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The prevalence of musculoskeletal pain and injuries in South African competitive Ballroom and Latin American dancers

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The prevalence of musculoskeletal pain and injuries in South African competitive Ballroom and Latin American dancers.

A research dissertation presented to the
Faculty of Health Sciences, University of Witwatersrand,
in fulfilment of the degree of
MSc Medicine in the field of Sports and Exercise Science

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23 June 2022

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DECLARATION

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FACULTY OF HEALTH SCIENCES

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LIST OF ABBREVIATIONS / NOMENCLATURE

ASSOCIATIONS

DSSA	DanceSport South Africa
EADA	English Amateur DanceSport Association
IADMS	International Association for Dance Medicine and Science
	MPIIQM Musculoskeletal Pain Intensity and Interference Questionnaire for Musicians
NDCA	National Dance Council of America
SADF	South African Dance Foundation
WDSF	World DanceSport Federation
WDC	World Dance Council
SASCOC	South African Sports Confederation and Olympic Committee

OTHER DANCE TERMS

IM	International Modern (Standard / Ballroom Dance styles)
IL	International Latin (Latin American Dance styles)

MPIIQM	Musculoskeletal Pain Intensity and Interference Questionnaire for Musicians

1. INTRODUCTION

Besides there being no consistent definition of injury in dance research [1–3], the majority of dance research (injuries and otherwise) is in Ballet dancers, with very little in Ballroom and Latin American dance styles, and almost no research on the elite/professional dancers in these styles [4–11].

This research's main objective was to describe musculoskeletal pain and injuries in competitive South African Ballroom and Latin American dancers. This project will add to the scientific literature regarding injuries within the sport, intending to ultimately improve the health and training of people participating in this sport. This study is considered a starting pointing and to inform further research.

Epidemiological studies, used to describe the nature of injury or illness in a specific population, are common in various sports, however these methods are less common in performing arts and dance [1]. Although it is well known that the majority of injuries in dancers occur in the lower limb [1]. There is extensive research on Ballet dancers [6], yet there is little literature on Ballroom and Latin American dancing internationally, and locally there is even less. Most of the research on this style of dancing focuses on its health benefits in relation to chronic diseases, such as Parkinson's' Disease [12–19]. As these dance styles are growing in popularity[11], it is important to broaden the knowledge on the musculoskeletal pain and injuries that these dancers face, with future aims to implement management, training, and prevention strategies [20]. These aesthetic athletes [3,21–23] are subject to the same unyielding demands as other athletes [21] and deserve to have training protocols that have been developed and informed from research.

This research project involved the gathering of primary data from ninety-seven respondents, comprised of competitive dancers that were sampled at two competitions taking place in South Africa in 2019. Respondents, all South African Ballroom and Latin American competitive dancers, were asked to complete a self-report survey outlining their dancing history, pain and injuries and interference thereof, footwear habits and habits regarding medical attention when injured. Some of the important variables that were collected included: pain experienced over time; how that affected mood;

enjoyment of life and their dancing; anatomical pain location; heel height; shoe age etc.

The research did not identify any strong relationships between variables, however the clinical implications from the anatomical sites indicated that those most affected are valuable in understanding not just the prevalence of pain but the specific locations and structures involved.

This is a particularly under-researched area of sports medicine. This project will be a starting point for further research on this specific dance population. The data from this study will contribute to the medical knowledge regarding Ballroom and Latin American dancers in South Africa.

2. BACKGROUND

Within the realm of dance research, the majority of research focuses on Ballet. Ballroom and Latin American dancing are not the most popular forms of dance. A brief overview of these styles of dance is presented, so that readers may understand the styles, structure, and associated organisations.

2.1. Dance Styles

Ballroom and Latin American dance styles are unique in that they are danced as couples. The dances require speed, control, precision, strength, flexibility, balance, agility, endurance, technique, and co-ordination [4,8]. They also require co-ordination as a couple, musicality, timing and rhythm [4]. Dancers of these styles must also master the art of proper technical execution of the movements to look as if they require minimal effort [8].

The physiological demands of the Latin dances are greater than the Ballroom equivalents, especially in female dancers [22]. The Latin dances show greater explosiveness, strength, and flexibility of the musculoskeletal system and require greater energy when compared to Ballroom dances which require greater endurance and lower energy expenditure [8]. Therefore, there should be a differentiation between the two styles in terms of training and competition preparation [8]. This may explain why many dancers prefer one style over the other, and why the Ten-Dance section (where dancers compete in both styles with five dances in each style) is a specialist competition category.

Both styles of dance have a very particular posture, the more extreme being that of the Ballroom posture [22] (Figure 1).



Figure 1 Latin (left) and Ballroom (right) postures (Ronda, 2013)
Permission granted, see Appendix 10.1.

2.2. Competition Structure.

As a competitive sport there are potential monetary rewards in the form of competition winnings and recognition by world rankings [7]. Competitions are held at local, regional, national and international (World Championship) levels [5,6]. The international organisational bodies (World Dance Council (WDC) and the World DanceSport Federation (WDSF)) have similar standards rules, however each country and each local association (if there is more than one in a country) has their own variations on local competition rules, and age group and competition classifications to suit their needs [6,7,24]. Competitions are held over 1-2 days with heats leading up to finals [6,21]. A dancer can go through six to eight heats in 1 or 2 days, which means they would be dancing (competitively) up to 10 minutes per round and 80 minutes per day [9,24]. This excludes practice time.

A 2011 review outlined the number of a few major competitions sanctioned by some of the biggest national and international organisational bodies[7]:

Table 1 Major international competitions by the largest organisational bodies.

Organisational Bodies	Sanctioned Competitions
National Dance Council of America (NDCA):	75
English Amateur DanceSport Association (EADA):	117
World Dance Council (WDC):	85
World DanceSport Federation (WDSF):	148
	425 Total

The Blackpool Dance Festival, held in England annually, is considered the most prestigious DanceSport competition in the world [7]. In 2019, the event's 94th year, 56 countries were represented with a total number of 2827 entries across 13 events.

2.2.1. South African Competition Categories and Classifications

South Africa has two major associations that are affiliated with their two parent international associations:

DanceSport South Africa (DSSA), a member of the WDSF, recognised by South African Sports Confederation and Olympic Committee (SASCOC), is an association that mostly represents amateur dancers who do not dance as a profession.

and

South African Dance Foundation (SADF) a member of the WDC.

They share basic competition classifications, in line with the international structures:

Levels

There is a system of levels that dancers must progress through, which are described below. Each level has a certain number of "figures" (groups of steps/technique) that dancers must master or be deemed competent in before moving up into the next

level. There is an increase in difficulty and complexity of these figures as the levels progress. This ensures a systematic increase in skill but also ensures the dancers do not skip a level of technical development.

Progressing through the levels can be done via examination and/or competitions. It is quicker to progress through the levels through competition if a dancer is competing regularly. Examinations are recommended every 6 months, which, in the Pro-Am division may take 18 months to get through all three bronze levels, as opposed to 6 months during competitions if competing regularly.

Bronze, Silver, and Gold levels have fixed syllabus steps creating a foundation of technique.

Novice, Pre-Champ / Rising Star, Championship, and Professional levels are “open choreography” rather than syllabus steps. Routines are choreographed to the appropriate level to show of the dancers’ technical strengths (e.g., spins, flexibility etc).

At competitions, although there are ‘winners’ per level (based on accumulated points), the aim of levels is to be competent in the required technique to be able to advance to the next level. Only the professional level has prize money winnings. The professional level can also be completed as an exam (rather than a performance) if the dancer/s would like to advance to becoming judges/examiners themselves.

Pro-Am Division

The dance-couple is made up of one professional dancer (teacher) and one amateur dancer. Only the amateur dancer is being scored during the competition. These are often recreational dancers, dancers moving through grading levels, or dancers who have not been able to find a suitable competitive partner. Syllabus levels (as mentioned above) are split into 3 sections because dancing with a teacher can be costly which leads to limited practice time. The syllabus is broken down into smaller segments.

Bronze 1, 2, 3
Silver 1, 2, 3
Gold 1, 2, 3 (Gold Final)
Open Gold / Novice / Pre-Champ / Championship

Competitive *Division*

The competing dance-couples are focused couples who have chosen to be in a partnership. Dancers have a set dance partner that they train with, create routines with and compete with. These couples are scored as one (team), gaining points and moving up the ranks. If a dancer changes partners, they will then dance at the level of the dancer with the higher rank/points or they may drop a maximum of only 1 level from the higher rank. This is dictated by the National bodies to prevent unfair advantage of a couple who has a more experienced dancer dancing in more novice levels.

All the sections of a particular level from the Pro-Am division (e.g., Bronze 1, 2, & 3) are grouped together (e.g., Bronze) in the Competitive division because practicing with partner is easier, more frequent, and less costly than with a teacher. Instead of only having one hour per week with a teacher, such as with the Pro-Am dancers, these couples can practice with their partners as and when it suits them, in addition to that time with their coach/teacher. Increased rehearsal time results in quicker technical skill acquisition and quicker progression through the levels and ranks.

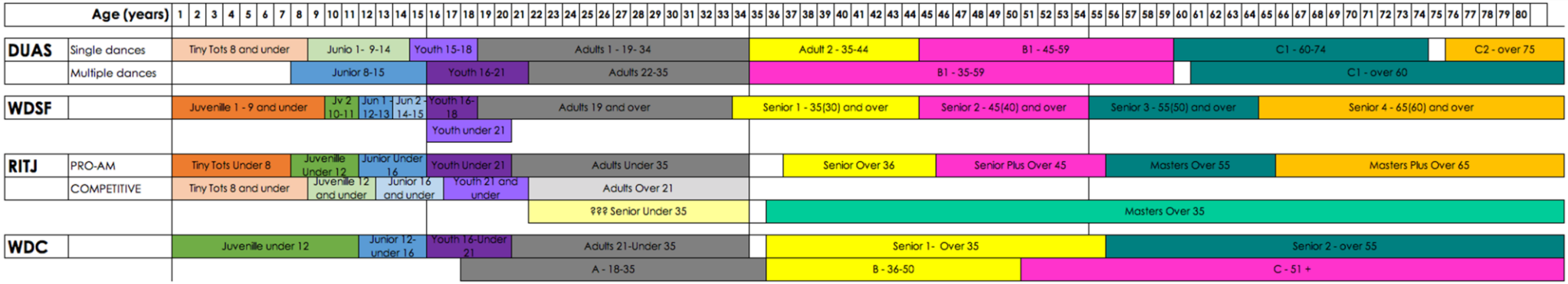
Bronze
Silver
Gold
Novice & Pre-Champ / Rising Star
Championship
Professional

There have been sections for same-sex couples, often when there are not enough men to partner women, but also, more recently, as an inclusion section for those who prefer to have dance partners of the same sex.

Age Groups

Age groups vary according to the guidelines of the international bodies. There is no internationally standardised age group classification (Table 2).

Table 2 Comparison of age group classifications for international and respective national organisational bodies



2.3. DanceSport and the Olympic Games

The WDSF was recognised by the international Olympic Committee as the representative body for DanceSport in 1997 [5,25]. In 2007 the International Olympic Committee highlighted DanceSport as a potential new competition event for the Summer Olympics [5,7]. It was announced (20-03-2019) that Breaking (a particular dance style within the umbrella of DanceSport) will be included in the 2024 Olympic Games, after its debut in the 2018 Youth Olympic Games [25]. This is the first time any DanceSport discipline will appear at an Olympic Games. This will continue the push for Ballroom and Latin dancing to be included, even after its rejection for the 2020 Olympic Games.

2.4. DanceSport in South Africa

"Ballroom dancing has received virtually no academic or historical attention in South Africa" [10]. Even with the diversifying efforts of historians over the last 20 years, this culture and form of art has not been studied by many academics in South Africa [10].

Ballroom dancing originated in Europe in the fourteenth century and made its way to South Africa with the European settlers in the mid-seventeenth century [10]. It is recorded that Ballroom dances were formally danced from at least the beginning of the eighteenth century [10]. However, these are not quite the same dances we know today. Current techniques were only standardised shortly before the Second World War (1939-1945) [10]**.** The urbanisation and industrialisation of the early twentieth century created a large middle class population that had disposable income and leisure time, which assisted the spread of new American and European dance styles throughout the world and SA [10]. The early twentieth century was therefore the "heyday" of Ballroom dancing [10].

South Africa has a long history of competitive Ballroom and Latin dancing with the first national Ballroom competition having taken place in 1928, following several heats at provincial level [10].

Research on these styles of dance will not only be valuable for the international bodies, but also for our local dancers. Knowledge on injury risks and prevention will help

manage factors that can be controlled (e.g., training load) in situations where there are many things that cannot be controlled (e.g., floors).

2.5. Influences on Public Interest and Participation.

Ballroom dancing remains a popular pastime in the twenty-first century [10], but the international success of the movie *Shall We Dance (2004)*, as well as the television series *Strictly Come Dancing (2004)* sparked an increase in participation of these particular dance styles in various locations around the world [5,7,10]. The South African version of *Strictly Come Dancing* premiered in February 2006. The increase in international and local media coverage of these styles may have led to increased enrolment at local and international dance schools [10].

2.6. Aims and Objectives.

This study aimed to answer the question:

> *What is the prevalence of musculoskeletal pain and injuries in South African competitive Ballroom and Latin American dancers?*

The objectives of this research were:

1. To describe musculoskeletal pain and injuries in South African competitive Ballroom and Latin American dancers

2. To identify associations between pain and injuries and the following factors:
    - Gender
    - Age
    - Competition level
    - Experience (years dancing)
    - Dance activity load (hours of dancing) / practice habits
    - Pain/injury location and severity
    - Footwear Habits (heel height)
    - Activity interference and/or interruption due to pain/injury
    - Quality of life

- Type of flooring

3. To explore the behaviours of South African competitive Ballroom and Latin American dancers regarding seeking medical attention / treatment for their musculoskeletal pain and injuries.

3. LITERATURE REVIEW

3.1. Terms and Definitions

3.1.1. DanceSport

The WDSF (2020) defines DanceSport as

> "*The activity that combines sport and dance, and that allows the participants to improve physical fitness and mental well-being, to form social relationships and to obtain results in competition at all levels*".

Traditionally DanceSport is a term used as a collective description for the variations of competitive Ballroom and Latin American dances, including Ten-Dance. However, over the years it has evolved to incorporate other styles of dance including Rock 'n' Roll, Street, Breaking, Salsa and Wheelchair dancing, to name a few [7].

The most common competition disciplines that this study involved are International Modern (IM), which consists of Ballroom Dance styles and International Latin (IL), which consists of the Latin American Dance styles (Figure 2). These disciplines differ from one another in terms of basic character, style, rhythm, and tempo [8]. Ten-Dance is a competition discipline where all IM and IL scores are combined [5,6,8,21,22,24]. This study has also included the American Smooth and Rhythm styles, as the dance styles are similar to that of Ballroom and Latin American dance styles respectively. They ultimately have the same steps but are performed in a slightly different manner (Figure 2).

This study will use the terms Ballroom and Latin American dancing/dancers.

International Modern / Ballroom	American Smooth	International Latin / Latin American	American Rhythm
Waltz	Waltz	Cha Cha	Cha Cha
Tango	Tango	Samba	Rumba
Viennese Waltz	Foxtrot	Rumba	Swing
Foxtrot	Viennese Waltz	Paso Doble	Bolero
Quickstep		Jive	Mambo

Ten-Dance Nine-Dance

Figure 2 International and American Competition Categories Comparison.

3.1.2. Injury in Dance

There is no consistent definition of injury in dance research [1–3].

The International Association for Dance Medicine and Science (IADMS) started the Standard Measures Consensus Initiative (SMCI) with the aim of creating a uniform protocol for measuring and reporting injury in dancers [2,26]. It recommended that an injury in a dancer should be defined as an *anatomic tissue-level impairment as diagnosed by a licensed health care practitioner that results in full-time loss of activity for one or more days beyond the day of onset* [2]. This definition does not therefore include injuries, such as musculoskeletal complaints, which may fall outside of this strict definition.

The researcher of this study finds this definition too limited as dancers experience many transient issues that they continue to dance through, not all injuries result in time-loss, not all injures are diagnosed, and most dancers do not seek medical attention for injuries, until they becomes chronic. [1,2,6,7]. Therefore, a broader definition was used for this study. As per the Musculoskeletal Pain Intensity and Interference Questionnaire for Musicians (MPIIQM) (which was modified for this research), the definition was described as follows (with dance appropriate adaptions):

Dance-related musculoskeletal problems are defined as "pain, weakness, numbness, tingling, or other symptoms that interfere with your ability to dance your style at the level to which you are accustomed". This definition does not include mild transient aches and pains. [27,28]

3.2. DanceSport Specific Research and Literature

Internationally, there is very little knowledge on the injuries, both acute and overuse, that Ballroom and Latin dancers experience [4–9,11]. The research that exists on Ballroom and Latin dancing is mostly related to its benefits with the elderly and chronic diseases such as Parkinson's Disease. There is almost no research on the competitive population, and even less in a South African context [6,10,11].

There are only seven journal articles (excluding two that are written in German) that focus on injury in Ballroom and Latin American dancers, two of which are case studies. Case studies are useful, but do not allow for generalisation to a larger population of dancers [5]. These studies are summarised in Table 3**.**

Table 3 Comparison of published literature focused on musculoskeletal injury in Ballroom and Latin American dancers.

