

## Perceived severity and management of low back pain in adult dancers in the United States

Item Type	Journal article
Authors	Henn, Erica;Smith, Tina;Ambegaonkar, Jatin;Wyon, Matthew
Citation	Henn, E., Smith, T., Ambegaonkar, J. and Wyon, M. (2022) Perceived severity and management of low back pain in adult dancers in the United States. <i>Journal of Dance Medicine and Science</i> , 26(3), pp.173-180. DOI: <a href="https://doi.org/10.12678/1089-313X.091522d">https://doi.org/10.12678/1089-313X.091522d</a>
DOI	<a href="https://doi.org/10.12678/1089-313X.091522d">10.12678/1089-313X.091522d</a>
Publisher	J.Michael Ryan Publishing Inc.
Journal	<i>Journal of Dance Medicine and Science</i>
Download date	2025-05-23 12:01:02
License	<a href="https://creativecommons.org/licenses/by-nc-nd/4.0/">https://creativecommons.org/licenses/by-nc-nd/4.0/</a>
Link to Item	<a href="http://hdl.handle.net/2436/624472">http://hdl.handle.net/2436/624472</a>

## **Perceived Severity and Management of Low Back Pain in Adult Dancers in the United States**

Erica D. Henn, MA<sup>1</sup>; Dr. Tina Smith, PhD<sup>1</sup>; Dr. Jatin Ambegaonkar, PhD<sup>2</sup>; Dr. Matthew Wyon PhD<sup>1,3</sup>

<sup>1</sup>Institute of Human Sciences, University of Wolverhampton, UK

<sup>2</sup>Sports Medicine Assessment, Research, and Testing Laboratory, George Mason University, USA

<sup>3</sup>National Institute of Dance Medicine and Science, UK

### Correspondence:

Erica D. Henn, MA

Institute of Human Sciences

University of Wolverhampton

Walsall, West Midlands

UK WS1 3BD

[E.D.Henn@wlv.ac.uk](mailto:E.D.Henn@wlv.ac.uk)

### Acknowledgement:

Thank you to all of our participants, and to these organizations for participating in this research: International Association for Dance Medicine and Science (IADMS), Boston Conservatory, Case Western Reserve University, Connecticut College, Duke University, George Mason University, James Madison University, Oberlin College, The Ohio State University, Shenandoah University, Temple University, Texas A&M University, Texas State University, University of Colorado - Boulder, University of Hartford, University of Iowa, University of Montana, University of New Hampshire, University of Rochester & BIODANCE Company, University of South Carolina - Columbia, University of Washington, West Virginia University, and Western Michigan University.

Disclosure: The authors have nothing to disclose, no conflicts of interest, and nothing to disclaim.

# Abstract:

**Introduction:** Low back pain (LBP) lifetime prevalence in dancers reportedly ranges from 17%-88%.

LBP can have negative secondary consequences on dancers' lives and careers. Still, how LBP impacts dancer function and medical care-seeking behaviors, and whether these issues differ across dance genres, is understudied.

**Materials and Methods:** 289 ballet, modern, and hip-hop dancers and teachers (median age=20.3 years; range:18-69) in the United States age 18 years and older completed an online 24 question survey assessing LBP related self-reported injury history, impact on their lives, and management strategies. We defined LBP as occurrence of acute or chronic pain in the lumbar or sacral regions of the back.

**Results:** 257 participants (88.9% of 289 total) reported at least one instance of LBP during their lifetime and 220 participants reported LBP in the prior four weeks. Of these 220, 72 (32.7%) had LBP severe enough to limit their activities of daily living. Of the 213 who had LBP and danced during that time, 89 (41.8%) reported that LBP limited their dancing. Pain intensity (median:4 on a 0-10 scale, IQR:3.0) and LBP prevalence were similar across dance genres. Dancers sought multiple medical professionals, most often chiropractors (n=94, 33.8%), medical doctors (n=77, 27.7%), and physiotherapists (n=60, 21.6%). 90 dancers (35.0% of those with LBP) never sought medical care for their LBP at all. Dancers who did seek care reported higher pain intensities (median:4, IQR:3.8) than those who did not (median:3, IQR:3.0).

**Conclusion:** Overall, most participants did suffer from LBP. LBP negatively impacts dancers' everyday activities and dancing. Pain intensity and loss of function may impact care-seeking. Our findings highlight the need for all dance stakeholders to educate dancers about their health, provide resources for dancer healthcare, and proactively create an environment that supports injury reporting behaviors in dancers.

**Key Words:** low back pain, dancers, care-seeking

**Abstract Word Count (including key words):** 300 words

# Introduction

Low back pain (LBP) presents an increasing global problem in the general population, being ranked fourth amongst global health issues in 2017<sup>[1]</sup>. The monetary cost of LBP is substantial<sup>[2]</sup>. In a systematic review and meta-synthesis examining LBP in the general population<sup>[3]</sup>, Froud and researchers described that LBP had pervasive and life-changing effects that threatened the participants' quality of life<sup>[3]</sup>. Furthermore, three of the most important themes identified in people with LBP were loss of function, negative impact on employment, and fear of stigma. LBP has been shown to be an affliction that can have a long-term impact on general population<sup>[4]</sup>, and also dancers even into retirement<sup>[5]</sup>.

