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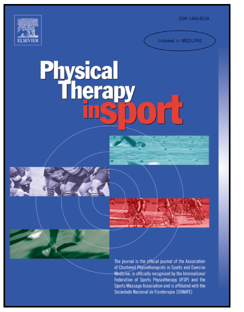

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The prevalence and impact of low back pain in pre-professional and professional dancers: a prospective study

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Structured Abstract

Objectives: To determine the prevalence of low back pain (LBP) in pre-professional and professional dancers and its impact on dance participation, care-seeking and medication use.

Design: Prospective cohort study

Setting: One pre-professional ballet school, two pre-professional university dance programs, and a professional ballet company.

Participants: Male and female classical ballet and contemporary dancers

Main Outcome Measures: An initial questionnaire collected demographic and LBP history data. The monthly prevalence of LBP (all episodes, activity limiting episodes and chronic LBP) and impact (activity limitation, care-seeking, and medication use) was collected over a nine-month period.

Results: 119 dancers participated, which represented 54% of those invited. Activity limiting LBP was reported by 52% of dancers, while chronic LBP was reported by 24%. Seventeen percent of all episodes of LBP resulted in some form of dance activity being completely missed. One-third of the sample reported care-seeking and one-fifth of the sample used medication. A history of LBP was associated with activity limiting LBP ($p<0.01$; adjusted odds ratio: 3.98; 95% confidence interval: 1.44, 11.00).

Conclusions: LBP in dancers was common and had multiple impacts. This study reinforces the need for dancer access to healthcare professionals with expertise in evidence-based LBP prevention and management.

Key words

Epidemiology; Pain experience; Spine; Dance

Highlights

- Prevalence of LBP in dancers is similar to those reported in other elite sport
- A high degree of variation exists between LBP experience and impact on participation
- Past history of LBP increases future risk

Introduction

Low back pain (LBP) is the leading cause of disability worldwide and represents significant personal and social cost (Maher, Underwood, & Buchbinder, 2017). It is often first experienced in childhood, with lifetime prevalence reaching adult levels by late adolescence (Calvo-Munoz, Gomez-Conesa, & Sanchez-Meca, 2013). Dance, which is a rigorous physical pursuit that boasts the highest participant rate for all cultural, sporting and leisure activities amongst Australian girls and the second highest for Australian male and female children combined (ABS, 2012), has been associated with a high prevalence of LBP (Crookshanks & Trotter, 1999; McMeeken, et al., 2001; Swain, Bradshaw, Whyte, & Ekegren, 2017). There is a strong rationale underlying this correlation. For instance, epidemiological evidence shows that engaging in work with high physical demands is a risk factor for the initial onset of LBP (Ferguson & Marras, 1997), while specific spine movements such as repetitive bending and twisting, which are integral to dance, are associated with increased reports of LBP as well as functional loss and spine injury (Ferguson & Marras, 1997; Marras, Lavender, Ferguson, Splittstoesser, & Yang, 2010).

Accordingly, epidemiological studies of dance injuries have identified the low back as the third most common site of injury in both pre-professional and professional classical ballet dancers (Allen, Nevill, Brooks, Koutedakis, & Wyon, 2012; Ekegren, Quested, & Brodrick, 2014), and the second most common site of chronic injury in Australian professional dancers (Crookshanks & Trotter, 1999). In adolescent ballet dancers aged between 9 and 20, LBP history has been associated with future musculoskeletal injury (Gamboa, Roberts, Maring, & Fergus, 2008). Two previous LBP studies in dancers, both cross-sectional in design, have observed higher rates of LBP in dancers than controls (McMeeken, et al., 2001), as well as lifetime and point prevalence rates surpassing those seen in global adolescent and adult populations (Swain, et al., 2017). These findings endorse LBP as a common health issue in young, as well as professional dancers and, being well above that of the general population, warranting more attention.

Importantly, there is considerable variability in how LBP manifests in individuals (Menezes Costa, et al., 2012), and simple measures of prevalence can only provide a partial overview of the problem. Little is currently known about the impact of LBP on dancers, as previous studies have focussed on how much LBP is experienced, rather than the extent to which it disrupts dance practice, or incites care-seeking and medication use. In addition, little is known about the factors associated with LBP in dance, which limits the capacity to develop targeted prevention strategies. This study had three aims: 1) to investigate, via prospective cohort design, the prevalence of LBP in pre-professional and professional dancers, 2) to determine the impact of LBP on dance participation, care-seeking and medication use, and 3) to determine factors associated with the experience of LBP.