Authors & Date	Title	Country of Origin	n	Description	Outcomes / Conclusion
Tsung, 1998[1]	Ballroom dancing and cervical radiculopathy: A case report	United States	1	Case study on cervical radiculopathy due to rotation and hyperextension of the cervical spine	Neck position and movement (frequent hyperextension and lateral rotation) resulted in the development of cervical radiculopathy.
Tsien, 2001[2]	Internal rotation knee injury during ballroom dance: a case report.	United States	1	Case study on a popliteus tendon strain during an internal rotation of the leg	Ballroom dancing may result in internal rotation injury to the knee which is uncommon in other styles of dance.
Riding Mccabe, Hopkins, *et al.*, 2013[3]	Contributions of Muscle Fatigue to a Neuromuscular Neck Injury in Female Ballroom Dancers	United Kingdom	20	Electromyography study investigating muscle fatigue and neck injuries in female Ballroom dancers	Unique research of neck injuries even though aetiology of injury unknown.
Miletic, 2015[4]	Age-related progressive increase of lower back pain among male dance sport competitors	Croatia	200	Online questionnaire for male dancers only.	Lower back pain is a significant problem in male dancers, increases with age, and is not resolved with decreasing training intensity and 28% of male dancers seek medical help because of musculoskeletal pain.
Riding, McCabe, 2014[5]	Fit to dance survey: a comparison with DanceSport injuries.	United Kingdom	99	Online survey comparing injury profiles to other forms of dance	Muscles and joints were the most common type of injury, with the knee being the top injury site. The main perceived cause of injury was repetitive movements and physiotherapists were the most common type of medical professionals from whom the dancers sought treatment.
Pellicciari, 2016[6]	Injuries Among Italian DanceSport Athletes: A Questionnaire Survey.	Italy	153	Questionnaire survey describing the injury profile of Italian Ballroom and Latin American dancers, looking at demographic and training parameters that are injury risk factors	Half of the dancers reported at least 1 injury, particularly in the lower limbs and predominantly strain and sprain injuries.
Kuises, Camacho, et al 2012[7]	Self-reported incidence of injuries among ballroom dancers	South Africa	116	Questionnaire to quantify the injury incidence, identify nature of injuries and identify potential risk factors.	Acute injuries occurred more frequently in males and chronic injuries occurred more frequently in females. The most frequently injured anatomical sites were ankle, foot and toe, followed by back and neck.

3.3. Comparisons to other Dance Styles

It has been well documented that dancers, in general, but specifically ballet dancers, have high risk and prevalence of injury [2,29] The prevalence presents in different ways, with some examples presented below:

- 67% to 95% of professional ballet dancers sustain an injury every year [2].
- 42.5% of recreational ballet dancers sustain an injury every year [2].
- 84% ballet and modern dancers experienced an injury sufficient to affect their dancing at some time [29].
- 53% ballet and modern dancers had a chronic injury that gave them continuing problems [29].
- 43% of ballet and modern dancers had sustained at least one injury in the previous six months that had affected their dancing [29].
- Professional Irish dancers have an injury rate of 76.6% in a 5 year period [30].

Most literature agrees that the lower extremities are the areas most affected by injury in dancers [2,3,11,23,29–31], and as a result of repetitive stress [2]. There are different injury profiles between sexes due to distinctly different Ballet roles [2]. Females suffer more foot and ankle injuries due to the nature of pointe work and males more lumber back injuries due to overhead lifting of their female dance partners [2].

The latest Fit to Dance survey (2014) compared results from DanceSport participants to previous studies (1993 and 2002), which did not include DanceSport participants [6]. Some of the results include:

- DanceSport has a higher percentage of male dancers compared to other types of dancing. This is because DanceSport is a partnered dance style with a couple comprising, typically, of a man and a woman.
- Dancers participating in DanceSport started dancing later in life.
- The population is older than that of other dance forms: 28% in the 40+ years category as opposed to 3% in 1993 and 1% in 2002.
- Although BMI in both 2002 and 2011 are mostly normal in 57% and 69% respectively, there is a higher proportion of dancers in the overweight BMI category at 18% in 2011 as opposed to 2% in 2002.

- Participants spent more time in non-dance conditioning activities than actual dancing, whereas the previous study showed the opposite.
- There are fewer professionals in the 2011 (13%) survey compared to 2002 (25%) and 1993 (50%).

3.4. Injuries in Ballroom and Latin American Dancers

The increase of physical requirements in high-performance-sport, is always accompanied by an increase of injury rates [4]. Ballroom and Latin dancing are not exceptions, particularly because they fall into the heavy to extremely heavy category of energy expenditure [24]. Ballroom and Latin dancers perform complex artistic movements requiring a high degree of athletic competence that places stress on the musculoskeletal system, putting them at an increased risk of injury [5]. Both professional and recreational dancers have high injury risks [32].

Similar to other styles of dance, the most frequent injury sites are in the lower extremity [1,6,8,11,32]. There are some differences in literature about the exact incidence of injury per anatomical site, however they all agree on the following being the most commonly injured sites: foot, ankle, knee and lower-back [8,11,24,32].

An international survey in 2015 [20] found that there was a significant increase in back pain with age in male dancers. They suspect this due to the extreme posture of the standard dances in conjunction with long and intense training sessions. There is also mention of hypermobility and holding sustained postured in extreme ranges of motion, as contributing to injury and pain.

The 2016 study of Italian DanceSport participants[5] interestingly found no significant differences in demographic data, dance participation, and training variables between injured and non-injured athletes. However, Riding et al (2013) found that neck injuries in female Ballroom dancers had a higher incidence in the group that had been dancing for longer, which was also reflected in their higher competition level.

The foot in Ballroom and Latin American dancers is subject to sport-specific stress and extreme conditions, similar to that of the en pointe position in ballet[4]. However, the researcher has observed that literature, in general, does not go into much more detail than “foot and/or ankle”. These are both areas of the body with complex anatomy and need to be investigated in more detail for clinical application. Unpublished data from

2013[4] showed that more than 60% of Ballroom and Latin dancers with foot pain identified the 1st metatarsophalangeal joint (MTPJ) as the most frequent area of pain. Other research agrees that there is “a remarkable incidence of injury in the ankle, foot, and first metatarsal” [8].

Even though competitive couples train together with equal duration, there are role based technique differences: leads (typically male) dance forward, followers (typically female), dance backwards with a different upper body posture [6,24]. This makes for role based injury patterns that are unique to this style of dance[6]. Riding McCabe et al (2014) noticed a gender disparity regarding anatomical sites in order of decreasing frequency:

Lead (typically men): knees, ankle, lower back, thighs.
Follow (typically women): lower back, neck, feet, knees

It has also been noted that adolescent dancers have different sites that are affected and this may be due to inappropriate training load which may suggest that coaches and teachers are either not planning, or not educated in planning, training programmes or teaching technique and injury prevention[6]. There is no mention of child- or adolescent-specific events such as growth spurts and puberty, and how they may affect injury and or training.

Table 5 presents data on anatomical sites of injury across the literature[5,6,11,20]. Due to different methodologies and anatomical categories, they are not directly comparable. However, they do provide an overview of pain and injury in Ballroom and Latin American dancers. Most studies use “foot & ankle” or “foot” and “ankle” in their break downs of the lower limb which lacks accuracy[5,6,11,20]. The foot and ankle are complex parts of the human body with many detailed structures, yet the descriptions of the foot and ankle are insufficiently detailed to provide useful information relevant for a clinical setting. Only one study[20] mentioned “toes” in their anatomical breakdown. It is important to standardise the data for comparison and to provide a sufficient level of detail to allow for clinical applications.

Table 4 Comparison of pain and/or injury rates across anatomical categories.

				LOWER LIMB														SPINE					UPPER LIMB			
Authors & Date	**Title**		**n**	toes	feet	ankle	Feet& ankles	calves	lower limb / shins	knee	thighs	thighs front	thighs back	hip	Pelvis	groin		Lumbar / Lower Back	Ribs	Thoracic / Upper Back	Cervical		Shoulder	Elbow	Arm / Wrist / Hand	
(Pellicciari *et al.*, 2016).	Injuries Among Italian DanceSport Athletes: A Questionnaire Survey.		153			34.3%				23.5%				15.7%			**73.5%**	9.8%		2.9%	5.9%	**18.6%**	3.9%	2.0%	2.0%	**7.9%**
(Riding McCabe *et al.*, 2014)	Fit to dance survey: a comparison with dancesport injuries.		99		10.0%	10.0%			1.0%	17.0%	10.0%			4.0%	2.0%	6.0%	**60.0%**	14.0%	1.0%	2.0%	10.0%	**27.0%**	7.0%	0.0%	6.0%	**13.0%**
(Miletic, Miletic and Milavic, 2015)	Age-related progressive increase of lower back pain among male dance sport competitors		200																							
		Junior	47	38.3%			25.5%	12.8%	10.6%	44.7%		4.2%	12.8%	10.6%			**159.5%**	36.2%		29.8%	19.1%	**85.1%**	25.5%		1.0%	**26.5%**
		Senior I	82	37.8%			36.6%	24.4%	12.2%	36.6%		13.4%	14.6%	18.3%			**193.9%**	54.9%		32.9%	26.8%	**114.6%**	32.9%		9.7%	**42.6%**
		Senior II	71	45.1%			45.1%	23.9%	16.9%	49.3%		15.5%	15.5%	28.2%			**239.5%**	63.4%		36.6%	33.8%	**133.8%**	46.5%		5.6%	**52.1%**
(Kuises, Camacho etal., 2012)	Self-reported incidence of injuries among ballroom dancers		116	39.0%						16.0%	7.0%						**62.0%**	23.0%				**23.0%**	5.0%			**5.0%**

A number of factors may contribute to injury in Ballroom and Latin dancers identified in the literature include:

- muscular weakness / imbalance / lack of flexibility [6,8]
- biokinetics / kinetic chain dysfunction / anatomical variation [6,8]
- competition level, training schedule and load, fatigue, overwork, repetitive actions, lack of warmup/cooldown [4,6,20,30]
- floor surfaces, costumes, accidents [6,30]
- footwear (high heeled, constrictive, narrow) [1,4,6,31]
- psychological factors [30]
- poor rehabilitation of previous injury [6]
- poor dance technique [6,8,24]
- technique errors can occur because of fatigue, anatomical causes, lack of knowledge, bad teaching, and environmental causes. [24]

These risk factors are common to other styles of dance, including ballet, modern and Irish [30].

The experience, control, and level of the dancers must be taken into account when injuries occur [8]. This is important when exploring the epidemiology of injuries in such an under-researched field, such as DanceSport [8].

3.5. DanceSport Participants seeking Medical Attention.

Although pain is subjective, the attitude of dancers is often to ignore muscular pain until it heals itself, or becomes a severe injury [1,7]. This increases the risk of impaired healing and chronic injury [2], which may seriously affect careers and long-term health outcomes [29]. Researchers have observed that a number of dancers, when injured, will continue to dance, with or without modification, then try self-care before seeking help from a medical professional [1,6]. Less than half of injured dancers consult medical professionals [29]. If they do, most dancers' first choice is to go to a physiotherapist. Table 5 shows that the percentage of dancers seeking medical attention, from a medical professional when injured, ranges from 28-60%.

Table 5 Comparison of literature reporting on dancers seeking medical attention when injured.

Authors	Research Title	Question / situation	n	Yes
(Miletic, Miletic and Milavic, 2015)	Age-related progressive increase of lower back pain among male dance sport competitors	*If you were injured, did you consult a physician?*	200	28%
Bowling, 1989[29]	Injuries to Dancers: prevalence, treatment, and perceptions of causes	*All 59 dancers who had been injured in the previous six months in a way that affected their dancing consulted a health professional:*	141	42% (n=59) (100% of injured dancers)
Riding McCabe, et al, 2014[6]	Fit to dance survey: a comparison with dancesport injuries.	*When the dancers in this survey suspected an injury,*	658 1056	37% (1993) 60% (2002) 20% (2011)

3.6. Training and Conditioning

Some researchers are of the view that dancing alone is insufficient as a conditioning strategy for dancers [9]. It seems that there is no established training methodology that specifically targets aspects of physical conditioning or performance preparation, and certainly none that address psychological preparation for competitions [9]. Generally, dancers do not practice sufficient warm up or cool down protocols for rehearsals, or competitions [9]. Many dancers (and trainers/coaches/teachers) remain unaware of or are uneducated of strategic planning methodologies such as macro-cycle periodization planning [9]. It has been suggested that injury prevention strategies (for ballet) should focus on non-dancing aspects, including core muscle strengthening, pelvic stabilisers, improving alignment and increasing aerobic fitness [2].

There are differences between Ballroom and Latin American dance styles that may contribute to different injury patterns: Latin dances require more muscle flexibility whereas the Ballroom dances require greater endurance [8]. Therefore, there must be a clear differentiation between the two styles in terms of training and planning [8]. Knowledge about prevalence, location and, mechanisms of injury play an important role in helping to design prevention strategies to maintain dancer's health [5].

3.7. The Effects of Footwear

Footwear is often excluded in dance injury research, and research on high heels in dance is scarce [1,32,33]. Increasing the knowledge of the effects of footwear on dance-specific movements will help to understand, and potentially minimize, the influence of footwear on injury type and rate[32].

There are several dance forms that require high-heeled footwear, namely Broadway, musical theatre, corporate, and some styles of jazz dance, but Ballroom and Latin are unique in that training leads up to wearing high heels. The female dancers start in half-inch (1.3cm) or one inch (2.5cm) shoes and progress their way up to three inches (7.6cm), over many years of training. In the Latin style the men work their way up to a one or one-and-a-half inch (3.8cm) heel. Although not particularly high, this is the highest heel commercially available for men in dancing. A 1996 cross-sectional survey in Broadway dancers [31] showed that females are more likely to become injured than males, and even though the cause is not entirely clear, they believe that wearing high-heeled footwear may contribute.

Wearing high heels in Ballroom and Latin American dancing can be likened to wearing Pointe shoes in Ballet. The progression through the levels is all focussed on wearing higher and higher heels, however, Ballroom and Latin American dancers do not seem to be trained in fine footwork technique like ballet dancers are. There are no specific exercises or syllabi that strengthen the muscles in the feet and legs prior to wearing high heels like there are in ballet.

High-heeled footwear places the ankle complex in a plantar-flexed position, restricting the motion of the foot and ankle complex.[32] This posture places the gastrocnemius and soleus muscles in a shortened position resulting in a less efficient use of the length-tension phenomenon and diminishes energy generation and storage.[32] Similarly, walking in 5.4cm and 8.5 cm heeled shoes results in an increase of rectus femoris muscle activity while the knee goes through increased knee flexion range.[32] This may result in an increased work demand placed on the knee and a decreased work demand on the ankle when wearing heeled shoes.[32] The tibialis anterior functions as an ankle stabiliser in that it adjusts dorsiflexion of the foot.[33] The tibialis anterior has been shown

to be particularly vulnerable to increasing heel height with increased electromyography (EMG) reading indicating increased muscle activity.[33] This implies that dancing with high heel shoes would consume more energy to control balance.[33]

In dancers performing jumps in heeled shoes, the ankle has a decreased ankle plantar flexor moment due to the restricted sagittal plane motion available [32]. Barefoot, the ankle does the work for both take-off and landing phases in unipedal and bipedal tasks, however, with high heels shoes it is the knee and not the ankle joint, that does the majority of the work[32]. The demand of work shifts from the ankle to the knee when dancers perform a dance-style hopping task in heeled shoes, compared to barefoot [32]. This may have implications for dancers with a history of knee injuries and overuse syndromes – such as tendinopathy or patellofemoral pain [32].

The majority of literature on high heeled footwear is focused on high-heeled shoes being worn during low-energy pedestrian tasks, such walking and using stairs [32]. Dancing in heels, especially involving jumps, places a greater work demand on the joints of the legs than walking or using stairs [32]. This may increase the risk of injuries in the lower extremities and, more specifically, increase the risk of overuse injuries [32]. Increasing the knowledge of the effects of footwear, and footwear heel height, on dance-specific movements will help to understand and potentially minimize the influence of footwear on injury type and rate [32,34].

3.8. Floors

Dance floors are an important part of the dance environment, yet there is little information and research on floors themselves, let alone how they affect performance and injury [1135]. There are international standard for general types of floors but none for dance-specific floors [35].

Often it is assumed that sports floors are appropriate for dance, but this is not the case: many sports require a firm floor which allows a ball to bounce predictably, and the footwear is cushioned to protect against impact, as well as provide grip for traction (‘Specifying Dance Floors: White Paper’, 2018). Dancers’ footwear varies according to style but generally does not offer cushioning, and therefore dancers require more

absorptive and cushioned floors; thus, dance floors need to be softer than sports floors (‘Specifying Dance Floors: White Paper’, 2018).

There are also different floor requirements between dance styles: Ballroom and Latin American dancers appreciate the slide and speed of a traditionally finished wooden floor, whereas contemporary dancers will be apprehensive of splinters, and tap dancers will fear damaging the surface with their shoes [35].

Dancing on a floor that is too hard does not allow for appropriate shock attenuation, whereas soft floors result in muscles and tendons to work harder, both situations increasing the risk of injury [35].

Raked (angled) stages are often implicated as a risk factor for injuries in performing artists [1] however this is not a variable to be considered in Ballroom and Latin research as these dance styles are danced exclusively on level floors.

From the author’s own experience and from talking to industry leaders, most dance schools in South Africa do not have specific dance floors. Dance schools often use church, school and recreation halls which are typically cement with lino tiles or parquet.

Understanding the interaction between dancers and floors could provide insight for performance training [36] as well as injury prevention [35].