LBP is anecdotally cited as a frequent problem amongst dancers, with pervasiveness of LBP in dancers ranging from 3% to 75%<sup>[6-9]</sup>. Most researchers have examined LBP in female professional and pre-professional ballet or modern dancers, finding a lifetime LBP prevalence of 50% and a median point prevalence of 27% across studies<sup>[9]</sup>. Fewer researchers have examined LBP in hip-hop dancers<sup>[10]</sup>, but those that have suggest a prevalence similar to ballet dancers<sup>[10]</sup>. Therefore, further investigation on LBP across different genres is required to explore whether they are impacted in similar ways.

Studies on LBP in dancers use a variety of reporting methods to assess LBP<sup>[10]</sup>. Self-report (e.g., questionnaires) and medical records are two of the most common methods used to assess LBP in dancers<sup>[10]</sup>. While participation bias exists for most injury surveys, obtaining self-reported accounts from many participants is crucial to comprehensively examine the impact of a condition. Some studies focus on tool validation for pain in dancers, using tools developed in other disciplines and applying them to dancers. Dance-specific tools do not seem to have been developed yet. Many studies on LBP intensity note that they measured intensity, but do not always publish the mean, median, or pain scale, or they studied a dissimilar demographic than our participants.

There were three objectives to this study: (1) to determine if LBP negatively impacts functioning of dancers' normal day-to-day activities/dancing, (2) to examine if dancers are managing their LBP

through medical care-seeking behaviors, and (3) to examine if LBP severity, typical functions, and care-seeking behaviors differs by dance genre.

## Materials and Methods

### Participants

Inclusion criteria were dancers from dance companies or university dance programs of any proficiency, including teachers, 18 years and above. Exclusion criteria were dancers younger than 18. Ethics permission was granted by the Institutional Review Board of <<BLINDED>>. Participants completed an informed consent prior to beginning the survey. This informed the participants of the nature of this study, their ability to withdraw at any time, and to confirm they were 18 years of age or older.

### Survey Design

We collected data using the Online Surveys program (formerly BOS; Jisc, Bristol, United Kingdom); the survey content was custom-created based on current best practices and other questionnaires, as we were unable to find a dance-specific, LBP function and care-seeking questionnaire in the published literature. The online survey with 24 questions (20 multiple choice, 2 rating scale, and 2 open-ended) was created to examine LBP history, impact, and management strategies. There were 5 demographic questions asking for age, years dancing, country that they dance in, primary dance genre, and years dancing in their primary genre. The demographic questions enabled the researchers to screen for exclusion criteria. The primary dance genre question was multiple choice, and provided four options: ballet, modern, hip-hop, and other. Ballet and modern dance are popular genres at dance institutions, and hip-hop dance was included in an attempt to increase LBP research on this population, an issue identified in a previous literature review by these authors, completed in 2018<sup>[10]</sup>.

Five questions examined dance exposure (engagement in a dance activity) and dance experience, asking hours of dance per week during a normal week, hours of dance per week in the week preceding survey completion, maximum hours danced in a single day in the last four weeks, rest days per week in the last four weeks, and hours of rest during a normal day. There was 1 stress-related question that asked on a scale of 1-5, how stressed did the dancers feel on an average day. There were 4 LBP history questions that asked if they had LBP, where they perceived their LBP originated from if they had LBP, did LBP limit their activities of daily living in the past four weeks, and did LBP limit their dancing in the last four weeks. The MeSH definition of low back pain<sup>[11]</sup> was used, which defines LBP as an acute or chronic pain in the lumbar or sacral regions of the back. We included an anatomical diagram highlighting the area of pain as suggested by Dionne and researchers<sup>[12]</sup>. We also limited the recall timeframe for LBP in most questions to four weeks to prevent recall bias<sup>[12]</sup>. As LBP tends to recur<sup>[13-16]</sup>, we included three questions to assess self-reported lifetime occurrence of LBP, despite the risk of recall bias.

There were 3 LBP coping strategy questions that asked if participants had ever sought professional help for LBP, how often in the last four weeks did they seek help for LBP, and if they had ever been diagnosed with LBP by a medical professional. And lastly, those who had experienced LBP were asked 6 questions about the impact of their LBP on their lives. Participants were asked if LBP is on their mind at least once per day, do they perceive their LBP to regularly inhibit their non-dance life, has their LBP inhibited their non-dance life in the last four weeks (open ended), how intense is their LBP on a scale of 0-10, have they received any diagnostic imaging related to LBP, and are there any dance movements that increased their LBP (open ended). Some questions were modified to assess dance-centric functions in addition to overall activities of daily living (ADL). We defined ADL as: 'Day-to-day activities that are basic activities of everyday life and self-care, such as dressing yourself, walking, sleeping, standing, eating; in this case, everyday non-dance activities'.

