handbook for using the App on a smart phone or iPad device was provided to all participants.

Throughout the 1-month pilot period, automated alerts of low wellness scores (between 0 and 3), high muscle severity scores (between 7 and 10), and inability to participate due to injury were sent for 3 consecutive days to the researcher and medical staff member through the App. In addition, alerts were sent to the participant and the principal researcher if wellness or activity or injury data was missing for 2 consecutive days.

Following the 1-month data entry period, a focus group was conducted by the principal researcher that provided the dancers an opportunity to

Table 1 Training Impacts: Thoracic Spine Recording Through the OSTRC

Participation	Number of Times Recorded
Unable to participate	0
Reduced participation	2
Fully participating with physical complaint	3
Extent of Reduced Training Volume	Number of Times Recorded
Cannot participate	0
To a major extent	2
To a moderate extent	1
To a minor extent	1
No reduction	1
Extent Affected Performance	Number of Times Recorded
Cannot participate	0
To a major extent	2
To a moderate extent	1
To a minor extent	1
No effect	1
Symptoms	Number of Times Recorded
Severe pain	1
Moderate pain	2
Mild pain	1
No pain	0

describe their experiences and to hear the experiences of co-participants. A semi-structured interview format was adopted for the focus group exploring App use and experiences, completion of daily data entries, self-awareness, areas of improvement, and suggestions for further development of the App. The focus group data were transcribed verbatim by the primary researcher and the interview data were analyzed via thematic analysis and condensed to information summaries. Due to the small sample group and the importance of maintaining confidentiality, the principal researcher chose not to denote participants as “Dancer A,” “Dancer B,” or to use other pseudonyms that might identify participants. Following the focus group, dancers were presented with a brief summary of the results of the pilot study.

Statistical Analysis

Data analyses were performed in IBM SPSS Statistics software version 25 (IBM, Armonk, New York, USA).

Data were reported using descriptive statistics. OSTRC findings were reported as frequencies (Tables 1 and 4).

Results

Quantitative Data

Over the 1-month period, a 97% adherence rating was recorded, with participants scheduling alarm reminders through the App. They detected technical difficulties on three occasions when data were not entered. One participant entered two consecutive days of low fatigue ratings (0 to 3).

Average wellness scores ranged from 6 to 7.92, which corresponded to reports of being “slightly stressed or fatigued,” and the frequency of alerts for low wellness (0 to 3) were highest for fatigue and lowest for sleep quantity (Table 2). Dancers’ participation in training activities included: technique class (36%), coaching class (1.5%), rehearsal (31%), performance (24%), strength and conditioning (32%), and double shows (4.4%).

Foot pain was reported most frequently, and the highest severity of pain was recorded in the neck (Table 3).

Over a cumulative 118 days of recorded activity data, dancers reported full participation (N = 96), full participation with physical complaint (N = 9), reduced participation due to physical complaint (N = 4), and unable to participate due to physical complaint (N = 2). Seven illness events were recorded that impacted participation and performance.

Thoracic spine pain limited training most often and resulted in modification of training participation and performance (Table 4).

Qualitative Data

Qualitative thematic analysis of the focus group was conducted. Themes were refined into a summary that revealed two main concepts: enhanced self-awareness (effectiveness and ease of use of the wellness App), and further development (considerations for a wellness App explicitly for professional ballet).

Table 2 Average Wellness Scores Recorded Over the 4-Week Period

Wellness Parameter	Mean	Standard Deviation	Number of Alerts for Low Wellness
Fatigue	6.00	0.54	6
Stress	7.10	0.73	3
Sleep Quality	6.76	1.18	5
Sleep Quantity (hours)	7.92	1.03	0
Overall Wellness	6.98	0.51	2

Table 3 Muscle Soreness Areas Recorded Over the 4-Week Period

Body Area	Number of Times Body Area Recorded as Sore	Average Severity Rating	Highest Rating Severity Score Recorded on a Scale of 1 to 10
Foot	30	0.80	2
Ankle	16	1.80	4
Pelvis	7	0.80	2
Neck	6	2.40	5
Thoracic Spine	5	1.80	4
Lower Leg	5	0.40	2
Thigh	5	0.60	3
Knee	4	0.80	4
Shoulder	2	0.60	3

Table 4 Number of Times Over 4 Weeks an Area of the Body Was Recorded as Limiting Performance

Body area	Impact on Performance
Thoracic Spine	5
Lower Leg	4
Knee	2
Ankle	2
Neck	1
Shoulder	1

Enhanced Self-Awareness: Effectiveness and Ease of Use of the Wellness App

Dancers reported that the App was simple to use; each section flowed with ease and could be completed quickly. All five dancers reported the App “enhanced” their self-awareness and provided an opportunity for reflection on their health. Two dancers found that they regularly checked the history component of the App. In particular, two of the five dancers reported that they regularly reviewed their fatigue and self-reported sleep quality and quantity over the week. Dancers acknowledged that psychological awareness and consideration of holistic well-being was “not always at the forefront” of their mind. They said that their physical and psychological awareness was enhanced in preparing for and recovering from training and performance demands, and using the App encouraged them to be more aware of their holistic well-being; for example: “In terms of how many hours I’ve slept and my level of fatigue in the morning, using the App I’ve actually stopped and thought wait, have I had enough sleep, am I actually tired. That’s kind of good in making me aware.” Dancers summarized their experiences using the wellness App as positive, beneficial, and practical for use in professional ballet. As a final component of this theme, dancers supported this trial of the App.