Methods

A prospective cohort study was conducted over a nine-month period. Classical ballet dancers from a pre-professional ballet school (n=95, aged 11-18), and a professional nationally touring ballet company (n=29, age range unavailable) as well as contemporary dancers from two pre-professional university dance programmes (n=77 and n=19, aged 17-25) were invited to participate. Acceptance into each cohort is via an audition process, ensuring a threshold of ability. Volunteers were eligible for inclusion in this study if they were aged 12 years or more. No incentives were offered in return for participation. After providing informed consent/assent, participants provided their email addresses to researchers to allow distribution of online questionnaires. Ethics approval was granted by the X University Human Research Ethics Committee.

Questionnaires were developed following review of the LBP, sport, and dance injury literature. Participants received an initial online questionnaire (Qualtrics, USA) via email at the commencement of the study, followed by a questionnaire sent at the end of each month during the study period (Supplement 1). A single reminder email was sent to participants that had not completed the questionnaire within seven days. All collected data were de-identified, with participants creating their own login identification to allow for individual tracking.

The initial questionnaire collected demographic, dance and LBP history data, which have been reported previously (Swain, et al., 2017). Subsequent questionnaires determined the monthly prevalence of LBP, asking 'In the past month, have you had pain in your lower back?' and were accompanied by a diagram of the posterior aspect of the body, highlighting the region between the lower margin of the 12th ribs and the gluteal folds (Dionne, et al., 2008). Participants who indicated they had experienced LBP were then asked whether the episode was new (i.e. not present in the previous questionnaire), how intense the pain was (a numeric scale of 0-10), and whether they were currently experiencing LBP. To determine the impact of LBP, participants were asked the total amount, as well as percentage, of dance activity they had to either modify or miss due to their pain, and whether they consulted a health professional (yes or no) or used medication for their pain (yes or no). To provide a measure of dance participation, all participants were asked for information about their dance activity for the past month, including the type (class, rehearsal, or performance) and style (classical, contemporary, or other), as well as the number and average duration of each activity.

The prevalence of LBP (aim 1) was reported for the entire study period and for each month of the study period, proportional to survey respondents. Episodes of LBP were defined as 'any LBP episode', which included all episodes of LBP, 'activity limiting LBP', which was an episode of LBP that resulted in some form of missed or modified practice, and 'chronic LBP', which occurred when participants indicated that they experienced three consecutive episodes of LBP that were not new in a three-month period. Point prevalence was calculated as the proportion of responders that indicated they were currently experiencing LBP at the time of completing the questionnaire.

To determine the impact of LBP (aim 2), the proportion of LBP episodes requiring activity-modification was calculated as a proportion of all LBP episodes. The proportion of the sample that engaged in care-seeking or medication use was calculated as a proportion of the entire sample as well a proportion of those that experienced LBP. Spearman correlations were used to examine the relationship between reported pain-intensity of LBP episodes and these outcomes. Significance was set at $p < 0.05$.

To determine factors associated with the experience of LBP (aim 3), exposure variables including age, sex, body mass index (BMI), age started dancing, cohort type (dance school, university, or company), and LBP history were described using frequencies and percentages for categorical variables, and means (standard deviation) for continuous variables. Chi square analyses and independent t-tests were used to examine univariate associations between exposure measures and the presence or absence of LBP (i.e. i) 'any LBP episode', ii) 'activity limiting LBP' and iii) 'chronic LBP'), followed by multivariate logistic regression to adjust for confounders. Variables that showed significant association following univariate analyses ($p<0.25$) were entered into the multivariate model. A backward stepwise approach was planned, whereby non-significant variables were removed from the model individually ($p<0.05$), and the reduced model compared with the initial model using likelihood ratio tests. The resulting adjusted odds ratios (AORs) and associated 95% confidence intervals (CIs) were reported. Multivariate models for any episode of LBP and chronic LBP were underpowered and therefore, only the model for activity limiting LBP is presented. To assess for a relationship between dance participation and LBP prevalence, Pearson (for parametric data) and Spearman (for non-parametric data) correlations were performed between monthly prevalence for all LBP episodes as well activity limiting LBP episodes and the mean number of dance activities (class, rehearsal, and performance) as well as dance hours (number of each activity type multiplied by the average duration of each corresponding activity) for each month. All statistical analyses were performed using SPSS software for Windows (version 22.0, SPSS Inc., Chicago, IL, USA).