4. METHODS

The researcher is a Podiatrist, with six years professional clinical experience. During this time the researcher observed a lack of knowledge around pain and injury in Ballroom and Latin American dancers, both by dancers and practitioners. The researcher was motivated by the absence of detailed information in the practitioner space to review the state of the academic literature and found a similar scarcity of information.

A validated questionnaire[27,28], that was originally used for the impact of injury or pain on musicians' performance, was modified and used to survey South African Ballroom and Latin American dancers, to determine the prevalence of pain and injury. The questionnaire was chosen because

1. it used an appropriately broad definition of injury: "*Dance-related musculoskeletal problems are defined as "pain, weakness, numbness, tingling, or other symptoms that interfere with your ability to dance your style at the level to which you are accustomed*".
2. differentiated between the single most painful area and all the areas that were experiencing pain, problems and injuries.
3. It looked at pain intensity as well as its interference and life quality.

The structure of the questionnaire was maintained, and the wording was updated slightly, to make it applicable to dancers.

Additional sections were added to gain an understanding of footwear habits as well and habits around seeking medical attention when injured. The original questionnaire can be seen in Appendix 10.3, and the modified one used for this study in Appendix 10.4.

4.1. Background Research and Problem Statement

The author danced for twenty years, and as a practising Podiatrist, has a special interesting in dancers (and their lower limbs). Being involved in the International Association of Dance Medicine and Science exposed the author to literature on dance medicine, the majority of which is focused on Ballet. There is considerably less literature on Ballroom and Latin American styles. Ballroom and Latin American are

significant sports and are contending to be included in the Olympic Games. The author finds this lack of research problematic as other sports have the advantage of research and science to improve performance as well as athlete health and well-being. This was part of the motivation for conducting this research. Developing treatment and implementing strategies for improving dancer health requires a strong understanding of the problems faced by dancers. Therefore, an epidemiological study was the most appropriate place to start.

Before the formal survey process was conducted, as part of background research in preparing for the survey, the author contacted industry leaders, patients who were under the researcher's care, organisational bodies and medical professionals who had a special interest in treating dancers (both locally and internationally). These interactions (emails, calls, meetings and even a dance class) helped the author understand the international and local Ballroom and Latin American dance community, structure and ongoings in more detail.

This project started with the intention of studying elite/professional dancers only, however preliminary research indicated that the sample of elite/professional dancers available for the research survey was prohibitively small. Therefore, the criteria were expanded to include amateur dancers who participate in competitions. Competitive dancers are actively working towards improving their technical skill through competing and by doing so dance more (increased load) than purely recreational dancers who are not participating in competitions. Increased load / dancing time is one of the variables gathered in this research.

The next step was to find the right data collection tool. The author found that the dance specific data collection tools did not meet the criteria for gathering the required data, mostly because the definitions for injury were too limited. Some [5,30] define an injury with regards to time off dancing, this would be of limited utility as dancers are known as a population that continues to train, even with injuries and pain [1,2,7].

At a WITS Research Methodology course at the beginning of the project, Doctor Tunde Ajidahun, a post-doctorate research fellow, suggested a tool that he had used to survey

orchestra musicians, the *Musculoskeletal Pain Intensity and Interference Questionnaire for Musicians (MPIIQM).* It investigated not only pain and injury, but also its interference with mood and enjoyment of life, which better suited the intended research goals.

The survey tool asked for respondents to describe pain in different areas of the body. The distal lower limbs were defined as “foot” and “ankle”. This provided an insufficient level of detail for those areas for the purposes of this research. Consequently, the researcher developed a new, more detailed method for capturing pain in the foot and ankle. The researcher’s tool enabled respondents to describe pain and injury in the foot or ankle by aspect (dorsal, medial, plantar, lateral) as well as segments (forefoot, midfoot, hindfoot). The new method for describing pain in the foot and ankle was implemented using the Research Electronic Data Capture (RedCap) survey tool. RedCap was used as the data-capturing tool for this research project. When filling out the questionnaire, if a dancer selected foot and ankle, a detailed diagram of the foot and ankle was presented to them, in order for them to make a more detailed and accurate selection. The author prepared the detailed foot and ankle diagram from a simple drawing, which the author sectioned out into appropriate areas. The RedCap development team was then tasked with using the image to develop an interactive map, which functioned the same as the body map, which was already in the programme. The researcher took great pride in this process.

Throughout the development of this research project, the researcher was in continuous consultation with dance industry experts to ensure that the plan, data collection tool and system were well developed.

4.2. Study design

This study is a descriptive, cross-sectional survey using an adapted version of the Musculoskeletal Pain Intensity and Interference Questionnaire for Musicians [28].
Epidemiological studies are useful to describe the nature of injury or illness in specific populations [1]. They study and analyse the distribution, patterns, and determinants of pain/injury in a defined population. This gives valuable insight to the problems a certain population is facing, with the intention of further research to understand why and what

to do about it. The current study is an epidemiological study seeking to describe pain and injury in competitive Ballroom and Latin American dancers.

4.3. Population, Participants & Site

The population for this study was South African Ballroom and Latin dancers competing at two major dance competitions in South Africa. As this study was focused on competitive dancers in Latin and Ballroom it was decided to invite dancers at two competitions taking place in South Africa to participate in this study. The two competitions were:

- Dancing Under African Skies – 11-13 Oct 2019 – Emperors' Palace, Johannesburg, Gauteng Province
- Rumba in the Jungle – 24-27 Oct 2019 – Sun City, Northwest Province

Dancers competing at these two competitions, in South Africa in 2019, were invited to participate in this study. The author met with, discussed, made agreements with and got permission from the competition organising committees to conduct this research (Appendix 10.2). The competition organisers were supportive of the study and assisted with the sampling process. The invitation for dancers to participate in this study was issued by the competition organisers during the competitions. Dancers were informed of the study via competition social media pages, announcements during the competitions, and in person by the author at a stand near the competition halls and rehearsal areas.

Participation in the survey was voluntary and participants were asked to answer the questions honestly and based on their own experience.

4.3.1. Inclusion Criteria

- South African (amateur and professionally) Competitive Ballroom and/or Latin Dancers, for simplicity.
    - Who participate in Ballroom and/or Latin (and/or Smooth/Rhythm) as their main style of dance.
- Child assent and parental consent or participants under the age of 18.

4.3.2. Exclusion Criteria

- Non-South African competitors.
- Recreational / non-competitive dancers.
- Other styles of dance as their primary dance form of dancing.
- Previous completion of the survey (participants may only participate once).

4.4. Outcome Measures

4.4.1. Pain Questionnaire

The author could not find a dance related questionnaire that had a sufficiently broad definition of injury and that as well as included sufficient depth on the ways in which pain and injury affects other aspects of a dancer's life. A questionnaire used on musicians, *Musculoskeletal Pain Intensity and Interference Questionnaire for Musicians (MPIIQM) (*Appendix 10.3*),* fitted the criteria better and was adapted for this study (Appendix 10.4).

The *MPIIQM* [27] is a valid and reliable self-reporting instrument for the measurement and evaluation of musculoskeletal pain and pain interference in a population of professional orchestral musicians. It does not only assess musculoskeletal pain and problems, but also how they interfere with activities and quality of life. It adds qualitative and psychometric elements that are often excluded in quantitative and anatomical/epidemiological studies. It was validated on 183 Scottish musicians, experts showed it to have strong face and content validity [27,28]. It had a substantial test–retest reliability for the pain intensity items, and moderate to substantial test–retest reliability for the pain interference items [27]. It has been suggested as an outcome measure tool in interventional studies or in clinical practice, as well as an injury surveillance tool [27].

The structure and function of the questionnaire was not changed. However, some slight modifications to the wording of the questionnaire was necessary so that it would be relevant to dancers, rather than the musicians it was designed for, and did not materially change the questionnaire. For example:

MPIIQM	**Changed to:**
On average, how many hours per week do you spend playing your instrument in the orchestra (this includes rehearsals, performances, recordings)?	On average, how many hours per week do you spend dancing this style for rehearsals and preparing for competitions?
Have you had pain/problems that have interfered with your ability to play your instrument at the level to which you are accustomed during the last month (4 weeks)?	Have you had pain/problems/injuries that have interfered with your ability to dance at the level to which you are accustomed during the LAST MONTH (4 WEEKS)?
For each of the following, during the past week, as a result of your pain/problems, did you have any difficulty: Using your usual technique for playing your instrument?	During the past week, as a result of your pain/problems/injuries, did you have any difficulty: Using your usual technique for your style of dance?

The Author also noted that the foot and ankle section of the body chart was insufficiently detailed for this research project and consequently the additional, more detailed, foot and ankle tool was used, shown in Figure 3. If a participant selected either the foot and or ankle segment, the online survey would present another more detailed diagram of the foot and ankle for further selection, Figure 3.

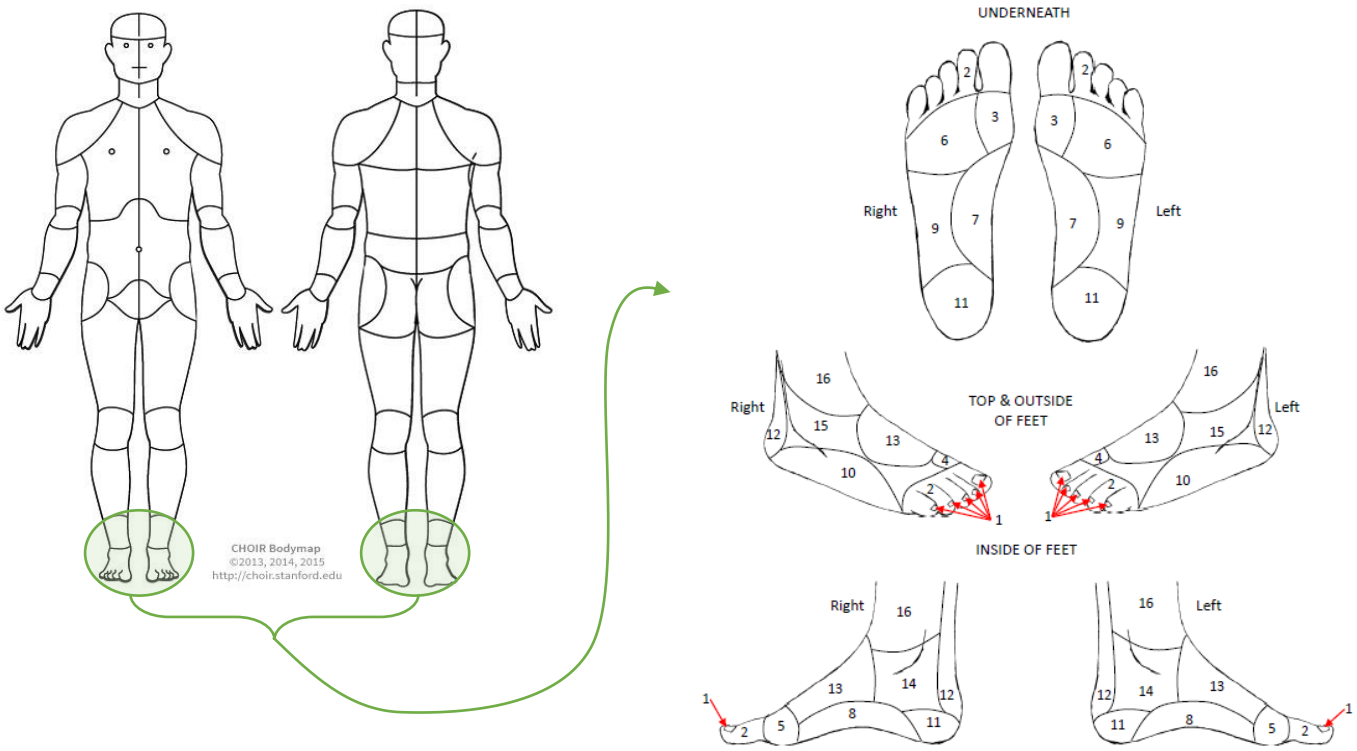


Figure 3 Body map and foot map used in RedCap for this project.

The following information was also included at the end of the modified questionnaire to capture other variables that may play a role in pain and injury in Ballroom and Latin American dancers.

- Competition category
- Activity load (of all dance styles as well as other activities)
- Footwear habits (e.g.: heel height, age and size of shoes)
- Floors (types of floors)
- Dancer habits regarding seeking medical attention when injured. This was included as a qualitative aspect to get an understanding of what dancers know and do about injuries as well as their opinions on the dance-specific knowledge of medical professionals. An open-ended question was included for dancers to share their experiences about health professional with regards to their dance-related injuries and issues.

Injuries in dance may be as a result of a number of factors, the survey captured information about the nature and interference of the injuries experienced (what pain did they feel, where and how did it affect their mood etc). These additional questions looked to try and identify patterns in the risk factors (potential causes) of those injuries.

All additional sections were part of the online survey. They were presented after the modified MPIIQM questions and can be seen in Appendix 10.4.

4.4.2. Questionnaire Delivery

At each competition there was a stand where the survey stations were set up. Three laptops were set up for data capture, so that three respondents could be completing the questionnaire simultaneously. For the sake of privacy and confidentiality, the three laptops were set up in such a way that the screens were not visible to people at the other stations. The survey was conducted online, though RedCap, an electronic data capture tool hosted by the University of Witwatersrand [37,38]. It is a secure, web-based application designed to support data capture for research studies, providing: 1) an intuitive interface for validated data entry; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for importing data from external sources [37,38].

Respondents were asked to fill out the questionnaire online. Each respondent filled out the questionnaire by themselves, however the researcher was available to assist with questions if they needed help.

4.4.3. Questionnaire exposure

The entrants from both competitions were made aware of the study leading up to the competition dates via the competition social media pages. During the competitions, regular announcements were made by the announcers at the event, reminding the dancers that the survey was taking place and requesting that they participate. At each competition, there was an exhibition stand set up with information about this study. There was also a large banner and pamphlets with information about the study. The pamphlet had a QR code that dancers could scan and complete the survey privately

on their own devices. Competitors only needed to complete the survey a single time over both competitions, which were two weeks apart. There was a declaration statement in the questionnaire for the dancers to declare that they had not completed this survey before, to limit duplication. Consent was implied by the participants willingness to do the survey. No personally identifiable information was gathered.

4.5. Pilot

In order to ensure the questionnaire worked as expected, a pilot study was conducted with four dancers. The four pilot study respondents were dancers who did not participate in the chosen competitions. They were recruited from the competition organising committees, in the month before the competitions (September 2019). The aim of the pilot was to test the questionnaire, to ensure the tools were working correctly and that the questions were clear and that there were no ambiguous or confusing questions. The pilot study also provided the organising committees exposure to the content of the survey – so that they could better understand the process.

4.6. Data collection

Data were captured directly into a database using RedCap.

4.7. Data Analysis

Of the 771 dancers in both competitions, 128 dancers filled out the questionnaire, of which 102 were complete. After the survey was completed, the data was first organised to remove all incomplete responses. Four non-South Africans were also excluded, and 98 responses were used for preliminary analysis. One dancer indicated that her main style of dancer was a style other than Ballroom and Latin American and was therefore excluded from further analysis. Ninety-seven (13%) responses were used for further analysis.

Some of the data was then reorganised to be more suitable for some statistical tests or for presentation. For example, BMI was calculated via a formula in RedCap giving the BMI number for each respondent. The BMI numbers were then organised into categories (<18.5 = underweight, 18.5-24.9 = healthy weight, 25-29.9 = overweight,

≥30 = overweight) for better comparison to other research which reported their BMI data in that manner.

As part of the data analysis, a number of statistical tests were performed using Statistica 13.5.0.17. Descriptive statistics are presented about the sample demographics and then about the pain and injuries experienced. Measures of central tendency (mean, median, mode) as well as measures of variability (standard deviation, variation, minimum and maximum variable) are also presented. This information is presented in tables and graphs/charts.

The normal distribution for each factor were assessed as it determines which statistical tests to perform between different types of variables. The distribution indicates how a set of responses is distributed around the mean of the data set. A normal distribution is when most the responses are close to the mean, and the further a response deviates from the mean, the lower the probability of it occurring.

Inferential statistics included:

The Mann-Whitney test - to compare medians between two groups (one categorical and one continuous) where the variables had non-normal distributions.

The Chi-square (χ2) or Fisher's exact test (if the expected values in the contingency table were <5) - to compare the means between two groups, both categorical.

The independent T Test - to compare the means of two groups (one categorical and one ordinal) where the variables had a normal distribution.

The level of significance for all tests was = 0.05.

4.8. Data Storage

Only the author has access to the raw data. Even though only non-identifiable information was collected, the data have been treated as confidential. The data were stored directly on the RedCap server, and a copy was downloaded for analysis. The downloaded data is stored securely on the author's password protected and encrypted work laptop. The laptop holds personal and confidential medical information of patients, and security thereof is governed by Health Professions Council of South Africa (HPCSA) guidelines[39]. The research data was treated using the same guidelines.

4.9. Ethics

Information regarding this research was presented at the beginning of the online survey and was also made available in hard copy to any dancer that wished to receive it. Consent was given by virtue of agreeing to participate. Hard copy consent forms were not practical as they would require collection of personal information.

Participants under the age of 18 years provided their assent along with parental consent within the survey. The 'current age' input directed a branching logic instruction to those under 18 to answer *"My parent or guardian help me with this and does/does not grant their permission for me to participate"*. Hardcopies of the declaration form were also made available at the competitions, at the stand, manned by the author.

The survey was designed to be completed anonymously, i.e., no identifiable information (e.g., name, surname, ID number, date of birth, contact details) was recorded during the course of this research.

Laptops supplied at the stand were strategically positioned so that no person, other than the participants were able to view the screen. Participants were also given the option to complete this survey on their own mobile devices, allowing them additional control of privacy and confidentiality.