## Survey Pilot Testing for Validity

We validated the content of the survey using a pilot test. Advertisements were posted on <<BLINDED>> group social media page on 27 April 2019, with a requested completion date of 10 May 2019. Participants anonymously accessed the survey via a link and were asked to complete the survey in full. Six participants completed the pilot study, with a median age of 29.6, a median of 25.8 years dancing, and a median of 12.8 years dancing in their primary dance genre (4 modern, 1 hip-hop, 1 tap dance). No ballet dancers participated in the pilot study and the training load was relatively light (0-10 hours per week). After reviewing the survey responses to the pilot study, we identified that two questions (#10, #11) pertaining to rest used unclear wording, with some respondents interpreting the question to include hours sleeping (i.e., 24 hours of rest). Thus, we updated the language of these questions to exclude sleeping for clarity. This pilot version of the survey was identical to the survey used in the larger study, except for the wording of questions 10 and 11.

## Dissemination

To assess a range of professional and student dancers and teachers, we disseminated the survey via social media, added to <<BLINDED>>, an international professional membership electronic newsletter, and emailed to 150 university dance programs in the United States. The university contacts were encouraged to share the study with any local or affiliated dance companies to “snowball” participants, which is the survey technique of asking participants to share the survey with anyone they think fits the inclusion criteria of the study to receive more participants. Twenty-two of the dance programs confirmed they would share with their students, teachers, and nearby dance companies. Although “snowballing” participants increased the reach of the survey, the response rate is unknown. The survey was open for 2 months and sent out in two rounds: 20 May 2019 - 20 June 2019 and 16 August 2019 - 16 September 2019. A second reminder email was sent out to the remaining dance programs who had not confirmed dissemination near the close of the survey.

## Data Extraction and Processing

After the first data extraction process and check, we chose to remove participants whose primary location of dance activities was outside the United States ( $n=7$ ) as these numbers were lower than the total numbers of United States respondents ( $n=290$ ). We then transformed raw data into numbers for statistical processing (e.g., 6 years and three months = 6.25 years). Duplicates were removed by closely comparing possible matches summer temporal data to fall temporal data for identical answers; one fall entry was removed as a result (final count was 289 participants). Some questions on the survey addressed participants with a history of LBP specifically and asked those participants without a history of LBP to skip these questions.

## Data Analyses

Data analyses were two-fold, as the survey recorded both quantitative and qualitative data. All quantitative data were processed in Jamovi<sup>[17]</sup>. We first examined normality for all data using basic frequency analysis. We used parametric test (e.g., t-tests) if data were normally distributed. If data were not normally distributed, we used non-parametric tests (e.g., chi-square tests, Kruskal-Wallis, and Mann-Whitney U tests) as appropriate. We used t-tests to compare those with a history and those without LBP history. While the Bonferroni correction has its own limitations, a Bonferroni-adjusted alpha ( $\alpha_B$ ) of 0.004 was used to determine significance for all tests due to multiple comparisons being performed.

Qualitative data were compiled using the conventional content analysis (CCA) method described by Hsieh and Shannon<sup>[18]</sup>. For these open-ended questions, participants were encouraged to provide as much information as they wished. Codes were derived from the responses, compiled into categories, and the number of responses for each were tabulated. Participants could indicate multiple codes within one response. The questions were phrased as, “Has your low back pain inhibited other non-dance aspects of your life within the last four weeks specifically? Please tell us about your experiences,” and “Are there any dance movements that increase your low back pain?” The main variables of interest included history



of LBP (frequencies), perceived source of LBP (frequencies) pain intensity (Likert scale 0-10), interfering with ADL (frequencies), interfering with dancing (frequencies), interfering with specific non-dance movements (open-ended, CCA), movements that exacerbate LBP (open-ended, CCA), care-seeking due to LBP (frequencies), and who the participants sought care from (frequencies).

## Results

### Demographics

Twenty-two university dance programs and one dance company formally responded to our request for dissemination, located across the United States. The median age was 20.3 years of age (range: 18-69 years), with 219/289 (76%) participants aged 18-21 who completed the survey. Participants had a median of 15.8 years of overall dance training (range: 1-65 years) with a median of 10.3 years training in their primary dance genre (range: 1-55 years). modern/contemporary dance was the most popular genre (172/289 participants, 59.5%), followed by ballet/classical dance (86/289 participants, 29.8%), other (23/289 participants, 8.0%), and hip-hop dance (8/289 participants, 2.8%). Those dancers who selected other listed multiple genres or genre fusions, or single genres like African, ballroom, belly dancing, drill team, flamenco, jazz, musical theater, or tap. Hip-hop dance had only 8 participants and was therefore combined into the category “other dance genre” to total 31/289 participants.