Results

Out of 220 individuals invited, 168 agreed to participate. The email addresses of three individuals were invalid, necessitating their exclusion from the study. Two individuals completed only the initial questionnaire, and were excluded from the final analysis. The initial questionnaire as well as at least one subsequent monthly questionnaire was returned by 119 participants (54% of the sample invited, n=100 females). Participant demographic data is presented in Table 1. Five hundred and eighty-five total monthly questionnaires were collected throughout the course of the study. Twenty-two dancers completed all 10 questionnaires, 50 completed between five and nine, and 47 completed four or less. The highest response rate was obtained for the first monthly questionnaire (62%) and the lowest was recorded for the final questionnaire (22%). Sixty-three percent of monthly questionnaires were completed within five minutes and 87% within 10 minutes.

Ninety-three (78%) participants reported at least one episode of LBP over the course of the study, while 62 (52%) experienced an episode that resulted in some form of activity limitation, and 29 (24%) experienced chronic LBP (Table 1). The point prevalence of LBP was between 8 and 25%, with the highest rate observed in the third month (Figure 1). Monthly prevalence (Figure 1) ranged from 19 to 58%, and 11 to 34% for all episodes of LBP and activity limiting LBP, respectively.

For each LBP episode, 49% resulted in no modification to dance activities, 46% resulted in up to half of dance activities being modified and the remaining 5% resulted in modification of more than half of dance activities. Seventeen percent of LBP episodes resulted in some portion of training being completely missed. A median pain intensity score of 4/10 (Interquartile range (IQR) = 3-6) was observed for all episodes of LBP and 5/10 (IQR = 3-7) for episodes of activity limiting LBP. Of the 62 individuals that experienced activity limiting LBP, 48% reported multiple episodes over the course of the study.

Thirty-four (29%) participants reported seeking health care for their LBP. Physiotherapists were the most commonly seen professionals (seen by n=16), followed by, Pilates instructors (n=5), chiropractors (n=5), and medical professionals (n=4). Medication use was reported by 25 (21%) participants, with 17 reporting the use of non-steroidal anti-inflammatories (NSAIDS), and 14 reporting the use of paracetamol on at least one occasion. Other medication reported included 'pain killers' or undisclosed (n=2). Of the medications reported, one (Celebrex®, n=1) is available as prescription medication only. A median intensity score of 5/10 (IQR = 4-7) was observed for LBP episodes that resulted in care-seeking and 6/10 (IQR = 5-7) for episodes resulting in medication use. There were significant, medium sized, positive correlations between the intensity of each episode of LBP and care seeking ($r = 0.31$, $p<0.01$), as well as medication use ($r = 0.38$, $p<0.01$) each month.

The mean number of dance activities reported per month ranged from 35.5 to 60.2 (SD range: 14.0-24.9). No significant relationship was identified between monthly dance activities and the monthly prevalence of any LBP ($r= 0.29$, $p= 0.45$) or activity limiting LBP ($r= 0.38$, $p= 0.32$). The mean dance hours per month ranged between 49.9 to 85.3 (SD range: 21.4 to 44.4). No significant relationship was also identified between monthly dance hours and the monthly prevalence of any LBP ($r= 0.48$, $p= 0.19$) or AL LBP ($r= 0.57$, $p= 0.11$). Large variability was evident in the dance participation measures even when cohorts were considered separately (standard deviations for dance hours ranging from 5.1 to 85.9 hours per month), and when subgroups (e.g. year group) within cohorts were considered.

Exposure variables significantly associated with activity limiting LBP were entered into a multivariate model (Table 2). These included history of LBP, age, age started dancing, and cohort type (school, university, and company). After adjusting for confounding variables, lifetime history was the only significant predictor of activity limiting LBP ($p=0.01$).