Participants were able to withdraw during the course of completing the questionnaire. However, due to the anonymity of the data collection, a participant's information could not be deleted after completion of the survey.

The protocol for this study was submitted to the University of the Witwatersrand Human Research Ethics Committee (Medical). Ethical clearance (M190674) was granted prior to the commencement of data collection. Certificate: Appendix 10.7.

5. RESULTS

Of the 771 dancers between both competitions, there was a 12.7% (n=97) response rate (complete responses used for main data analysis). Figure 4 shows the break down in more detail.

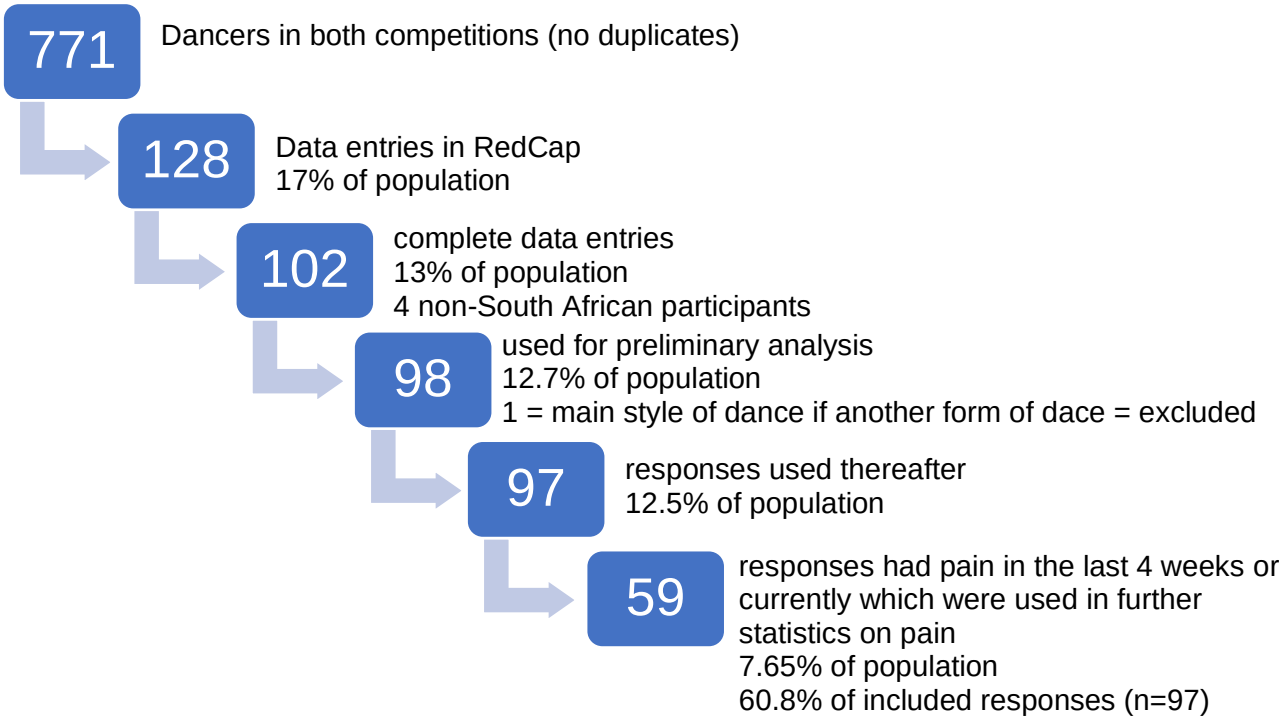


Figure 4 Breakdown of the number of respondents who completed the survey and were used in data analysis.

5.1. Demographic Descriptive Statistics

The demographics of the sample are presented below. The variables selected for this study are those that may play a role in pain and injury in Ballroom and Latin American dancers. This survey gathered data on 85 variables, while various statistical tests were run on these variables, only the most relevant are discussed below.

5.1.1. Age and Sex

Height and weight were self-reported. Of the 98 responses included in the study, 73% (n=72) are adults, and 27% (n=26) children (under the age of 18). The average age of the participants was 29 years old, with the youngest participant being 5 years old and the eldest 78 (n=98, SD=16.33. This data is not normally distributed.

76% (n=74) are female and 24% (n=24) male, a ratio of 3:1.

5.1.2. Height, Weight, BMI

Table 6 shows the average height of the participants was 164cm; weight, 62kg and BMI, 23. All these categories were normally distributed. BMI was organised into categories and Table 7 shows that 41% of the dancers fall within the normal category. The missing data in this survey may be due to dancers not completing information on either their height or weight.

Table 6 height, weight, and BMI of dancers.

Variable	Valid N	Minimum	Maximum	Mean	Std Dev
Height (cm)	79	120	189	164	11.89
Weight (kg)	84	25	115	62	17.14
BMI	77	16	34	23	4.56

Table 7 BMI categories, with a comparison to the only other study that included BMI in DanceSport research.

BMI Category	Current Study	Riding MCabe et al, 2014
Underweight = <18.5	12%	12%
Normal weight = 18.5–24.9	41%	69%
Overweight = 25–29.9	14%	18%
Obese = ≥30	9%	1%
Missing	24%	0

5.1.3. Home Province

Figure 5 shows the home province of the respondents, most of which are from Gauteng. Data collection took place at competitions in two provinces, one in Gauteng and one in the Northwest, although the one in Northwest was easily accessible to competitors from Gauteng. Therefore, the large number of Gauteng participants is due to competition proximity. The national distribution of dancers is unknown due to the limited data collection.

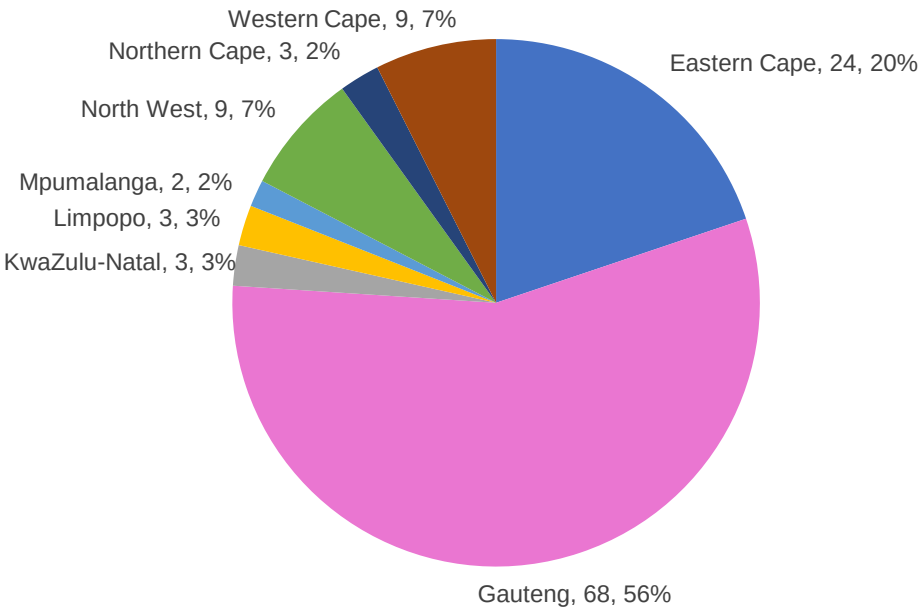


Figure 5 Home Province distribution of the respondents.

5.2. Dance Specific Statistics including Inferential Statistics

5.2.1. Dance Style

Most dancers (62%, n=61) participate in both Ballroom and Latin, whereas 27% (n=26) do Latin only and only 10% (n=10) do Ballroom only. One participant that selected that their main style of dance was something other than Ballroom or Latin was excluded from further analysis, as per the exclusion criteria.

5.2.2. Years dancing and competing

Table 8 shows that this sample had been dancing for an average of 7.5 years and competing for an average of just over 5 years. This data is not normally distributed.

Table 8 Number of years dancing and competing.

	Count	Minimum	Maximum	Mean	Std Dev
Years Danced	97	0.5	32	7.6	6.87
Years Competing	97	0.0	27	5.3	5.29

5.2.3. Professional vs Recreational Participation

Only 16% of the respondents dance professionally (as their job) whereas the majority (84%) dance recreationally, as their sport or hobby.

5.2.4. Competition Categories

Figure 6 shows the distribution across the competition categories. Those that dance in both categories are often the Professional dancers who compete individually in the Competitive section and then partner with their Students in the Pro-Am category.

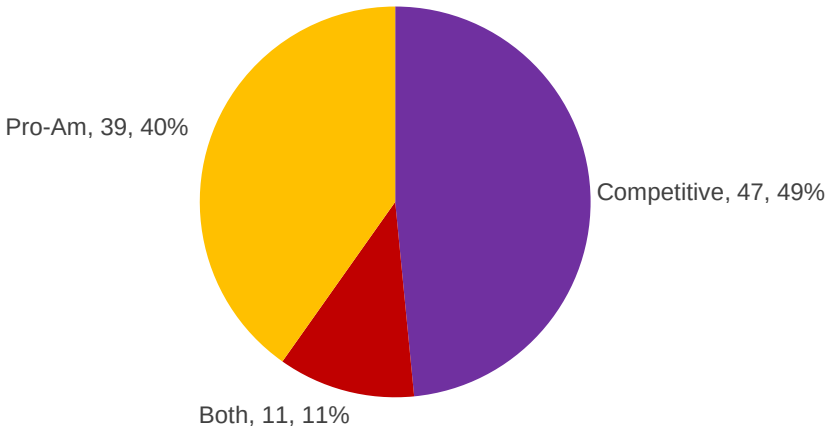


Figure 6 Competition Categories

Competitive Subdivision

Figure 7 shows that most respondents in the Competition subdivision are in the Novice/Pre-Champ/Rising Star section.

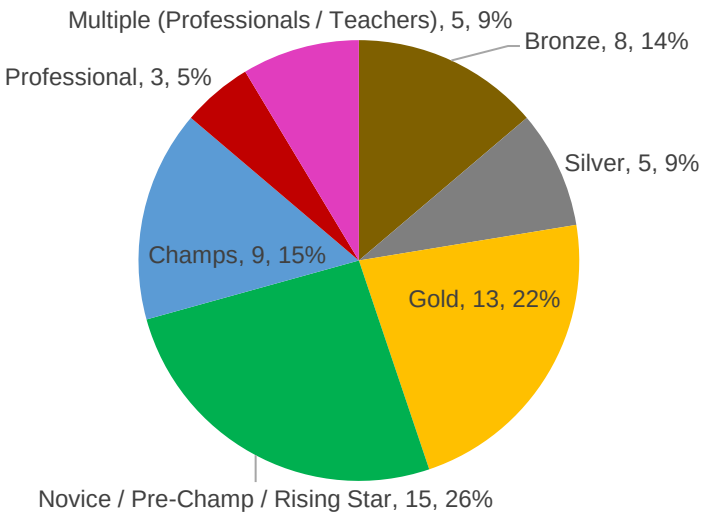


Figure 7 Competitive Category subdivision breakdown

Pro-Am Subdivision

Figure 8 shows that the majority of respondents in the Pro-Am subdivision were in the Open Gold/Novice/Pre-Champ/Champ section.

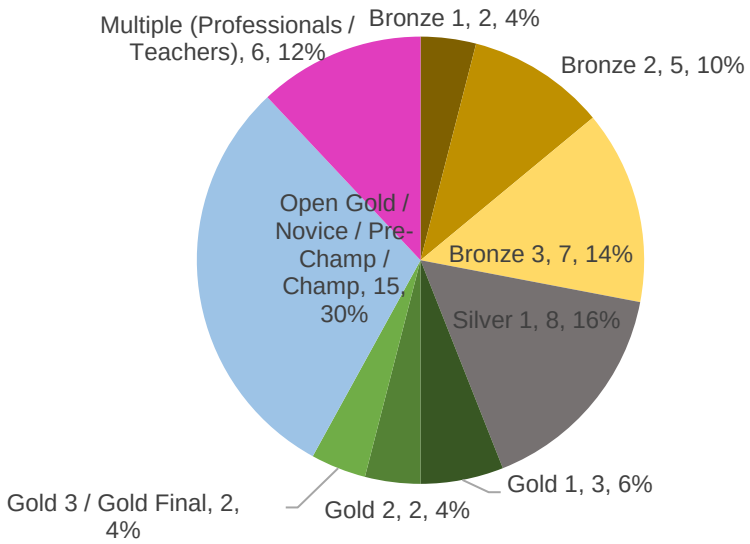


Figure 8 Pro-Am Category subdivision breakdown

5.2.5. Dancing load

Table 9 shows how much time the dancers spend preparing for competitions (rehearsal etc) as well as how much time they spend dancing outside of competition preparation. Dancing outside of competition preparation may be for fun (socials) or teaching (professionals). Neither of these were normally distributed.

Table 9 Dancing Load

Hours per week spent dancing this style	Count	Minimum	Maximum	Mean	Std Dev
For rehearsals and preparing for competitions	96	1	50	10.15	9.97
Outside of competition preparation	96	0	48	5.85	7.1

5.2.6. Pain experienced by dancers

Figure 9 shows the percentage dancers who had experienced pain at set time intervals. Of all the dancers who completed the survey

77% (n = 97) have experienced pain at some point in their dance career,

69% (n = 97) have experienced pain in the last 12 months,

54% (n = 97) have experienced pain in the last month and

48% (n = 97) were in pain at the time of completing the survey at the competitions.

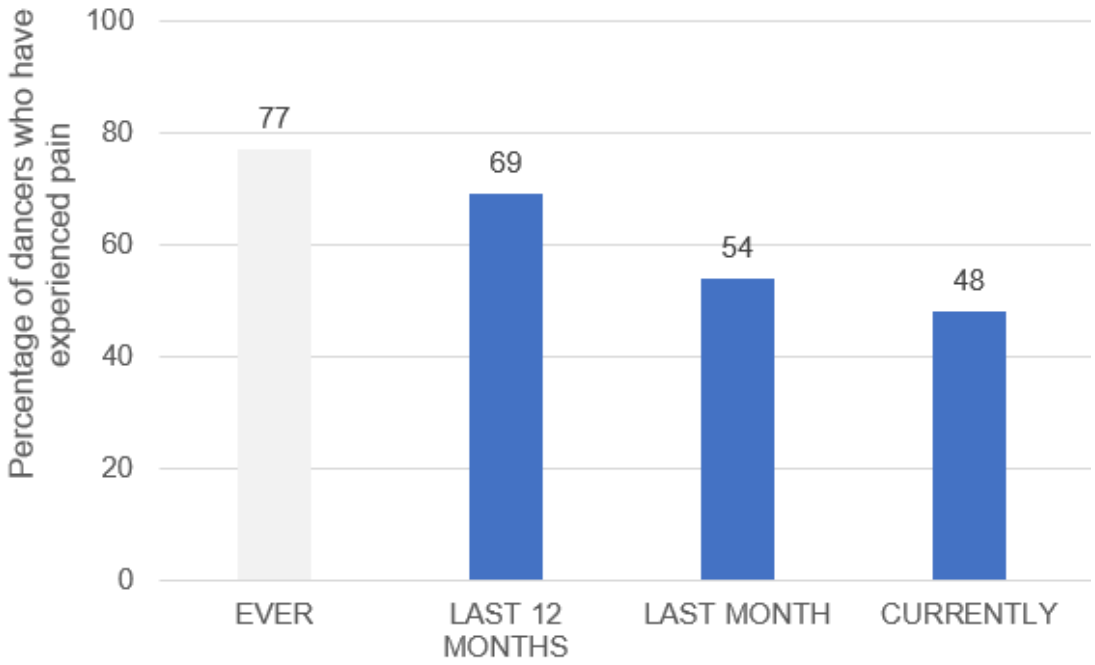


Figure 9 Percentage of dancers who have experienced pain at different time intervals.

Table 10 shows that there was no relationship between the presence of pain/problems/injuries in the last 12 months, 4 weeks, 1 weeks and currently experienced by the dancers and

- Sex (Chi^2 test for independence)
- Age (Mann Whitney U Test)
- Years dancing in general (Mann Whitney U Test)

- Years competing (Mann Whitney U Test)
- Weekly hours of dancing for competitions and preparation (Mann Whitney U Test)
- Weekly hour of dancing outside of competition preparation (Mann Whitney U Test)
- Professional or recreational participation (Chi^2 test for independence)
- Competition Section (Competitive vs Pro-Am) (Chi^2 test for independence)

The level of significance for all tests was $\alpha = 0.05$.

Table 10 Statistical tests and p values of pain/problems/injuries experienced at certain intervals and other demographic and dance variables.

	SEX	AGE	YEARS DANCING	YEARS COMPETING	WEEKLY HOURS OF COMPETITION PREPARATION	WEEKLY HOURS OF NON-COMPETITION DANCING	PROFESSIONAL / RECREATIONAL	COMPETITIVE / PRO-AM
	Chi Squared test for independence	Mann Whitley U Test	Mann Whitley U Test	Mann Whitley U Test	Mann Whitley U Test	Mann Whitley U Test	Chi Squared test for independence	Chi Squared test for independence
Pain/problems/injuries experienced:								
Ever	p = 0.75	p = 0.53	p = 0.41	p = 0.89	p = 0.81	p = 0.97	p = 0.07	p = 0.07
In the last 12 months	p = 0.47	p = 0.8	p = 0.89	p = 0.68	p = 0.29	p = 0.56	p = 0.53	p = 0.12
In the last 4 weeks	p = 0.32	p = 0.11	p = 0.58	p = 0.98	p = 0.56	p = 0.76	p = 0.39	p = 0.96
In the last 7 days	p = 0.86	p = 0.08	p = 0.48	p = 0.41	p = 0.89	p = 0.39	p = 0.34	p = 0.22

5.2.7. Anatomical areas of pain only

Data from the body charts were consolidated into larger anatomical sections and presented as how many people reported pain in those anatomical sections. Detailed data can be found in Appendix 10.8. The most selected area of pain is the foot and ankle, followed by the knee and shin, back and neck and shoulder (Figure 10). There was no significant difference between these groupings and the pain-rating at its worst, least, average, and now (all p values were greater than $\alpha = 0.05$) (Table 11).