Further Development: Considerations for a Wellness App Explicitly for Professional Ballet

Dancers reported that they experienced difficulty in identifying if they

had entered daily wellness and activity data and suggested that a tracking option via a visual calendar in the App may assist in tracing data entries and avoiding the potential for missed or duplicated data being entered. Dancers also discussed their experience of entering data in the morning and noticing that their wellness and muscle soreness varied throughout the day. For example, dancers reported that in the morning before class, when they entered their wellness data, they were feeling fresh, not stressed, and had limited muscle soreness. However, by the end of the day, if tested, they may have scored lower wellness and higher muscle soreness. One participant suggested entering whether dancers were on analgesic medications, as that might impact their wellness scores. A final recommendation was to provide medical points of contact and contact details through the App.

Discussion

A self-report wellness monitoring App was tested with a small sample of dancers in a professional ballet company and found to be useful. The App captured self-reported wellness, frequency of work-related activity, and injury status data, with dancers reporting that the App enhanced awareness of their well-being. Five wellness parameters based on the Hooper Index self-assessment questionnaire were included in the current App, involving well-being ratings relative to sleep, stress, fatigue, and muscle soreness.^{23,25,26} The small number of wellness variables was chosen to enhance adherence to entering data, and participants found that the

App was easy to use, data entry was efficient, and the questions succinct. Consistent with previous research,¹ participants in this study discussed the benefits of recording and reviewing their own data, acknowledging that wellness is often “not at the forefront of their mind.”

Monitoring wellness can be useful for early detection and intervention before performance, injury, and health decrements are observed. Increased awareness and acknowledgment of wellness status on a daily basis can provide a greater depth of understanding of an individual’s holistic well-being, for both dancers and the medical team, to reduce the risk of injury. Wellness data collected in this study was limited to the five variables mentioned above, but exploration of other states such as mood, energy level, and motivation may provide greater insights into professional ballet dancers’ wellness. Further, wellness data was collected only in the morning, before any work-related activity had begun. Regular wellness reporting throughout the day, after each type of activity is completed, may promote greater insight for the development of interventions to maintain and improve health and well-being.

Access to the App via their smart phones facilitated the completion of wellness recording in real-time and thus allowed for immediate personal reflection of wellness scores. Confidentiality was a priority for dancers testing the App; therefore, it was agreed that only the researcher and a medical team staff member would be privy to the daily data entries and alerts for low wellness or injury and participation issues throughout this pilot study. The App successfully alerted the researcher and medical staff member to a participant’s data entry of low fatigue scores over 2 consecutive days, encouraging conversations between the dancer and the medical staff member. The medical staff member met with the dancer as part of the protocol for alerts through the App. Further access, analysis, and interpretation of individual and group wellness data by medical professionals

within the company may be beneficial for rehabilitation program development and adjustment, intervention, and injury management.

In parallel with the research into athletes' overuse injuries,²⁴ the current study collected daily OSTRC recordings to identify how symptoms progress from day to day. The OSTRC daily reporting may provide greater insight into the progression and development of overuse injuries. Further research in this area with a larger sample size, recording daily OSTRC scores and comparing with daily wellness scores, may assist in identifying patterns, trends, and possible injury risk factors. As a result of the limited sample size and pilot-study design, evaluating the relationship between injury and participation status and wellness fluctuations was not possible. Comparing wellness data in each of the work-related activities was also beyond the scope of this pilot. However, it is recommended that this be investigated in future research to identify possible patterns and fluctuations in wellness relative to work-related activity.

Future directions to expand on the findings of this pilot study are recommended. First, a study with a larger sample size and over a longer period of time is required to provide meaningful data on the incidence of injury and its impact on performance and training in dance. Second, it is recommended that further research be conducted to compare wellness profiles between touring and non-touring periods and to investigate the relationship between wellness scores and injury incidence resulting from work-related activities. Third, we suggest that dancers should be educated about the potentially injurious effects of poor wellness habits on holistic well-being and performance.

Conclusions

The experimental App utilized in this study captured self-reported wellness, participation in work-related activities, and injury status data. It also provided alerts to missing data entry points and poor wellness and injury

reporting, enabling a timely and proactive approach to holistic well-being. To further develop monitoring tools for professional ballet companies, it is recommended that the App be made increasingly specific to the wellness needs of dancers.

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