Discussion

The purpose of this study was to determine the prevalence and impact of LBP in pre-professional and professional dancers. In this cohort, LBP was common. The proportion of dancers that experienced an episode of activity limiting LBP (52%) during the nine month study period was above the yearly prevalence observed in the global adolescent (34%)(Calvo-Munoz, et al., 2013) and adult populations (38%) (Hoy, et al., 2012), and within the yearly prevalence ranges observed in a systematic review of Olympic sport disciplines (24-66%) (Trompeter, Fett, & Platen, 2016). The monthly prevalence of activity limiting LBP ranged from 11-34%, which is slightly higher than that seen in elite rowers (6-25%) (Newlands, Reid, & Parmar, 2015); although, the mean (22%) was similar to the monthly prevalence seen in the global population (23%) (Hoy, et al., 2012). Mean point prevalence (17%) was above that seen in the global adolescent population (12%) (Calvo-Munoz, et al., 2013), similar to the adult population (18%) (Hoy, et al., 2012), and at the lower end of the range observed in Olympic sports (18-65%) (Trompeter, et al., 2016). However, observations of Olympic sports included both current episodes and episodes in the last seven days in their point prevalence definition, which potentially inflated the results.

Similar to patterns seen in other populations (Menezes Costa, et al., 2012), there was large variation in how LBP was experienced by individuals. Of those that reported at least one episode of pain, one third experienced no activity limitation and close to a third experienced only a single episode, compared to a quarter that experienced chronic LBP. These results highlight that disability as a result of LBP is not inevitable; however, nor is rapid recovery. They also indicate a simple description of prevalence provides only a partial insight into the problem.

The degree to which LBP incites care seeking can provide perspective on the impact of the condition. Close to one third of the entire sample and half of those that experienced activity limiting LBP reported seeking professional help. The moderate correlation between pain intensity and care seeking seen here is consistent with non-athletic populations(Traeger, et al., 2016), and indicates dancers are more likely to consult for episodes they perceive as more severe. In addition, previous studies have identified a link between emotional distress and consumption of health care for LBP, which emphasises the necessity for health professionals who have expertise in managing dance conditions. Many dancers who experienced LBP did not seek help, which is consistent with patterns in the general population (Maher, et al., 2017), reinforces the proposal that many episodes of LBP recover with minimal intervention (da, et al., 2012), and further highlights the variation in the experience of LBP. Notably, the proportion that did pursue health care was lower than that seen in Western Australian adolescents (O'Sullivan, Beales, Smith, & Straker, 2012). This may suggest episodes in dance are less severe or that dancers are able to cope with some level of pain (Jacobs, et al., 2017). It may also indicate reluctance amongst dancers to acknowledge their pain, potentially as a product of cultural expectations, or through fear of possible implications (Jacobs, et al., 2017; Turner & Wainwright, 2003).

More than one-fifth of the dancers in this sample reported the use of analgesic medication for their LBP. Current consensus statements do support analgesic use as a component of pain management in athletic populations (Hainline, et al., 2017) although, the effectiveness of analgesics as a treatment for LBP is unclear (Machado, et al., 2017; Machado, et al., 2015), and prolonged use can increase the likelihood of long-term sickness absence (Sundstrup, Jakobsen, Thorsen, & Andersen, 2017). Dancers were more likely to use pain medication for episodes that were more intense, or if they experienced activity limiting or chronic LBP. While a complete understanding of the factors that influence the decision to consume analgesics in this sample is not available, these results indicate that dancers do want some form of pain relief. The use of over-the-counter medications may indicate a level of self-management in the pain relieving process. If so, this would indicate the importance of providing dancers with the appropriate education and resources to play an active role in pain management (Sullivan & Vowles, 2017).

Consistent with previous studies, past history of LBP predicted the experience of activity limiting LBP (Ferguson & Marras, 1997). This may reflect the recurrent nature of the LBP experience (Maher, et al., 2017), or the influence of past experience on pain perception (Tabor, Thacker, Moseley, & Kording, 2017). It is also possible that individuals who experience LBP possess a range of underlying factors that increase their vulnerability to LBP, which may persist across the lifespan (Hestbaek, Leboeuf-Yde, & Kyvik, 2006). As such, a history of LBP should be included in dance health screening, and can be used to identify at-risk populations who may be suitable for clinical intervention.