**Table 1: Dancers with a History of Low Back Pain, by Dance Genre**

Have you experienced low back pain before?	Primary dance genre			
	All genre totals	Modern / contemporary dance	Ballet / classical dance	Other
I do not have/have not had low back pain	<b>32</b> (11.1% of total)	17 (9.9% of modern dancers) (5.9% of total)	12 (14.0% of ballet dancers) (4.2% of total)	3 (9.7% of other dancers) (1.0% of total)
Yes, I have had pain in the dark gray shaded area of this image	<b>257</b> (88.9% of total)	155 (90.1% of modern dancers) (53.6% of total)	74 (86.0% of ballet dancers) (25.6% of total)	28 (90.3% of other dancers) (9.7% of total)

## History of LBP

Participants reported an 88.9% (n=257/289) lifetime prevalence of at least one occurrence of LBP (Table 1). 32/289 participants (11.1%) reported no history of LBP. Of the participants that had LBP, 132/259\* attributed their LBP as originating from dance (\*two dancers indicated they did not have a history of LBP, but then indicated a source for their LBP, contradicting themselves), 28/259\* indicated a non-dance source, and 99/259\* were unsure where their LBP originated. Only 89/257 (30.8%) of dancers with LBP were diagnosed with LBP by a medical professional, compared to the 257 that self-reported having experienced LBP. Lifetime LBP, ADL-limiting LBP, dance-limiting LBP, and dance exposure seem to be similar across dance genres (Table 1).

## Impact of LBP

In the four weeks preceding survey completion, 220/289 dancers (76.1%) responded that they experienced LBP, and 72/220 of these dancers expressed that their LBP inhibited their ADL and 89/220 reported their LBP limited their ability to dance fully. Dance activity levels, including number of rest days taken, had no significant association with lifetime self-report of LBP, nor with negative impact of LBP on ADL or dancing ( $p>0.004$  for all measures). Of the dancers that had experienced at least one episode of LBP in their lifetime, 137/270 participants (50.7%) noted their LBP was on their mind often, at least once per day. Almost as many, 111/270 dancers (41.1%), agreed with the statement that their LBP did inhibit their non-dance life regularly. Most dancers rated their average LBP intensity low (Figure 1), with the most reported pain intensity being 2 on an 11-point scale (n=270) between 0 (“no pain”) and 10 (“intense, debilitating pain”), with median pain intensity being 4 (IQR: 3.0). When comparing dance genres, modern dancers had a median pain intensity of 4 (IQR: 4.0), ballet dancers had a median pain intensity of 3 (IQR: 3.0), and ‘other’ dancers had a median pain intensity of 3 (IQR: 3.0).

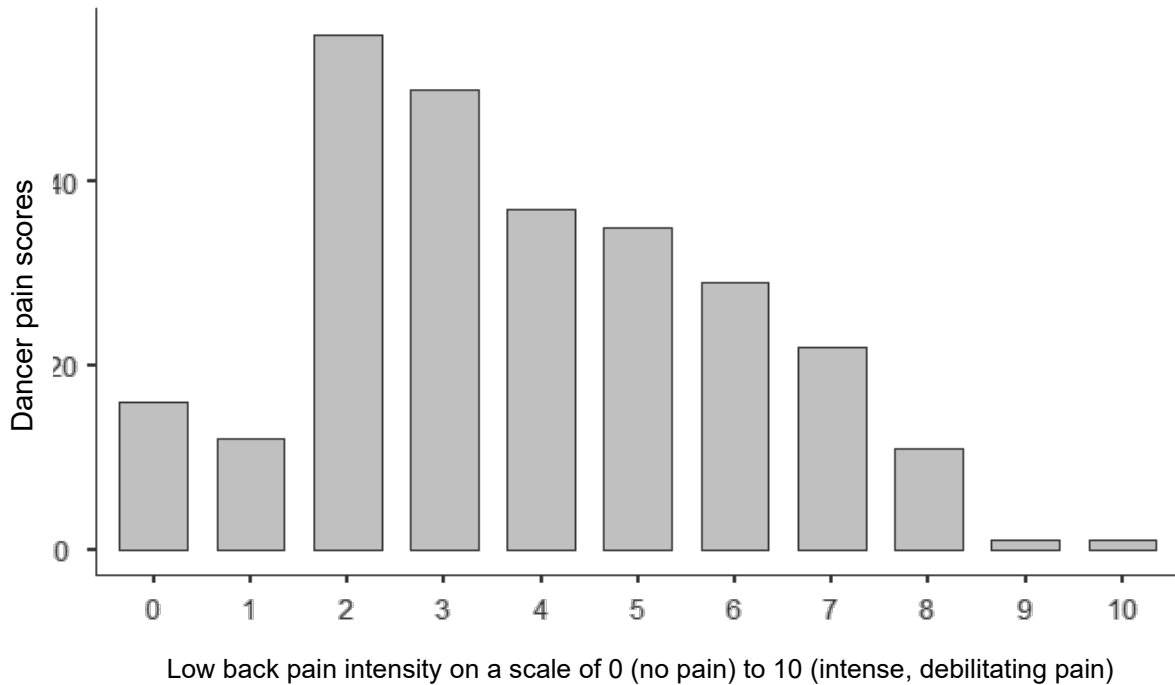


Figure 1: Frequency histogram of low back pain intensity for all dance genres, on a scale of 0 to 10.