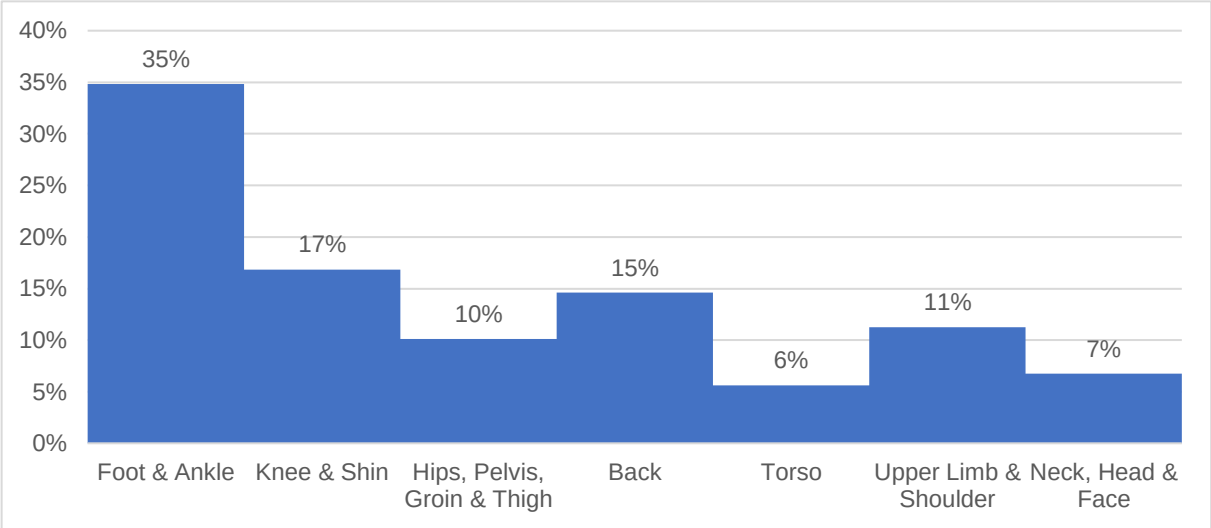


Figure 10 Shows the body parts selected as the single most painful area at the current time of competition.

Table 11 Statistical tests and p values of pain rating and areas of the body.

		Distribution	Statistical Test	Foot & Ankle	Knee & Shin	Hips, Pelvis, Groin & Thighs	Back	Torso	Upper Limb & Shoulder	Neck, Head & Face
Pain Rating										
	at its worst	Normal Distribution	T-test	0.91	0.37	0.37	0.76	0.19	0.49	0.87
	at its least	Not normal	Mann Whitney U	0.99	0.98	0.17	0.54	0.49	0.08	0.40
	on average	Normal Distribution	T-test	0.42	0.52	0.62	0.80	0.19	0.79	0.34
	now	Not normal	Mann Whitney U	0.99	0.34	0.79	0.99	0.31	0.16	0.59

In the detailed selection for the foot and ankle, the segments were grouped in two ways: aspects (plantar, medial etc) and anatomical areas (forefoot, midfoot, etc). It was beyond the scope of this research to describe the specific anatomical/osteological sectioning of these areas, as many anatomical structures will overlap the sections in the diagram Anatomical and clinical assumption are left up to the reader. Most pain was located on the plantar aspect of the foot (Figure 11) and the forefoot (Figure 12). There was no significant difference between pain-rating at its worst, least, average, and now and either of these sets of groupings (all p values were greater than $\alpha = 0.05$) (Table 12, Table 13).

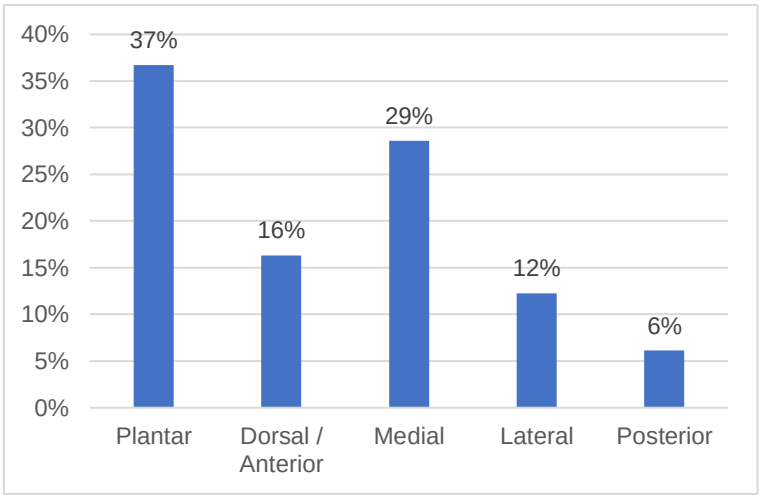


Figure 11 Shows the breakdown of foot and ankle areas selected as the single most painful area at the current time of competition, in the aspect grouping.

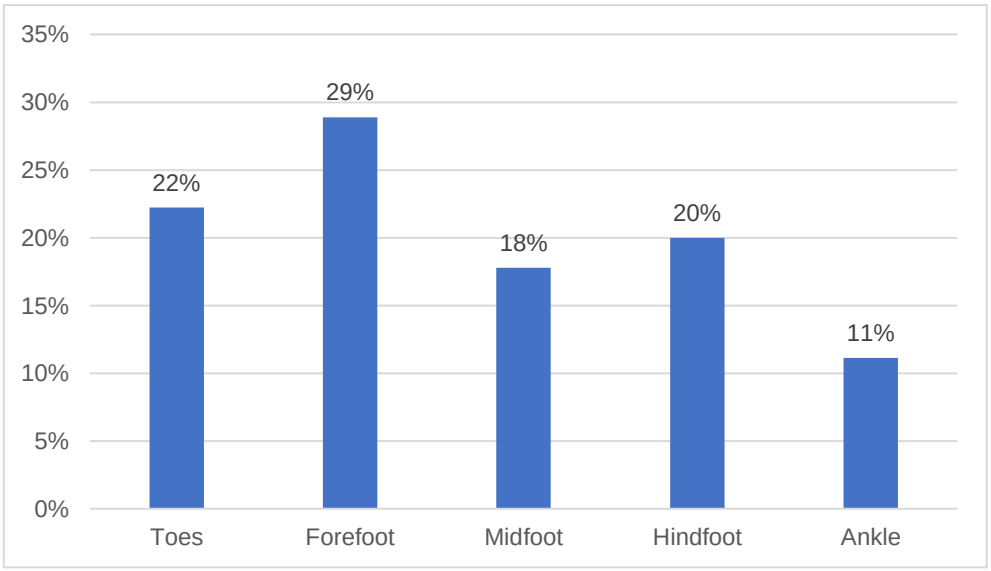


Figure 12 Single area of pain grouped into larger anatomical areas of the foot.

Table 12 Statistical tests and p values of pain rating and aspects of the foot.

		Distribution	Statistical Test	Plantar	Dorsal/ Anterior	Medial	Lateral	Posterior
Pain Rating								
	at its worst	Normal Distribution	T-test	0.10	0.28	0.45	0.47	0.20
	at its least	Not normal	Mann Whitney U	0.39	0.30	0.20	0.51	0.14
	on average	Normal Distribution	T-test	0.48	0.95	0.44	0.66	0.20
	now	Not normal	Mann Whitney U	0.09	0.94	0.12	0.78	0.39

Table 13 Statistical tests and p values of pain rating and larger areas of the foot

		Distribution	Statistical Test	Toes	ForeFoot	Midfoot	Hindfoot	Ankle
Pain Rating								
	at its worst	Normal Distribution	T-test	0.32	0.19	0.36	0.35	0.30
	at its least	Not normal	Mann Whitney U	0.43	0.86	0.87	0.88	0.83
	on average	Normal Distribution	T-test	0.79	0.11	0.76	0.19	0.73
	now	Not normal	Mann Whitney U	0.19	0.16	0.25	0.60	0.73

Looking at the foot & ankle data in its entirety, the first metatarsophalangeal joint area is the specific area of most pain (Figure 13). There is no significant difference between pain-rating at its worst, least, average, and now (all p values were greater than $\alpha = 0.05$) for most of the foot areas except for: Toenails and worst pain rating ($p= 0.01$) and posterior heel for average pain rating ($p=0.03$) (Table 14).

Table 14 Statistical tests and p values of pain rating and specific areas of the foot

		Distribution	Statistical Test	Plantar Toes	Plantar Lesser MTPJs	Plantar 1MTPJ	Plantar Lateral MF	Plantar MLA	Plantar Heel	Dorsal Ankle Joint	Lateral Malleolou	Lateral Midfoot	Dorsal Midfoot	Dorsal 1MTPJ	Toenails	Dorsal Toes	Posterior Heel	Medial Ankle	Medial Malleolus	Dorsomedial Midfoot	Medial MLA	Medial 1MPTJ	Medial Hallux
Pain Rating																							
	at its worst	Normal Distribution	T-test	0.78	0.47	0.22	0.45	0.35	0.71	0.74	0.33	0.89	0.55	0.41	0.01	0.60	0.35		0.74	0.53	0.24	0.58	0.89
	at its least	Not normal	Mann Whitney U	0.39	0.97	0.79	1.00	0.67	0.55	1.00	0.60	0.72	1.00	1.00	0.15	0.49	0.37	1.00	1.00	1.00	0.20	1.00	1.00
	on average	Normal Distribution	T-test	0.55	0.18	0.11	0.37	0.43	0.84	0.76	0.82	0.30	0.34	0.49	0.28	0.56	0.03		0.76	0.58	0.17	0.17	0.97
	now	Not normal	Mann Whitney U	0.15	0.24	0.31	1.00	0.09	0.46	1.00	0.92	0.54	0.66	1.00	0.28	0.30	0.95	1.00	1.00	1.00	0.15	0.31	0.12

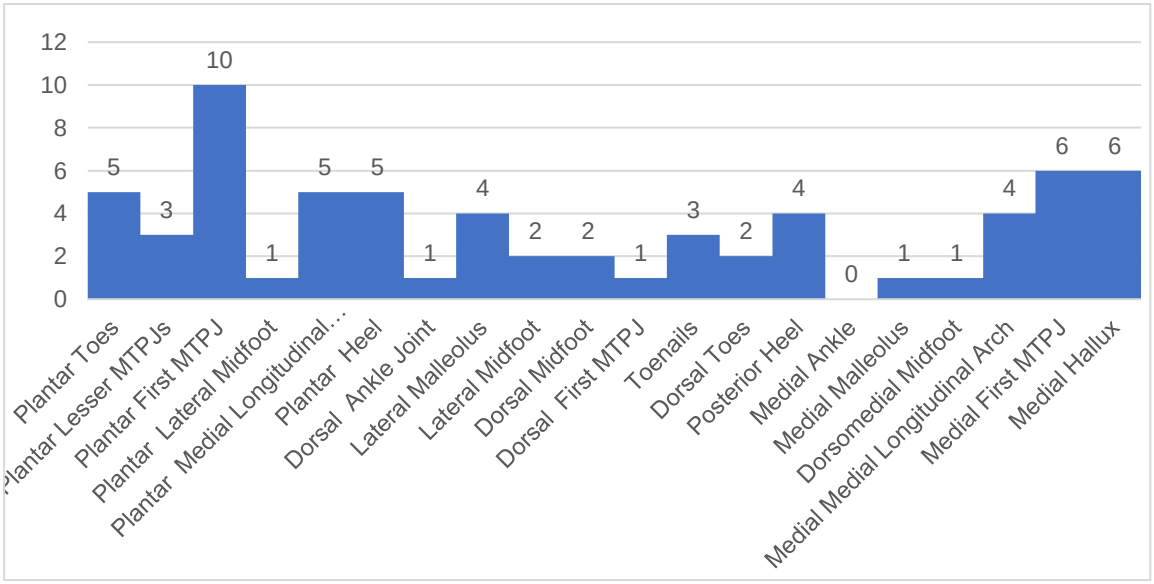


Figure 13 shows the distribution (count) of pain in the foot and ankle in more detail.

5.2.8. Pain severity and interference

For the anatomical site that hurt the most, pain was described in more detail for the week prior to the competition in Table 15. The mean values present the intensity of pain at its worst (6/10), least (2/10), on average (4/10) and during the time of the competitions (3/10).

Table 15 showing pain scores (0-100) in the week prior to data collection/competition.

	Count	Min	Max	Mean	Std Dev
pain AT ITS WORST in the last week	57	0	100	**61.89**	24.3
pain AT ITS LEAST in the last week.	56	0	64	**21.29**	20.67
pain ON AVERAGE in the last week.	55	0	99	**43.95**	23.26
pain you have RIGHT NOW.	56	0	90	**33.39**	28.17

Most dancers with pain (58%, n=34) did not withdraw from dancing in the competitions, despite their pain. Thirty-four percent (n=20) competed at the competitions with some difficultly and only 8% (n=5) did not compete due to pain. For those that did compete

with pain, most (53%, n=31) did not make use of any medication and 39% (n=23) did use medication. For those very few dancers who did not compete because of pain or injury, half had been out of activity for over 4 weeks.

5.2.9. Anatomical areas of Pain, Problems, and Injuries

Again, data was consolidated into larger anatomical sections and aspects as previously done. Detailed data can be found in the Appendix (10.9). The most selected area of to have pain, problems, or injury is the foot and ankle, followed by the knee and shin, back and neck and shoulder (Figure 14). There was no significant difference with regards to pain rating (Table 16).

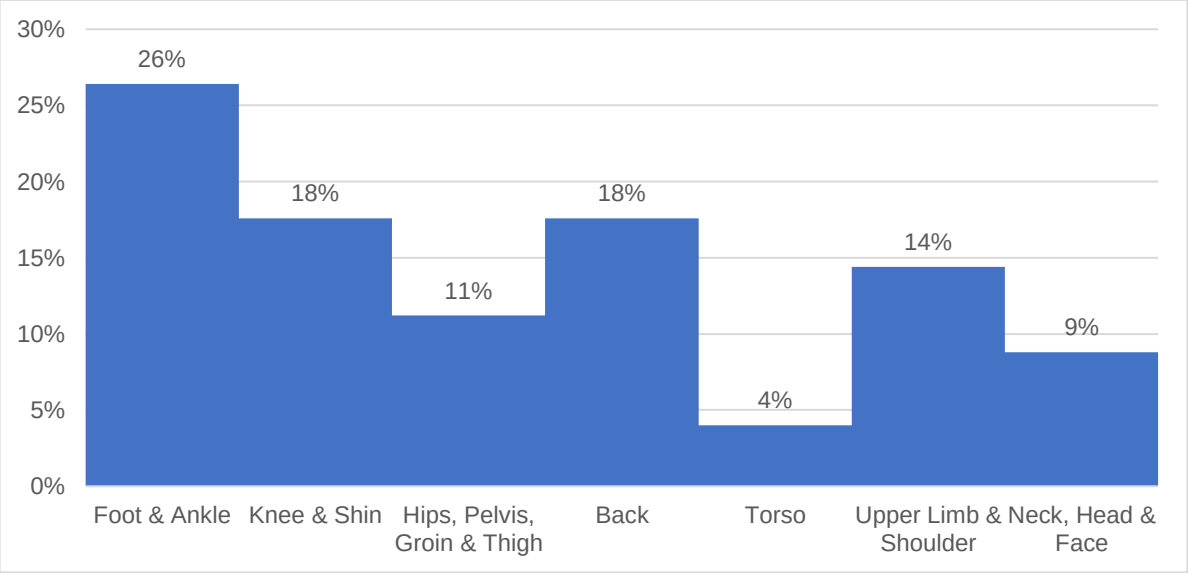


Figure 14 Shows the count of body parts selected as painful, problematic, or injured areas at the current time of competition.

Table 16 Statistical tests and p values of pain rating and areas of the body for pain, problems, and injuries.