The current study was unable to find any overall association between the experience of LBP and the participation data collected; although, these findings should be interpreted with caution, as the self-reported participation data had a high degree of variability. In epidemiological studies, documenting a link between physical exposure and LBP is difficult, particularly given the complexities of spinal loading as well as the subjective nature of the pain experience. This difficulty does not imply the lack of a causative relationship (Takala, 2010), as industry-based studies that have described exposure using precise quantitative measures have shown much greater ability to predict loss in spine function related to pain (Marras, et al., 2010), and cross sectional research in pre-professional dancers has observed higher LBP prevalence in dancers with higher weekly dance hours (McMeeken, et al., 2001). Nonetheless, it is also important to consider other factors that influence pain. For instance, prior research with Irish dancers found the severity of pain and injury was more closely linked to biopsychosocial factors than the mechanical measures collected (Cahalan, et al., 2016).

Monthly LBP, activity limiting LBP, and point prevalence steadily declined over the course of the study. There are several possible explanations for this finding. That LBP prevalence was lowest in the final month may partially reflect a seasonal effect. At this time, the two university cohorts had finished their final performances, while the school had completed its major performance three months earlier and the final term was close to conclusion. The findings may also indicate that an improvement in both fitness and movement ability occurred during the study period, increasing the capacity for dancers to manage the physical demands placed upon them. Alternatively, it is possible that continued participation in the project led to an upward shift in the individual threshold for reporting pain; however, the opposite may also be true, and ongoing participation may be just as likely to increase one's awareness of LBP and its impact. The attrition rate should be considered as a potential factor that contributed to the decline in prevalence, yet, dropout occurred in both individuals who experienced and did not experience pain, and a prior surveillance study found a decline in injury rate was not associated with a change in the response rate (Ekegren, Gabbe, & Finch, 2014).

The major limitation of this study was the response and attrition rate. To counter the expected attrition, we used multiple cohorts and communicated the purpose to each individual in person, although we were unable to offer any significant incentive. Self-report based surveillance studies that have achieved higher participation have often featured a collection of highly disciplined elite athletes (Clarsen, et al., 2014; Newlands, et al., 2015), more persistent and personalised follow up that may be linked to medical care (Clarsen, et al., 2014; Ekegren, Gabbe, et al., 2014), or researchers with a status that participants may admire (Cahalan, et al., 2016). The monthly questionnaire was designed to present minimal burden for participants; however, it was more complex than the tool used by (Clarsen, et al., 2014) and it is possible this contributed to the attrition. Reassuringly, available evidence does not suggest that a lower response rate in epidemiology studies automatically implies low validity or the presence of substantial bias (Galea & Tracy, 2007; Morton, Bandara, Robinson, & Carr, 2012), although the exact age range and sex distribution for each cohort was not attainable, and application to the wider dance community may not be automatically assumed.

While the questionnaire used was not formally validated or tested for reliability, the initial and monthly questionnaire were discussed with dance education and health professionals from more than one cohort, and reviewed by a dance science professional outside the research team as well as a group of senior ballet school students. The questionnaires were confirmed to have face validity. The definition of LBP, which was accompanied by a diagram, is consistent with the standardised definition of LBP for use in prevalence studies (Dionne, et al., 2008) and a meta-analysis of LBP prevalence studies in children and adolescents indicated that one month and point period prevalence's are less affected by publication bias (Calvo-Munoz, et al., 2013), which supports monthly distribution of questionnaires. The dance participation data component of the questionnaire was modelled on the tool used by Newlands et al., (2015), which although not validated, did successfully demonstrate a relationship between monthly training load and LBP in junior and senior elite rowers. This was modified so that the participation data matched the dance exposure categories (class, rehearsal, performance) described by an IADMS standard measures consensus statement (Liederbach, Hagins, Gamboa, & Welsh, 2012).

Importantly, LBP is not a homogenous condition. While this study describes the prevalence and impact of LBP in pre-professional and professional dancers, it is likely that the mechanisms responsible for LBP development within the sample are vast. For instance, repetitive application of complex loads to the spine, combined with aspects of growth and maturation, may predispose young dancers to specific spine injuries (Adams, 2004; Bergeron, et al., 2015). Similarly, the physical, social, and personal contexts would differ greatly between a university level contemporary dancer and a professional ballet dancer, and these may influence pain.