Derived from the open-ended responses, dancers reported that sitting, such as when driving a car, was the functional movement that was most inhibited by LBP (41/200 responses), followed by standing/walking (34/200 responses), and then prolonged lying down, such as when sleeping (20/200 responses) (Table 2). Responses from 130 modern dancers, 64 ballet dancers, and 21 other dancers indicated two categories of dance movements that increased their LBP: spinal movements and trunk stabilization when activated, loaded, or during impact. Dancers overwhelmingly reported that the most painful dance movements involved spinal extension, specifically arabesques and arching backwards (113/303 responses), followed by spinal flexion activities like curving forward or bending over (41/303 responses), spinal rotation (19/303 responses), and high kicks or lifting their leg (15/303 responses) (Table 2).

**Table 2: Codes and Categories for Open-Ended Questions assessing Low Back Pain Impact on Function**

Category	Codes
Staying in one position for prolonged time	driving, sitting
	walking, standing
	sleeping, laying down
General physical activity	kneeling, gardening
	working out, dance, yoga, house chores
Bending	squatting, getting up, getting dressed
Lifting heavy objects	carrying objects, bending to pick up objects
Spinal Movements while Dancing	spinal extension
	spinal flexion
	spinal rotation
	spinal lateral flexion
	when the leg moves into extreme range (high kicks, legwork, splits, <i>penché</i> )
Stabilizing Trunk Through Various Loads while Dancing	impact or interaction with the floor (“floorwork”)
	core and weight-bearing (crunches, flat backs, lifting, partnering, pelvic articulations)

## Care-Seeking and Management of LBP

In the four weeks preceding survey completion, nearly all of the dancers that sought help also had LBP in the same time period (59/60). Those that sought help three or more times nearly always had LBP that limited their ADL (16/19) and their dancing (16/19). No trends emerged when examining medical care-seeking behaviors by dance genre (Table 3). Of the 257 total participants with a history of LBP, 90/257 (35.0%) had never sought medical assistance despite having had LBP and 171/257 (66.5%) sought care at least once in their lifetime. Median pain intensity for care-seekers was 4 (IQR: 3.75), indicating moderate pain on a 0-10 scale. Median pain intensity for dancers who had LBP but did not seek care was 3 (IQR: 3.00); pain intensity was higher for care seekers compared to non-care seekers, although it was not significant ( $p=0.015$ ;  $\alpha_B=0.004$ ). Dancers often visited more than one professional to manage their LBP, with 60/171 (35.1%) of care-seekers utilizing more than one professional in their lifetime. The most common method was a chiropractor, with 94/171 participants having seen a chiropractor for their LBP,

77/171 having seen a medical doctor, including sport-specific doctors, 60/171 having seen a physiotherapist, 36/171 having seen an acupuncturist or other alternative method, and 11/171 having seen a professional for another method.

**Table 3: Care-Seeking amongst Dancers with Low Back Pain in a Four-Week Period**

	Dancers with low back pain (LBP) that limited activities of daily living (ADL)				Dancers with low back pain (LBP) that limited dancing		
	Total # of dancers in genre	Number of dancers who reported LBP	Number of dancers with ADL-limiting LBP	Number of dancers who sought care at least once	Number of dancers who reported LBP	Number of dancers with dance-limiting LBP	Number of dancers who sought care at least once
Modern	172 (100%)	135 (78.5%)	43 (25.0%)	37 (21.5%)	129 (75.0%)	51 (29.7%)	36 (20.9%)
Ballet	86 (100%)	61 (70.9%)	22 (25.6%)	14 (16.3%)	61 (70.9%)	28 (32.6%)	14 (16.3%)
Other	31 (100%)	24 (77.4%)	7 (22.6%)	8 (25.8%)	23 (74.2%)	10 (32.3%)	8 (25.8%)
<b>Total</b>	<b>289 (100%)</b>	<b>220 (76.1%)</b>	<b>72 (24.9%)</b>	<b>59 (20.4%)</b>	<b>213 (73.7%)</b>	<b>89 (30.8%)</b>	<b>58 (20.1%)</b>

## Discussion

### Primary Findings

The primary findings of the current study were that a majority of dance respondents had LBP. Dancers were limited in both dancing and non-dancing activities due to their LBP, especially during sustained activities. Furthermore, LBP was prevalent in dancers regardless of dance genre. While some dancers sought multiple professionals to care for their LBP, a third of the affected dancers did not seek care for their LBP at all. Pain intensity and loss of function may influence care-seeking behaviors for dancers with LBP.