	Distribution	Statistical Test	Foot & Ankle	Knee & Shin	Hips, Pelvis, Groin & Thighs	Back	Torso	Upper Limb & Shoulder	Neck, Head & Face
Pain Rating									
at its worst	Normal Distribution	T-test	0.55	0.27	0.44	0.87	0.75	0.98	0.53
at its least	Not normal	Mann Whitney U	0.52	0.90	0.30	0.58	0.92	0.21	0.67
on average	Normal Distribution	T-test	0.37	0.09	0.86	0.25	0.92	0.61	0.67
now	Not normal	Mann Whitney U	0.52	0.79	0.95	0.90	0.91	0.62	0.76

The plantar aspect of the foot was most affected by pain, problems, and injuries, closely followed by the medial aspect (**Figure 15**). Because the first metatarsophalangeal joint is in both these aspects, it is likely that it is most affected in these dancers. The current study found significant differences between the following variables which can also be seen in (Table 17):

- pain at its worst and medial and posterior foot pain;
- average pain and plantar foot pain; as well as
- current pain and plantar and medial foot pain.
-

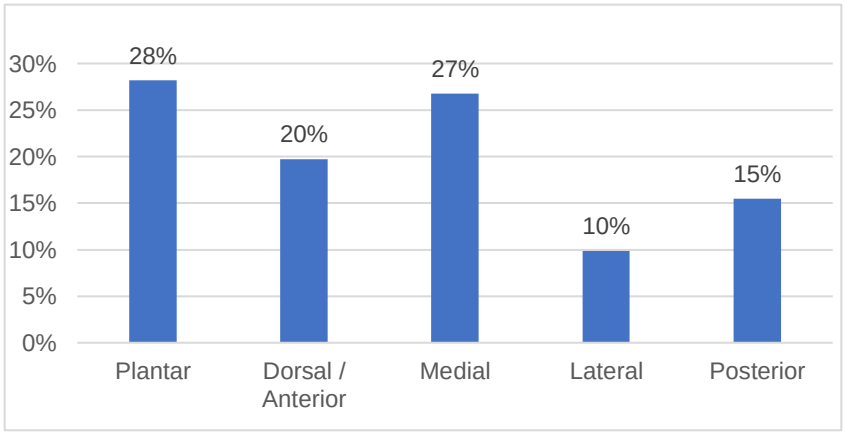


Figure 15 Shows pain, problems, or injuries for the aspect grouping of the foot and ankle.

Table 17 Statistical tests and p values of pain rating and aspects of the foot for all pain, problems and injuries.

	Distribution	Statistical Test	Plantar	Dorsal/ Anterior	Medial	Lateral	Posterior
Pain Rating							
at its worst	Normal Distribution	T-test	0.08	0.81	0.01	0.18	0.04
at its least	Not normal	Mann Whitney U	0.80	0.63	0.71	0.23	0.37
on average	Normal Distribution	T-test	0.03	0.31	0.19	0.77	0.43
now	Not normal	Mann Whitney U	0.02	0.50	0.00	0.23	0.48

Grouped by areas of the foot (rather than anatomical aspects (body planes)) the same data shows that the hindfoot has the highest incidence of pain, problems, and injuries (**Figure 16**). In this grouping there is a significant difference between current pain, problems and injuries and pain rating for current pain.

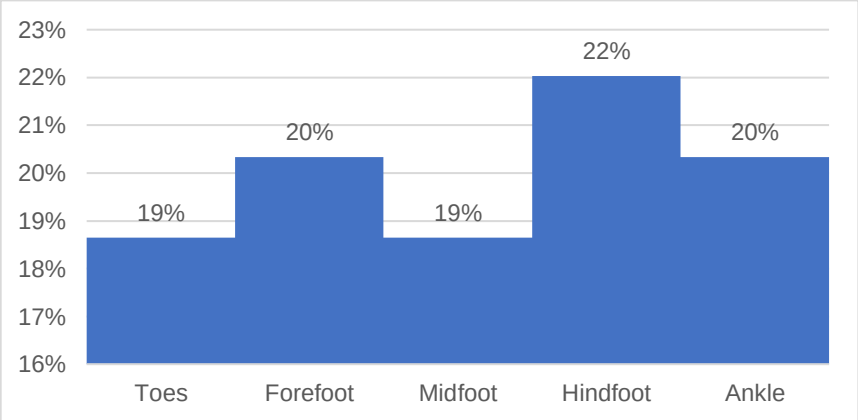


Figure 16 incidence of all pain, problems, and injuries grouped into larger sections of the foot.

Table 18 Statistical tests and p values of pain rating and anatomical areas of the foot for all pain, problems, and injuries.

	Distribution	Statistical Test	Toes	ForeFoot	Midfoot	Hindfoot	Ankle
Pain Rating							
at its worst	Normal Distribution	T-test	0.56	0.97	0.09	0.10	0.11
at its least	Not normal	Mann Whitney U	0.62	0.45	0.54	0.47	0.99
on average	Normal Distribution	T-test	0.94	0.63	0.10	0.55	0.60
now	Not normal	Mann Whitney U	0.01	0.02	0.13	0.52	0.26

Pain, problems, and injuries experienced in the 7 days prior to data collection had a significant relationship with the following anatomical aspects and areas:

Plantar foot (p = 0.02),

Dorsal foot (p = 0.02),

Medial foot (p = 0.03),

Toes (p = 0.05) and

Hindfoot (p = 0.03).

This was calculated using Fisher Exact with the level of significance at 0.05.

Figure 17 shows the distribution of pain, problems and injures in more detail in the foot and ankle. The posterior heel is the area with highest incidence of pain followed equally by the plantar 1MPTJ, plantar MLA and medial hallux.

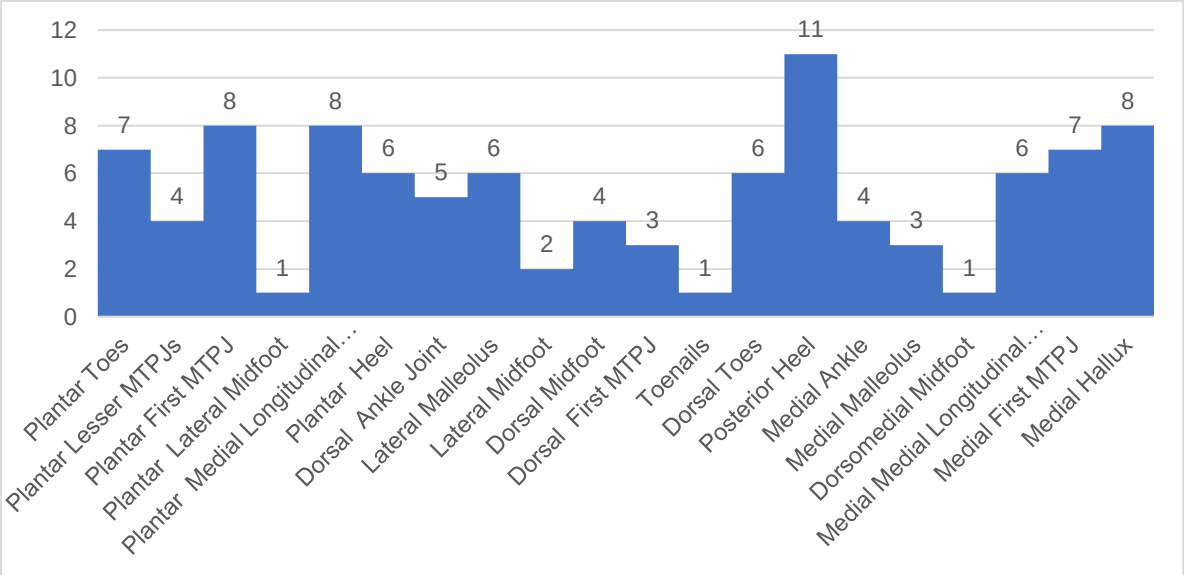


Figure 17 shows the distribution of pain, problems and injuries in the foot and ankle in more detail.

5.2.10. Pain interference

On average, pain, problems, and injuries only affect dancers' mood and enjoyment mildly at about 38-40/100 (0 = does not interfere, 100 = completely interferes) (Table 19). Enjoyment of life was normally distributed whereas mood was not.

Table 19 show the score (0-100) of how pain, problems and injury affect mood and enjoyment of life in injured dancers.

	Count	Min	Max	Mean	Std Dev
Mood	59	0	100	38.22	33.99
Enjoyment of Life	59	0	100	39.71	33.26

There is a significant difference between:

Mood and pain in the hindfoot (p = 0.04).

Enjoyment of life and pain in the hindfoot (p = 0.01) and pain in the posterior aspect of the foot (p = 0.03)

In Table 20, dancers described that pain, problems, and injuries interfere with dancing, technique, and competence. (0 = no difficulty dancing, 100 = unable to dance)

Table 20 show the score of difficulty in certain scenarios because of pain, problems, and injuries, 0 = no difficulty, 100 completely interferes.

During the past week, as a result of your pain/problems/injuries, did you have any difficulty:		Count	Min	Max	Mean	Std Dev
	Dancing your style of dance because of your symptoms	59	0	100	41.81	28.25
	Using your usual technique for your style of dance	59	0	100	47.27	28.23
	Dancing your style of dance as well as you would like	59	0	100	51.93	30.61

There is a significant difference between the following variables:

Being able to dance because of symptoms and
pain (only) of the anterior/dorsal foot (p = 0.04).

Being able to dance because of symptoms and
pain, problems, and injuries of the anterior/dorsal foot (p = 0.02).

Using usual technique and
pain (only) in the lateral aspect of the foot (p = 0.03)

Using usual technique and
pain, problems, and injuries of the anterior of the foot (p = 0.02).

Dancing as well as one would like and
pain, problems, and injuries of the midfoot (p = 0.02).

Dancing as well as one would like and
pain, problems, and injuries of the anterior/dorsal foot (p = 0.03).

5.2.11. Participation in other forms of exercise and dance styles

The majority (71%, n=42) of Ballroom and Latin American dancers do not participate in any other styles of dancing. The majority of dancers do not participate in other forms of exercise. The types of exercise and duration is detailed in Table 21.

Table 21 showing duration (hours per week) of exercises that dancers participate in. The bold numbers indicate the highest percentage per row.

	I don't do this	< 1 hr	1-2 hrs	3-4 hrs	5-6 hrs	7-8 hrs	9-10 hrs	>10 hrs
Ballroom and/or Smooth	20.32% (n=12)	10.17% (n=6)	16.64% (n=11)	**23.73% (n=14)**	15.25% (n=9)	5.08% (n=3)	0	6.78% (n=4)
Latin American and/or Rhythm	16.94% (n=10)	5.08% (n=3)	15.25% (n=9)	**25.42% (n=15)**	13.56% (n=8)	1.69% (n=1)	5.08% (n=3)	16.95% (n=10)
Other forms of dance (combined)	**71.19% (n=42)**	3.39% (n=2)	6.78% (n=4)	11.86% (n=7)	3.39% (n=2)	3.39% (n=2)	0	0
Strength/weight training	**50.92% (n=30)**	8.47% (n=5)	22.03% (n=13)	13.56% (n=8)	1.69% (n=1)	1.69% (n=1)	0	1.69% (n=1)
Pilates and/or Yoga	**77.97% (n=46)**	15.25% (n=9)	6.78% (n=4)	% (n=)	% (n=)	% (n=)	% (n=)	% (n=)
Running (road/trail/other)	**71.19% (n=42)**	13.56% (n=8)	10.17% (n=6)	3.39% (n=2)	1.69% (n=1)	0	0	0
Cycling (road/MTB/other)	**86.44% (n=51)**	8.47% (n=8)	3.40% (n=2)	1.69% (n=1)	0	0	0	0
Other	**86.44% (n=51)**	1.69% (n=1)	5.08% (n=3)	3.40% (n=2)	1.69% (n=1)	0	1.69% (n=1)	0

Missing answers were added to the “I don’t do this category” under the assumption that if it was not filled in, that the dancer is not involved with that style of dance or exercise.

5.3. Footwear

5.3.1. Shoe Size

Shoe sizes were manually converted to European (EU) sizes as the system has a single continues order of numbers from children’s’ to adult sizes as opposed to the UK system where children’s’ and adult sizes are separated, and those sizing numbers overlap. For example, a child’s UK11 is EU29, and an adult UK11 is EU46.

The average shoe size for both street and dance shoes was the same at EU38 (UK5) (Table 22).

Table 22 Shoe size descriptive statistics

	Count	Minimum	Maximum	Mean	Std Dev
Street Shoe Size	59	29	48	38	3.04
Dance Shoe Size	59	29	48	38	3.07

However, when looking at the frequencies, dance shoe sizes varied from 1.5 EU sizes smaller to 2 EU sizes bigger than street shoes. Yet the majority (49%) of dancers were shoes the same size as their street shoes (Figure 18).

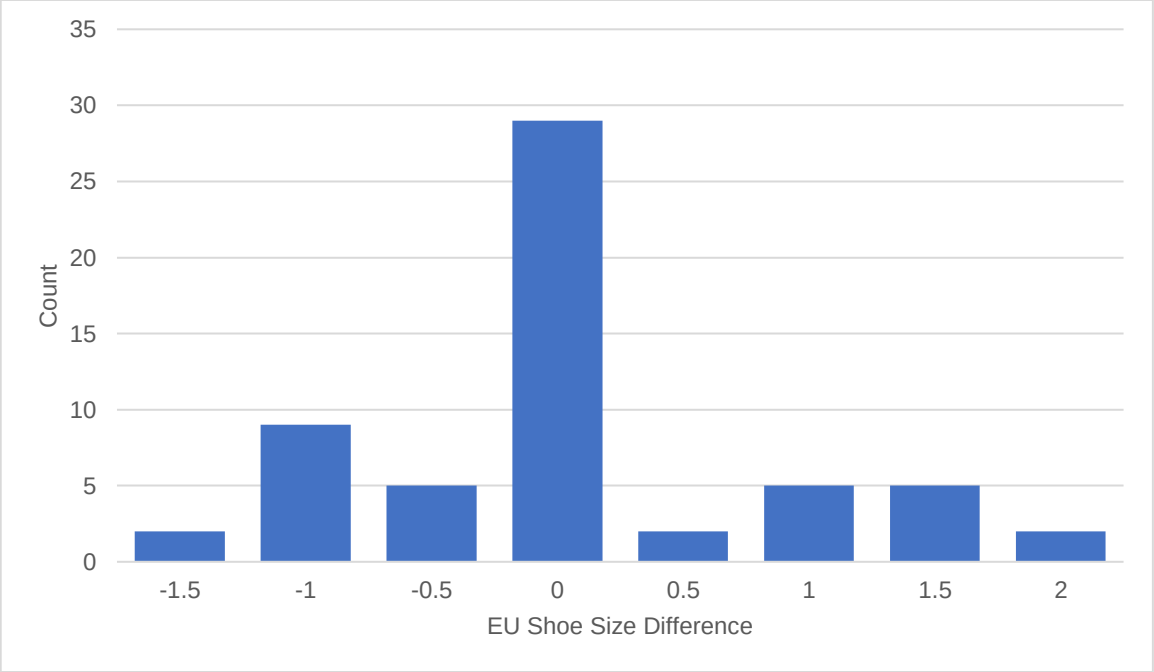


Figure 18 most dancers in this study wore the same size dance shoes as their street shoe.

5.3.2. Rehearsal Shoes

On average, each dancer owns 1.7 pairs of shoes. Some only one pair and the maximum pairs of shoes owned by a dancer was 5 (Table 23).

Table 23 shows how many pairs of shoes each dancer owns for rehearsal/practice.

	Count	Minimum	Maximum	Mean	Std Dev
Number of Rehearsal Shoes	59	1	5	1.7	0.68

For dancers that only own a single pair of shoes, the average age of those shoes is just over 5 years old. Some of them were 9 years old, shoe age such as this may contribute to dancer injury.

For dancers that owned more than one pair of shoes, their shoes ages ranged from 1-8 years old (Table 24).

Table 24 show the age (years) of the pairs of dance shoes used for rehearsal/practice purposes.

	Count	Minimum	Maximum	Mean	Std Dev
Age of current shoes (1 pair)	22	2	9	5.32	2.08
Age of newest pair (>1 pair)	37	1	7	2.68	1.86
Age of oldest pair (>1 pair)	36	2	8	5.5	1.76

5.3.3. Competition shoes

Just over half (57.63%) of dancers have different and specific shoes for their competitions and they range from a single pair to three with an average of 1.68 (SD 0.59). Competition shoes seem to have a lower average age (4.23 years) compared to rehearsal shoes but a similar age range (1-8 years) (Table 25).

Table 25 Shows the age (years) of the pairs of dance shoes used for competition purposes.

	Count	Minimum	Maximum	Mean	Std Dev
Age of current shoes (1 pair)	13	1	8	4.23	2.61
Age of newest pair (>1 pair)	21	1	7	2.7	2.11
Age of oldest pair (>1 pair)	19	2	8	5	1.82

While only having a single pair of shoes may be due to cost and affordability, the reasons for having more than one pair of shoes are listed in Table 26.

Table 26 Reasons dancers have more than one pair of dance shoes.

	Percentage
Longevity (to make them last longer)	25.42
Different shoes for different STYLES	33.9
Specific shoes for SPECIFIC DANCES (within in one style)	5.08
Different heel heights for different STYLES	15.25
Specific heel height for SPECIFIC DANCES (within in one style)	6.78
Different heel heights for different PARTNERS	1.69
Other (Costume decoration, support, comfort)	11.86

5.3.4. Heel Height

Most dancers wear 2.5" (6.5cm) heels for rehearsal and competitions in both Ballroom and Latin American styles. There is a slight tendency for the heels to be higher in Latin American and lower in Ballroom (Table 27).

Table 27 shows the footwear habits of dancers, regarding heel height, in different situations. Blue: highest percentage in that row, Green: second, Orange: third.

Percentage	Bare foot	Socks	Flat - < ½" (1.5cm)	½" (1.5cm)	1" (3cm)	1.5" (4cm)	2" (5cm)	2.5" (6.5cm)	3" (8cm)	3.5" (9cm)	4" (10cm)
Ballroom &/ Smooth REHEARSAL	2	-	10	3	14	7	22	17	3	-	-
Ballroom &/ Smooth COMPETITIONS	-	-	5	3	14	8	17	22	7	-	-
Latin American &/ Rhythm REHEARSAL	3	-	5	2	12	12	14	24	17	3	-
Latin American &/ Rhythm COMPETITIONS	2	-	3	2	10	8	12	25	19	5	-
Other Styles of Dance	8	2	19	2	3	2	3	2	-	-	-
Work	7	-	39	3	2	2	5	5	3	-	2
A night out	2	-	32	2	3	5	7	7	3	7	5
Casual outing	2	-	44	5	5	2	5	2	3	-	3
At Home	24	14	27	2	5	-	2	-	-	-	-

5.3.5. Floors

A substantial percentage (19-32%) of dancers do not know what kinds of floors they were dancing on, particularly at the competitions. Most of the rehearsal dancing is taking place on un-sprung floors (Table 28).