Clinically, as a history of LBP was identified as a predisposing factor to the experience of activity limiting LBP, reducing the incidence of first time LBP in young dancers could have long term health benefits. Furthermore, as dancers appear to be a population at risk, efforts to provide them with the skills and resources to play an active role in responding to pain would be appropriate. Future research would do well to investigate factors that contribute to LBP in dance, as well as dancer's knowledge of available pain management.

Conclusion

Results from this study support the assertion that pre-professional and professional dancers are vulnerable to experiencing LBP and there is suggestion of a seasonal effect in this population. Low back pain history increases future risk, and for a significant portion of dancers, pain is ongoing, interferes with dance participation and provokes care-seeking and medication use. Accordingly, dance students and professionals need access to healthcare professionals with expertise in the management of LBP and its consequences. Artistic and education staff should be sensitive to the complexities of pain, and its interaction with dance participation.

Conflicts of interest

None

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Table I: Descriptive data. Results are reported as mean (standard deviation) for continuous variables and frequencies (percentage) for categorical variables.

	Entire cohort		Any LBP		Activity limiting LBP		Chronic LBP	
	Male (n=19)	Female (n=100)	Yes 93 (78)	No 26 (22)	Yes 62 (52)	No 57 (48)	Yes 29 (24)	No 90 (76)
Male n (%)	…	…	15 (79)	4 (21)	8 (42)	11 (58)	6 (32)	13 (68)
Female n (%)	…	…	78 (78)	22 (22)	54 (54)	46 (46)	23 (23)	77 (77)
Age (yrs) †	17.1 (3.7)	17.9 (2.7)	18.0 (2.8)	16.8 (2.9)	18.3 (2.8)	17.1 (2.9)	18.2 (2.8)	17.6 (2.9)
Height (cm) ‡	175.2 (9.8)	165.1 (7.6)	167.7 (8.6)	163.4 (9.2)	167.6 (8.8)	166.1 (8.9)	168.0 (8.6)	166.4 (8.9)
Body mass (kg) §	65.1 (13.3)	54.0 (8.6)	56.9 (10.5)	52.0 (9.3)	56.8 (9.8)	54.9 (11.1)	58.3 (11.2)	54.9 (9.9)
BMI (kg/m²)¶	21.0 (3.1)	19.7 (2.4)	20.1 (2.7)	19.3 (2.0)	20.2(2.5)	19.7 (2.6)	20.6 (2.9)	20.6 (2.9)
Age started dance (yrs) #	9.3 (4.8)	7.4 (4.6)	7.6 (4.9)	8.0 (4.1)	8.3 (5.2)	7.1 (4.0)	8.2 (5.1)	7.5 (4.6)
Years dancing #	7.8 (6.2)	10.4 (5.0)	10.4 (5.3)	8.4 (5.3)	10.0 (5.4)	9.9 (5.2)	10.0 (5.7)	10.0 (5.2)
Cohort type								
School n (%)	10 (53)	27 (27)	24 (65)	13 (35)	13 (35)	24 (65)	7 (19)	30 (81)
University n (%)	8 (42)	59 (59)	57 (85)	10 (15)	37 (55)	30 (45)	18 (27)	49 (73)
Company n (%)	1 (5)	14 (14)	12 (80)	3 (20)	12 (80)	3 (20)	4 (27)	11 (73)
History of LBP n (%)†	15 (79)	65 (74)	70 (82)	10 (46)	50 (86)	30 (61)	28 (96)	52 (66)
Used healthcare n (%)	5 (26)	29 (29)	34 (37)	0	31 (50)	3 (5)	13 (45)	21 (23)
Used medication n (%)	3 (16)	22 (22)	25 (27)	0	20 (32)	5 (9)	12 (41)	13 (14)

†Data missing for n = 11 cases

‡Data missing for n = 20 cases

§Data missing for n = 21 cases

¶Data missing for n = 23 cases

[#]Data missing for n = 14 cases

Table 2: Univariate and multivariate associations with activity limiting low back pain