## Movements Inhibited by LBP

The participants described several functional movements that were inhibited due to their LBP. Basic movements, such as sitting, walking, standing, sleeping, and bending, were inhibited in the participants in the four weeks preceding our study. Non-dancers with LBP experience similar difficulties<sup>3</sup><sup>19]</sup>. We noted no difference in LBP rates between dance genres, suggesting that the movements themselves increase LBP, regardless of the aesthetic influence of any specific dance genre. Spinal extension movements increased LBP in dancers more than any other response. Other researchers examining pre-professional dancers found that regardless of LBP history, most dancers had negative back pain beliefs, and associated extreme spinal extension (backwards *port de bras*) with being dangerous to their back even if they themselves did not experience LBP<sup>20]</sup>.

In the current study, several other specific movements were grouped into a trunk stabilization category, where movements such as high kicks or leg lifts (e.g., *penchés*), jumping, lifting, or partnering were noted by some of the participants to increase their LBP. Professional ballet dancers with LBP have been shown to have less trunk dampening<sup>21]</sup> and collegiate dancers with LBP have shown reduced trunk muscle endurance<sup>22]</sup> when compared to those without. Multiple factors likely contribute to LBP in dancers, including spinal flexibility, strength, and shape<sup>23]</sup>. The spine is biomechanically complex; the nature and distribution of loads within the spine and associated structures can be challenging to study during dynamic human performance and there is still plenty of scope for spinal research to understand spinal function and injury-related aspects<sup>24]</sup>.

## LBP Management and Care-Seeking

Over a third of the participants who sought care for their LBP sought out more than one type of professional care provider, possibly practicing “health shopping”, where those afflicted seek second opinions from a variety of sources, as is seen in general LBP populations<sup>19]</sup>. The United States does not have universal healthcare; individuals pay for medical treatment, sometimes subsidized by private

insurance. As of 2010 under a provision of the Affordable Care Act, adult children may be ensured under a parent's plan as a dependent until they are 26 years of age. Professional dancers, particularly part time or in small companies, do not always have medical insurance<sup>[25]</sup>, due to a multitude of factors outside the scope of this article. Cost may be a factor in care-seeking behaviors unique to countries that do not have universal healthcare, especially as recurring episodes of LBP tend to cost more and last longer than the first instance<sup>[26]</sup>. As someone with LBP ages, this financial impact may be compounded, with Schofield and researchers finding that Australians who retired early due to their back problems accumulated less wealth<sup>[4]</sup>.

It is possible that dancers' beliefs about the nature of their LBP may have some implications as to their selection of care provider(s). A recent survey has suggested that stakeholders perceive that some dance education curricula may not be equipping dancers with high enough levels of health literacy<sup>[27]</sup>. Many of our participants did not seek help from any care providers at all, despite having LBP. Those who sought care for their LBP three times or more nearly always had LBP that limited their function in some way. This follows a trend in the general population where patients with LBP who are more disabled and in more pain tend to seek help more often<sup>[28]</sup>. Whether dancers with LBP will increase care-seeking due to loss of function is still unclear.

## Low Back Pain Intensity

The median LBP values from the current study are similar to other LBP intensity studies on the general population (79% of participants had mean pain intensity of less than 49 out of 100 at baseline<sup>[29]</sup>) and in athletes (pain intensity  $4.2 \pm 0.6$  –  $4.5 \pm 0.8$  on an 11-point scale at baseline in older, male recreational ice hockey players<sup>[30]</sup>). While not much data exists on LBP intensity in dancers, our values are similar to an undergraduate thesis study on hip flexor extensibility and LBP<sup>[31]</sup>. Advanced jazz and ballet dancers reported average LBP intensities of  $2.70 \pm 1.89$  on a 0 to 10 scale across a dance class, with pain intensity values taken before, during, and after dancing. However, the situational differences may prevent an accurate comparison. We also found that dancers' LBP median pain intensity was higher in

care-seekers than non-care-seekers, although this result was not significant under the Bonferroni correction. More research into LBP care-seeking in dancers is needed to validate pain intensity as an influence on care-seeking.

It is likely that the extent of injury and pain reported by dancers in non-anonymous settings is underestimated due to under-reporting from the dancers themselves<sup>[32]</sup> or limited injury capture<sup>[33]</sup>. In support, prior authors have noted that dancers may believe a stigma exists for those who become injured that endangers their employment<sup>[34]</sup>, similar to the “dilemma of disclosure”<sup>[19]</sup> seen in general population LBP experiences. Additionally, the threat that dancers perceive injury presents to their dancer self-identity can encourage this practice of under-reporting injuries<sup>[35]</sup>. We theorize rehabilitating pain or injury in dancers before it becomes debilitating is one method to decrease avoidance of professional care. Managing or rehabilitating minor injuries or pains before they intensify to negatively impact dancing and threaten dancer self-identity is crucial for life-long issues like LBP.