Table 28 Dance floors.

	Sprung floor (wood)	Un-sprung (wood/vinyl)	Tiles / Concrete	I don't know	Other
REHEARSAL	34% (n=20)	42% (n=25)	17% (n=10)	14% (n=8)	2% (n=1)
COMPETITIONS	37% (n=22)	36% (n=21)	8% (n=5)	32% (n=19)	2% (n=1)
Other Dance Styles	8% (n=5)	12% (n=7)	7% (n=4)	19% (n=11)	2% (n=1)

5.3.6. Seeking Medical Attention

Of those dancers that had pain, most of them seek medical attention only sometimes (Figure 19), however a substantial number (over 30%) never seek medical attention.

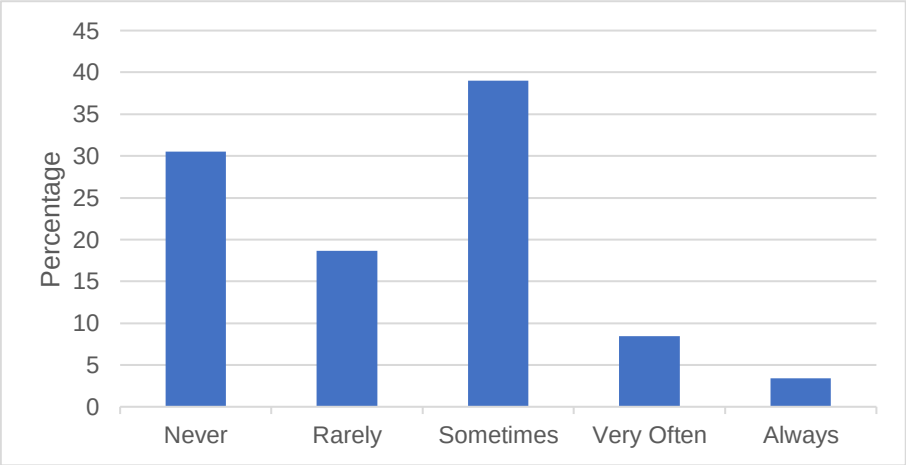


Figure 19 Percentage of dancers who seek medical attention when they have dance-related pain, problems, or injuries.

A physiotherapist is the most likely practitioner that dancers go to for their dance-related pain and problems, followed by a general practitioner (Figure 20).

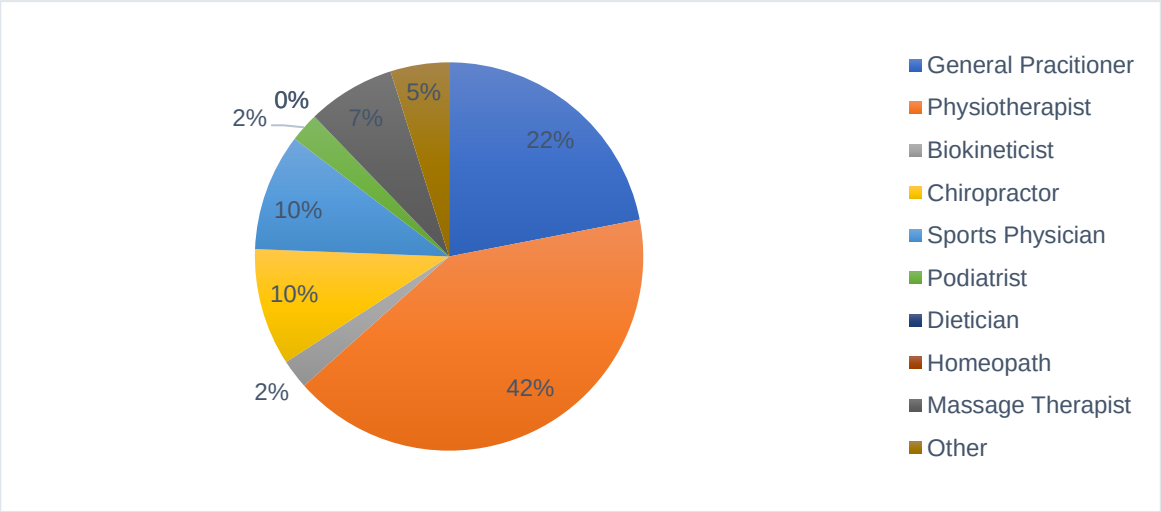


Figure 20 Medical professionals that dancers seek medical attention from.

Most dancers who sought medical attention felt that their medical professionals did understand their dance activities most of the time (Figure 21) with 51% of dancers saying they would go back to the same medical profession for future dance-related pain/problems/injuries.

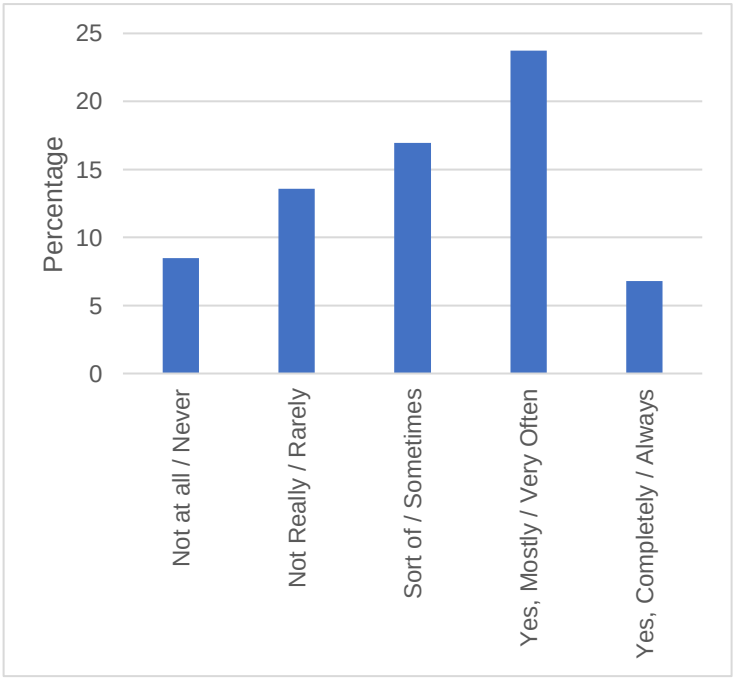


Figure 21 Dancers' opinions on how well the medical professional understood their dance activities and requirements.

The main reason for not seeking medical attention is that dancers feel that they can manage their pain and injury themselves (Figure 22).

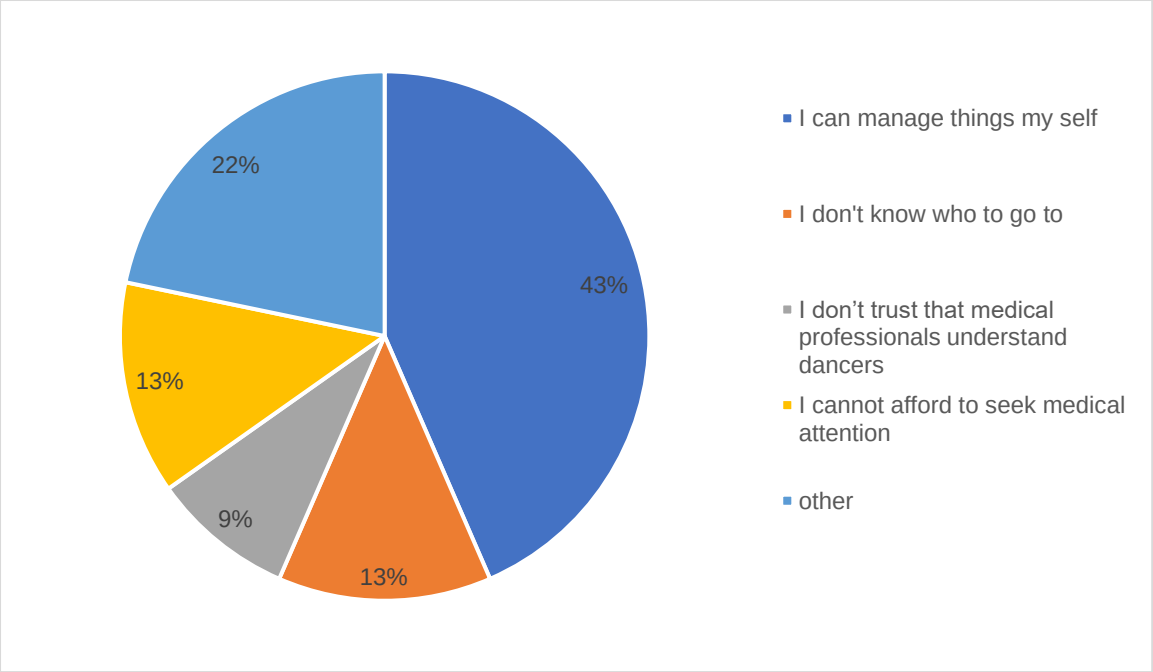


Figure 22 Reasons why dancers do not seek medical attention.

6. DISCUSSION

To date, this is one of only two studies on Ballroom and Latin American dancers in South Africa, and one of the largest in the world in this specific category of dance. This research captured data regarding pain and injuries from 97 Ballroom and Latin American dancers at two competitions in South Africa. The data capturing involved the use of the Musculoskeletal Pain Intensity and Interference Questionnaire for Musicians, which was adapted to be dancer-appropriate, and was supplemented with additional questions on activity load, footwear habits, floors, and habits regarding seeking medical attention. The resulting data set was analysed using various statistical tests and the results of this research are presented here. As the data set was extensive select key variables are discussed below.

6.1. Describing South African Ballroom and Latin American dancers

Below, the basic demographics of the dancers who participated in this research are outlined.

The age of Ballroom and Latin American dancers, in this sample, varied from 5 years old to 78, with an average age of 29. This indicates that these styles of dance may be enjoyed for many years. It was not within the scope of this research to look at the life span of professional dancers, but it is relatively well researched that Ballroom and Latin American dancing has benefits in old age and for chronic conditions such as Parkinson's[6,10].

Ballroom and Latin American dancing are unique in that they are performed by a couple, typically one male and one female. Riding McCabe *et al (*2014) noted that they had more male responses (43%) in their 2011 survey that included DanceSport participants, compared to 24% and 26% in their 1993 and 2002 surveys that did not include DanceSport participants. The current study had a disproportionate number of females to males (3:1). This, however, is not surprising as dancing seems to be more popular with females, particularly in the recreational dancers. It makes partnering a challenge, particularly at the top competitive levels. At competitions there are often solo sections to accommodate people who have not found suitable dance partners. More recently there has been a move to include same-sex-couples' sections, to be

inclusive of those who *choose* to dance with a partner of the same sex. Distinguishing male and female roles, or more inclusively: lead and follow roles, are important as they may indicate different injury patterns (discussed below).

BMI is often recorded in ballet literature because of the aesthetic requirements of the dance form[6]. In the Fit to Dance Survey (2014) they reported that in the previous data (2002), which did not include Ballroom and Latin American Dancers and only included ballet dancers, 2% of dancers were in the overweight BMI category. Their 2011 data, which included Ballroom and Latin American Dancers, indicated that 18% of dancers fell within the overweight BMI category. However, even though they reported 18% in the overweight category, most of the dancers fell into the normal weight category: 57% in 2002, and 69% in 2011. The current research shows similar results, with 41% in the normal weight category. Like other styles of dance, Ballroom and Latin American dancing is an aesthetic sport, however, they seem to be more accommodating of different body shapes and sizes.

The majority of those sampled (62%) participate in both Ballroom and Latin American styles. Most of them (84%) are recreational and only 16% dance professionally (as their job). Almost half of the respondents dance in the competitive category where they compete as a couple. The average time spent dancing per week is about 10 hours. On average, the dancers in the sample had been dancing for 7.5 years and competing for 5. The maximum years of dancing in this study was 32 years.

6.2. Describing Musculoskeletal Pain and Injuries in South African Ballroom and Latin American dancers

It is well known that dancers (of all styles) have a high incidence of injuries, with most of them occurring in the lower limb [2,3,11,23,29–31]. The author set out to describe the injury profile in South African Ballroom and Latin American dancers.

The current study confirms the high predisposition of dancers for pain, problems, and injuries with 77% of dancers reporting pain at some point in their careers. Fifty-four percent of dancers had pain in the previous month and 48% at the time of competition and data collection. The prevalence of injury may even be higher than this, as

respondents often under-report less significant injuries. It also confirms that the majority of those problems occurring on the lower limb, particularly the foot and ankle. This study shows that the highest prevalence for pain is in the foot and ankle: 26% had pain, problems and injuries, and 35% of dancers had pain (only) in the foot and ankle areas.

This research is unique in the detailed breakdown of anatomical site of the foot and ankle. Most other studies just use *foot* or *ankle* and most often those are combined into a single category (*foot and ankle*).

When asked about the single area that hurt the most, 35% of respondents indicated foot and ankle. Looking at the foot and ankle in more detail, the plantar aspect (37%) and forefoot section (29%) were the most-mentioned areas. This is important because the anatomy of the area has very specific structures that could be involved and the clinical implications thereof are significant. High heeled (dance) shoes shift the centre of mass forward, increasing pressure under the ball of the foot. The standard technique of these styles has the dancer mostly on the balls of their feet, this places high pressure under the medial side of the forefoot (first MTPJ). Improper technical, aesthetic habits, such as abducting the foot, emphasises this position and therefore the pressure on the medial forefoot. The first MTPJ is the most significant structure in the foot and forefoot for these dancers. The combination of reported forefoot and plantar foot points to the first MTPJ being the structure most affected by pain in these dancers. This is a valuable finding and is supported by unpublished data from Melchert (2013). Lack of intrinsic muscle preparation may also play a role in first MTPJ pain, as the toes are unable to create enough purchase to support the ball of the foot, and therefore all the pressure falls on the first MTPJ by default of the bony anatomy.

This study also asked about all the areas that experience pain, problems, or injury, which not only included the above single most painful area, but also included any transient aches and pains. Again, the foot and ankle ranked on top with 26%, followed closely with knee and shin, and back at 18% each. In more detail, the plantar and medial aspects of the foot were most affected, and from a different grouping the hindfoot. These findings are in line with those of others [4,8,11,24,32].

6.2.1. A note on self-medicating

Most dancers who indicated they had pain did not withdraw from dancing in the competitions, despite their pain with almost 40% having used medication for their pain. This is an important consideration with regards to doping, particularly as a sport that endeavours to be included in the Olympic Games. The use of medications to address pain has implications for athletes making use of performance enhancing drugs. The author was unaware of any testing at these competitions. It was beyond the scope of this study to explore this topic; however, it is worth studying further.

6.3. Relationships between variables

It was previously suggested that lead and follow roles have different patterns of injury, as a result of the different technical requirements of the roles. The author looked at prevalence of pain, problem, and injuries, comparing male (lead) and female (follow) roles. No differences in prevalence of injury between male (lead) and female (follow) roles were reported within the data.

It was expected that there would be a higher incidence of pain, problems, or injuries for increased years dancing and competing. This research did not show that. It is possible that as these athletes are amateurs and not dancing enough to have the cumulative effects which cause injury. It would be interesting to investigate in elite dancers in more detail; elite dancers being those who are dancing and/or competing professionally at an international level for monetary winnings.

There was a relationship between pain experienced in the 7 days prior to the competition dates and the plantar, dorsal, medial aspects of the foot as well as the toes and hindfoot. This indicates the high prevalence of foot and ankle injuries leading up to competitions. As a cross-sectional study, which looks at a single moment in time, it is unknown if this is due to increased training load prior to competition or if this is the norm always. Regardless, most of these dancers continued to dance with their injuries. This indicates a lack of education around load management, competition preparation and managing injuries. This is an important consideration for chronic pain and injuries which may affect and shorten the longevity of their dance careers. A long-term,

prospective study, using a regular monitoring tool would be ideal to further research this issue.

6.4. Footwear Habits

There is little research on dance shoes and footwear habits for dancers in general, and none focused on Ballroom & Latin American dance. Shoes are the most important piece of equipment for dancers, so it is surprising that there is so little research on dance shoes in general, and therefore no recommendations regarding lifespan, foot strengthening and heel height progression for these styles of dance.

6.4.1. Footwear Size and Age of Footwear

It is typical of competitive dancers to wear smaller dancer shoes than what they would for their street shoes. While it was expected, this was not the case with this sample population. It is not clear why this is so and may be because most of the dancers who participated in this study dance recreationally rather than professionally. It was surprising to note the average age of dance shoes was around 5 years. It is well known that old and damaged footwear/equipment is a risk factor for injury, but it is unknown if dancers are aware of that. Running shoes have a ‘rule-of-thumb’ life span of about 800kms yet dance shoes do not have any recommendations. Socioeconomic factors may also play a role in shoe age, with some people only being able to afford one pair of shoes and even some who rely on donated footwear.

6.4.2. Heel Height

A dancer’s height is important in Ballroom and Latin American dancing because of the unique nature of partnering. Footwear and the height of the heel plays a role and generally dancers are required to be similar height when in their specific footwear.

Most Ballroom dancers wear a slightly lower heel for rehearsal (2"/5cm) than for competitions (2.5"/6.5cm). For Latin American most dancers wear the same heel height for both rehearsal and competitions at (2.5"/6.5cm). The tendency is for heels to be higher for Latin American.