Population descriptor		Univariate analysis	Multivariable analysis	
	Mean (SD)/ n (%)	p	AOR (95% CI)	p
Age (yrs)[†]	18.3 (2.8)	0.05	0.99 (0.76, 1.29)	0.93
Age started dancing (yrs)[‡]	8.3 (5.2)	0.20	1.04 (0.95, 1.14)	0.40
Cohort Type		0.01*		
School n (%)	13 (35)		1.00 (ref)	
University n (%)	37 (55)		0.14 (0.01, 1.33)	0.09
Company n (%)	12 (80)		0.34 (0.07, 1.59)	0.17
History of LBP n (%)[a]	50 (86)	<0.01*	3.98 (1.44, 11.00)	<0.01*

AOR, adjusted odds ratio

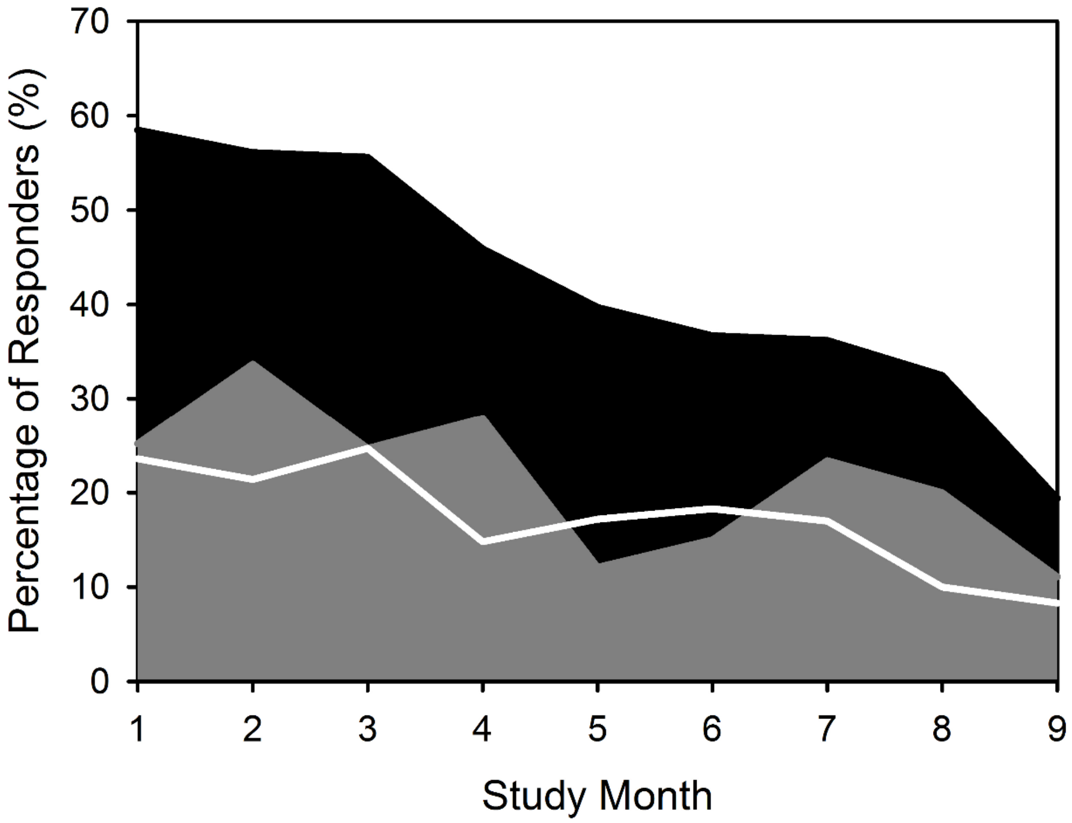
[†]Data missing for n = 11 cases

[‡]Data missing for n = 14 cases

*** p< 0.05**

Fig 1. Monthly experience of all episodes of LBP, activity limiting LBP, and current LBP.

The black area represents all episodes of LBP, the grey area represents episodes of activity limiting LBP and the white line represents the point prevalence of LBP.



Highlights

- Prevalence of LBP in dancers is similar to those reported in other elite sport
- A high degree of variation exists between LBP symptoms and impact on participation
- Past history of LBP increases future risk

ACCEPTED MANUSCRIPT

ETHICS STATEMENT: The prevalence and impact of low back pain in pre-professional and professional dancers: a prospective study

The authors confirm that the participants rights and confidentiality have been well protected in all aspects and they consented to the study described in the work. All relevant ethical safeguards have been met in relation to participant protection. Approval from the appropriate ethics committees have been obtained as indicated in the manuscript.