## Limitations and Future Recommendations

The authors recognize limitations to this study. The pilot study was small, and the participants were more experienced and older than the final survey population results; a tool with confirmed validity within the target population would allow future studies to be more robust. We collected information over two month-long time points. Dancers could complete the survey anytime within the month that the round was open. While we purposefully chose this sampling technique to increase completion participants numbers, we recognize that the findings are limited to a part of the year (i.e., when students go back to school after summer break). We also note that as we actively recruited participants from university-level dance programs, the dataset is skewed towards younger adults whose dominant dance style was modern dance. We also acknowledge participation bias, i.e., participants were more likely to take part if they had LBP than those who did not have any LBP, leading to an inflated prevalence. Additionally, the response rate is unknown other than 22 of the 150 contacted universities confirmed they would share this study



with their networks. Finally, while multiple steps were taken to limit recall bias, there is still a possibility of recall bias in questions that assessed lifetime history of a condition or previous action.

## Practical Relevance

The current findings suggest that dancers of any dance genre are likely to experience LBP, as dance genre did not significantly impact LBP prevalence. Health care professionals should expect these LBP complaints when working with dancer populations and may consider preventative LBP measures for all dancers. As we found that most dancers reported that their LBP increased through spinal extension movements, dance educators and artistic directors who support dancers with high volume repertoire should implement specific LBP preventions or interventions for dancers who participate in creative works that contain these movements repetitively. Dancer support staff should be aware that their dancers may have LBP but may not seek care until pain increases or function decreases. It may be prudent to discuss local or widely accessible LBP resources with dancers to hopefully increase care-seeking. Fostering an environment of communication around LBP can encourage dancers to proactively address their LBP before it becomes debilitating.

## Conclusion

While we recognize that these results cannot be overgeneralized outside of our study participants, we still maintain that the negative impact of LBP on dancers may be substantial and prevalent, both inside and outside of the dance studio. A majority of dancers in our study suffered from LBP with low to moderate pain intensity. Results were similar across ballet, modern, and combined 'other' dance genre categories. Dancers reported that both dance and non-dance activities that were exacerbated or were limited by their LBP. To manage their LBP, 35.1% (60/171) of care-seeking dancers sought out multiple care professionals, while 35.0% (90/257) of afflicted participants did not seek care for their LBP at all. These dancers may thus be more prone to secondary negative long-term sequelae that may harm their

dance careers. In summary, our findings continue to support the call for dance stakeholders to educate dancers about their health, provide resources for dancer healthcare, and proactively create an environment that supports injury reporting behaviors in dancers.

# References

1. Hurwitz EL, Randhawa K, Yu H, Cote P, Haldeman S. The Global Spine Care Initiative: a summary of the global burden. *European Spine Journal* 2018
2. Dagenais S, Caro J, Haldeman S. A systematic review of low back pain cost of illness studies in the United States and internationally. *Spine J* 2008;**8**(1):8-20 doi: 10.1016/j.spinee.2007.10.005[published Online First: Epub Date]].
3. Froud R, Patterson S, Eldridge S, et al. A systematic review and meta-synthesis of the impact of low back pain on people's lives. *BMC Musculoskeletal Disorders* 2014;**15**(50)
4. Schofield DJ, Shrestha RN, Percival R, Callander EJ, Kelly SJ, Passey ME. Early retirement and the financial assets of individuals. *European Spine Journal* 2011;**20**:731-36
5. Smith TO, de Medici A, Oduoza U, et al. National survey to evaluate musculoskeletal health in retired professional ballet dancers in the United Kingdom. *Physical Therapy in Sport* 2017;**23**:82-85
6. Smith P, Gerrie B, Varner K, McCulloch P, Lintner D, Harris J. Incidence and prevalence of musculoskeletal injury in ballet. *Ortho J Sports Med* 2015;**3**(7)
7. Hincapie C, Morton E, Cassidy J. Musculoskeletal injuries and pain in dancers: a systematic review. *Arch Phys Med Rehabil* 2008;**89**(9):1819-29
8. Smith T, Davies L, de Medici A, Hakim A, Haddad F, Macgregor A. Prevalence and profile of musculoskeletal injuries in ballet dancers: A systematic review and meta-analysis. *Phys Ther Sport* 2016;**19**:50-56
9. Swain C, Bradshaw E, Ekegren C, Whyte D. The epidemiology of low back pain and injury in dance: a systematic review. *J Orthop Sports Phys Ther* 2019:1-41
10. Henn ED, Tina Smith, Jatin Ambegaonkar, Matthew Wyon. Low back pain and injury in ballet, modern, and hip-hop dancers: a systematic literature review. *IJSPT* 2020(October 2020):Publication in progress
11. Low Back Pain. 1993 ed. Medical Subject Headings (MeSH) Database: NCBI, 2012.
12. Dionne C, Dunn K, Croft P, al. e. A consensus approach toward the standardization of back pain definitions for use in prevalence studies. *Spine* 2008;**20**(5):95-103
13. Stanton T, Latimer J, Maher C, Hancock M. A modified Delphi approach to standardize low back pain recurrence terminology. *Eur Spine J* 2011;**20**(5):744-52
14. von Korff M. Studying the natural history of back pain. *Spine* 1994;**19**(18Suppl):2041S-46S
15. Pengel L, Herbert R, Maher C, Refshauge K. Acute low back pain: systematic review of its prognosis. *BMJ* 2003;**327**(7410):323
16. Stanton T, Henschke N, Maher C, KM R, Latimer J, McAuley J. After an episode of acute low back pain, recurrence is unpredictable and not as common as previously thought. *Spine* 2008;**33**(26):2923-28
17. The jamovi project [program]. Version 1.6 version, 2019.
18. Hsieh H-F, Shannon S. Three approaches to qualitative content analysis. *Qualitative Health Research* 2005;**15**(9):1277-88
19. Bunzli S, Watkins R, Smith A, Schutze R, O'Sullivan P. Lives on hold: a qualitative synthesis exploring the experience of chronic low-back pain.
20. Hendry D, Straker L, Campbell A, Hopper L, Tunks R, O'Sullivan P. An exploration of pre-professional dancers' beliefs of the low back and dance-specific low back movements. *Med Probl Perf Art* 2019;**34**(3):147-53
21. Gildea JE, W VDH, Hides JA, Hodges PW. Trunk Dynamics Are Impaired in Ballet Dancers with Back Pain but Improve with Imagery. *Med Sci Sports Exerc* 2015;**47**(8):1665-71 doi: 10.1249/MSS.0000000000000594[published Online First: Epub Date]].

22. Swain C, Redding E. Trunk muscle endurance and low back pain in female dance students. *J Dance Med Sci* 2014;**18**(2):62-6 doi: 10.12678/1089-313X.18.2.62[published Online First: Epub Date]].
23. Kruusamae H, Maasalu K, Wyon M, et al. Spinal posture in different DanceSport dance styles compared with track and field athletes. *Medicina (Kaunas)* 2015;**51**(5):307-11 doi: 10.1016/j.medic.2015.08.003[published Online First: Epub Date]].
24. Oxland TR. Fundamental biomechanics of the spine--What we have learned in the past 25 years and future directions. *J Biomech* 2016;**49**(6):817-32 doi: 10.1016/j.jbiomech.2015.10.035[published Online First: Epub Date]].
25. Requa RKG, James G. Do Professional Dancers Have Medical Insurance? Company-Provided Medical Insurance for Professional Dancers. *JDMS* 2005;**9**(3-4):81-83
26. Wasiak R, Kim J, Pransky G. Work disability and costs caused by recurrence of low back pain: longer and more costly than in first episodes. *Spine* 2006;**31**:219-25
27. Kozai A, Ambegaonkar JP. Health Literacy for Collegiate Dancers: Provision and Perceptions of Health-Related Education in University Dance Programs. *J Dance Med Sci* 2020;**24**(3):118-25 doi: 10.12678/1089-313X.24.3.118[published Online First: Epub Date]].
28. Mortimer M, Ahlberg G, Group M-NS. To seek or not to seek? Care-seeking behaviour among people with low-back pain. *Scand J Public Health* 2003;**31**:194-203
29. Ng SK, Cicuttini FM, Wang Y, Wluka AE, Fitzgibbon B, Urquhart DM. Negative beliefs about low back pain are associated with persistent high intensity low back pain. *Psych Health Med* 2017;**22**(7):790-99
30. Jackson JK, Shepherd TR, Kell RT. The influence of periodized resistance training on recreationally active males with chronic nonspecific low back pain. *J Strength Cond Res* 2011;**25**(1):242-51 doi: 10.1519/JSC.0b013e3181b2c83d[published Online First: Epub Date]].
31. Richards T. Hip flexor extensibility and its correlation to hip hyperextension and lower back pain in dancers. Undergraduate Theses and Professional Papers 2016;**81** doi: <https://scholarworks.umt.edu/utpp/81>[published Online First: Epub Date]].
32. Jacobs CL, Cassidy JD, Côté P, et al. Musculoskeletal injury in professional dancers: prevalence and associated factors: an international cross-sectional study. *Clin J Sport Med* 2017;**27**(2):153-60
33. Kenney SJ, Palacios-Derflinger L, Whittaker JL, Emery CA. The influence of injury definition on injury burden in preprofessional ballet and contemporary dancers. *J Ortho & Sports Phys Ther* 2017;**48**(3):185-93
34. Vassallo AJ, Pappas E, Stamatakis E, Hiller CE. Injury fear, stigma, and reporting in professional dancers. *Safety and Health at Work* 2019;**10**:260-64
35. Mainwaring LM, Krasnow D, Kerr G. And the dance goes on: Psychological impact of injury. *JDMS* 2001;**5**(4)