Men wear lower heels than women with the max being (1.5"/45cm). This is still considered high.

Wearing high heels puts the foot in a vulnerable position, and it is exactly this position in which these styles of dance are performed. The ballet technique in the formative years, is based on preparing the feet to go en pointe. Exams and technique preparation involve specific and isolated foot movements to strengthen intrinsic and extrinsic foot muscles, along with balance and proprioception. For Ballroom and Latin American dancing, although there is a progression in steps and combination difficulty, they lack the specific foot preparation leading up to wearing increasingly high heels. This is an important point to consider when developing injury prevention strategies through training and conditioning going forward.

Unfortunately, due to time constraints, detailed analysis of the correlation between heel height and the presence of pain was not done for this set of data.

6.5. Flooring

Flooring plays an important role when considering forces acting on the body[35,40,41]. Also, it can be used to enhance performance and reduce the risk of injury. Sprung flooring has been developed to enhance the activity that is performed on them. Basketball, for example, makes use of sprung flooring to assist with shock absorption, performance enhancement and injury prevention[35,40,41]. According to the dancers' knowledge, it seems that most competitions are danced on sprung floors (37%). It is worth noting that they reported 36% of competitions are danced on unsprung floors, 8% on tiles/concrete, and 32 % of dancers do not know what floor they are competing on. The most important thing to note is that 42% of dancers rehearse on unsprung floors and 17% on tiles/concrete, making that 59% of dancers who rehearse on inadequate floors. Rehearsal makes up for the majority of their dancing and inadequate flooring increases their risk for injury. There are many logistical problems in the Ballroom and Latin American dance world, particularly in South Africa that prohibits dance studios from installing superior floors, the first being finance. Sprung floors are expensive and not within the budget of most dance studios. Studios often hire facilities

such as school and church halls where they have no choice in the floor that is available to them. Most often it is a lino covered concrete floor, and perhaps a parquet floor.

6.6. Habits With Regard to Seeking Medical Attention When Injured

Most dancers in this study (39%) sought medical attention (only sometimes) – this is in line with other research that found that less than half of injured dancers seek medical help [29]. A third of injured dancers stated that they never seek medical care when injured [29]. 43% of the dancers in the sample felt that they could manage their pain and injury themselves and physiotherapy is the most chosen profession (39%) to seek help, which is similar to that of Bowling (1989). Not seeking medical attention is due to a number of factors including cost of seeking medical attention, lack of knowledge of who to seek help from, and lack of trust that the practitioner will understand their dance-specific needs.

Of those that did seek medical attention, most (51%) were satisfied with the care they received and would return to that professional. Although, 95% percent of the respondents experiencing pain in the week prior to competition believe that there is a lack of “Dance Specialists” in healthcare and 97% of them believe that injury prevention strategies/workshops/classes would be valuable in preventing dance related injuries. Responses to an open-ended question revealed a few important themes regarding dance specific medical needs:

6.6.1. Education and injury prevention.

Several respondents noted that they would be interested in and benefit from education about injury prevention. They feel this will be more valuable than symptomatic relief which leaves them frustrated and with recurring problems.

Technical education for safe dancing to prevent injury.

Incorrect technique is well known for being a risk factor of injury and a few dancers mention issues with poor technical knowledge. Perhaps

this may be due to uneducated coaches and dancers or performing technical movement beyond the dancer's capability and training.

Fitness and conditioning.

Fatigue is a major contributor to overuse injuries. Prior to injury prevention education, focus needs to be directed to safe dance practices which includes education on the required flexibility, strength, stamina, and training load, etc. Perhaps this needs to be focused on by coaches, but also by dancers themselves.

Self-Care of injuries.

Respondents also mentioned a desire to have information on how to take care of their injuries themselves. Perhaps this desire for information on selfcare for injury stems from the lack of medical professionals who understand dance specific needs.

6.6.2. Dance Specific Medical Professionals

Even though most of the respondents who sought treatment were satisfied with the treatment from their medical personnel, many believe medical Professionals lack understanding of dancer's injuries and needs. Dancers are often told to stop dancing if they experience pain or injuries, which results in dancers delaying or avoiding seeking medical attention. This in turn results in injuries becoming chronic, and perhaps even shortening a dancer's career. A better understanding of dance-related injuries may improve the time needed to make an accurate diagnosis and provide appropriate treatment to address the cause, rather than focusing on symptomatic relief. Not all medical professionals will expand their knowledge on treating dancers, so there is a definite need for a list or network of dance specific medical professionals to be made available for dancers.

At competition events, there is always and emergency medic present. They are poorly equipped to deal with very specific dance injury needs. If this is the only interaction that some dancers have with a medical professional related to their dancing, it may put them off seeking other professional services. Perhaps it would be more appropriate to have a healthcare professional, such as a physiotherapist, who has an interest in dancers to attend these events

7. CONCLUSION

Although Dance Medicine, Science and research is growing, DanceSport-specific research is lacking. This study set out to investigate and describe pain and injury in competitive South African Ballroom and Latin American dancers. This survey captured detailed information on pain and injury in the foot and ankle. It also gained information on footwear habits, flooring, and habits regarding seeking medical attention.

Almost half (48%) the respondents reported pain at the time of competition, with the highest prevalence being the foot and ankle, specifically the plantar forefoot and hindfoot – with notable structures of clinical importance being the first MTPJ, plantar fascia and Achilles tendon. This study did not find many relationships between many of the numerous variables collected, but that does not rule them out as risk factors for pain and injury.

Respondents' dance shoes were older than anticipated, it is notable that there is no guidance within the dance community as to how long a pair of shoes should last. This may be an important factor to consider when looking at injury risk. Respondents wear different heels for different situations: lower heels for rehearsal, higher heels for competitions, lower heels for Ballroom dancing, higher heels for Latin American.

Most rehearsal (and therefore dance) time is spent on inadequate floors. Competitions, however, are mostly done on adequate floors. A substantial percentage of dancers are ignorant of the floor they dance on, particularly at competitions.

Although the respondents seemed to have good experiences with the medical professionals they sought help from, there seems to be a general lack of confidence in medical professionals' understanding dance-specific needs.

The results of this study are valuable as there is so little information about the prevalence or type of injuries in Ballroom and Latin American dancers in South Africa. The author hopes that this research and data collection tool will be valuable in expanding the knowledge on DanceSport specific research and that it will enable

others to continue to add to the literature on Ballroom and Latin American dancers, and to encourage researchers to investigate the foot and ankle in more detail.

8. LIMITATIONS

Although this research adds to the body of knowledge on Ballroom and Latin American dancers, which is valuable, the methodology was not perfect. Firstly, this study collected too much data. It included more variables than time and space allow for at Master's level, which means that some relationships were not able to be explored.

A potential weakness with the chosen sampling methodology is that dancers who did not compete due to pain were less likely to attend competition at which data collection occurred, which may mean that those with more serious injuries or injury patterns are underrepresented in this study.

There is a weakness in the design of the questionnaire in that only the participants that selected that they had pain *currently* answered questions on seeking medical attention and footwear. Both of these sections should have been completed by all respondents, injured or not, for a better understanding of their footwear habits and their thoughts of medical professionals in the dance world and seeking their help when or if injured.

Some participants did not follow instructions on some of the questions, particularly on the question "*On the body chart, select ONE area that HURTS the most*", where a number selected more than one answer. One participant selected 22 (out of 38) body parts. Even when the areas of the body map were grouped into larger sections, some respondents' answers still overlapped into multiple groups. This may have skewed some of the data. This could have been avoided by limiting the responses to only one selection in RedCap. The author chose not to do this because lower back or neck pain may have been central, rather than unilateral, so left and right sections of the body map would need to be selected to show that. The instructions stated as much: "*If your pain is central neck or back, please select both sides*". However, both sentences were ignored by the respondents for the most part.

As a retrospective survey, recall bias (underreporting due to flaws in memory of the participants) is always a limitation in acquiring accurate data [1,3,29]. Even though most of the data is presented on pain, problems, and injuries "*currently / in the last 7 days*",

it is likely that the prevalence of injury in the year preceding the competitions is higher than remembered and reported.

The research plan was to gather data from dancers at these two competitions and then compare this information with information held by two national dance organisations, DanceSport South Africa and South African Dance Foundation. The information required from the national organisations was their membership numbers, in total and per style of dance and competitive level, with a view to get a better understanding of the number of Ballroom and Latin American dancers in South Africa. Unfortunately, the researcher was unable to obtain this information from the two National organisations. This results in a limitation to the generalisability of this research data, as it is unknown how much of the total dance population was represented at the two competitions. The data from the two national organisations would have been useful in providing contextual and comparative information for the data collected in this survey.

Another limitation of this study is its small sample size, with limited generalizability to the population (dancers at the competitions) let alone the national population of dancers. The small sample size may additionally limit the ability of the study to find significant existing differences between variables.

9. RECOMMENDATIONS

Future research needs to done to add to the information on dancer injury in Latin American and Ballroom. Using prospective, longitudinal study designs can be done to prevent recall bias in future studies [1,3,29].

Nomenclature going forward may have to change due to the inclusion of same-sex categories. Instead of it being gender based, perhaps it would be more appropriate to have it roles based, referring to lead and follow roles rather than male as lead and female as follow. It is important to keep footwear in mind regarding this topic as the trends or standards are unknown. For example, a female-female partnership may both wear high heels or one or both may choose to wear lower heels. It will be of interest to see how this influences injury prevalence going forward.

Foot and ankle injuries need to be research in more anatomical detail to be more clinically applicable. The authors hopes that future research will make use of the detailed foot and ankle data capturing tool in RedCap. This could be applied to dance specific research as well as Podiatric research, or any research that involves a selection of the foot and ankle.

As this was a retrospective study without any physical or assessment component, there was no discussion or inclusion of foot morphology and function. This would be very interesting to include in future studies to identify any potential intrinsic risk factors for injury in these styles of dance, particularly because of the specific footwear.

This data may be of use to the Ballroom and Latin American dance community to guide future research. It is also good for the dance research community in general to take note of other areas to explore such as footwear (age, heel height, replacement habits), flooring, psychosomatic effects of pain and injury, and the relationship between dancers and medical professionals, particularly in countries where dance medicine is in its infancy. The author hopes this research will be useful in starting to understand the pain, problems and injuries that Ballroom and Latin American dancers face in the hopes of improving training and performance and to assist in the push to be included in the Olympic Games in the near future.

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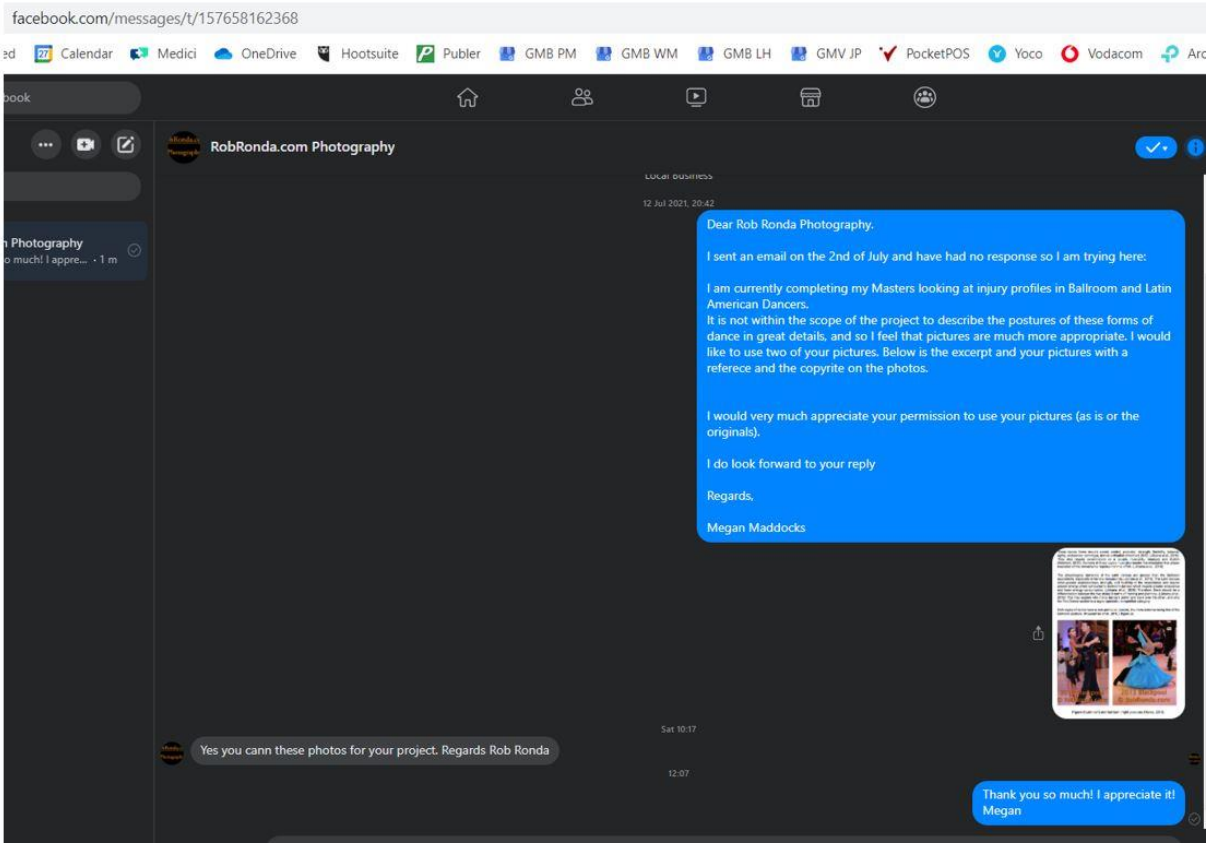
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APPENDICES

10.1. Permission from Rob Ronda to use dance pictures in the explanation of postures.



10.2. Permission from competition organisers to collect data.

Subject: RE: Research at RITJ
Date: Sunday, 30 June 2019 at 17:25:10 South Africa Standard Time
From: Mark Engelbrecht
To: megmaddocks@gmail.com

HI Megan
All sorted, we will provide you with a booth in the practise hall.

Regards
Mark

From: megmaddocks@gmail.com [mailto:megmaddocks@gmail.com]
Sent: 27 June 2019 07:16 AM
To: 'Mark Engelbrecht'
Subject: RE: Research at RITJ

Dear Mark,

I hope you are well and keeping warm.

How was the RITJ meeting?
I would just like to follow up on our collaboration and permission to conduct my research at RITJ.

I have attached the formal permission form.

I look forward to hearing from you and for the next few steps.

Warm regards,
Megan

From: Mark Engelbrecht <info@dancedomain.co.za>
Sent: Wednesday, 29 May 2019 10:32
To: megmaddocks@gmail.com
Subject: RE: Research at RITJ

HI Megan
Just to let you know we will probably have our next Rumba meeting middle June, where I'll be sure to present your proposal, but I doubt very much anyone will be opposed. I can only sign it once I have received confirmation however.

Regards
Mark

From: megmaddocks@gmail.com [mailto:megmaddocks@gmail.com]
Sent: 27 May 2019 07:04 PM
To: info@dancedomain.co.za
Subject: Research at RITJ

Dear Mark,

It was my pleasure chatting to you earlier this evening.

Just a little more about me: I have a long history of dance. My dad was a Latin champ and I grew up watching my parents dance so beautiful at special events. I however, was into tap and modern. I actually studies Musical Theatre when I left school but spending a year unemployed was a game changer. I then went on to study Podiatry where my many years of dancing turned into a special interest.

Just a little more about me: I have a long history of dance. My dad was a Latin champ and I grew up watching my parents dance so beautiful at special events. I however, was into tap and modern. I actually studies Musical Theatre when I left school but spending a year unemployed was a game changer. I then went on to study Podiatry where my many years of dancing turned into a special interest.

I am a member of the International Association of Dance Medicine and Science (promotions committee) and I endeavour to raise aware about the special requirements of dancers, also, to build a network of medical practitioners who have an interest in dancers, and of course, to look after dancers. However, my journey has led me down a rather bare path of information regarding dance forms other than ballet. I have a very particular interest in dance forms done in heels, and so Ballroom and Latin is at the top of the list, and waiting to be studied!

I am pleased to hear that you are interested in my academic endeavour, and I hope it will evolve into more.

Attached is the formal information sheet, but please feel free to give me a call to chat about anything that you may have questions about.
Once you are happy, then I would like to ask you to sign the consent/permission sheet for me to conduct my study at your competition.

Ideally, I would love EVERY (South African) competitive to be involved, and an online platform makes it possible, however, being present at the two biggest competitions will really encourage those who are there, to participate.

I look forward to this collaboration and the journey beyond it.

Yours in Dance,
Megan Maddocks
072 046 5001

Informed Consent

The prevalence of musculoskeletal pain and injuries in South African, competitive, Ballroom and Latin American dancers

I **Veronica Luksich** competition organiser of *Dancing Under African Skies*,

- Have read and understand the information regarding this research,
- Understand that competitors' participation is purely voluntary,
- Understand that they will not be paid for their involvement,
- Will provide space for a stand to be set up, where competitors can access information about this study,
- Understand that *Dancing Under African Skies*, and any affiliated organisational bodies, will not be compensated for this collaboration.

Conditions and Requests:

Veronica Luksich

The questionnaire will be made available to the organising body (excluding those eligible to participate in the study) for their scrutiny and approval prior to the competition weekend.

Apart from the exhibition stand and access to competitors, there will be no additional expectations or payment for services by or to Megan Maddocks or anyone else involved in this study.

I hereby, grant permission for this study to take place at *Dancing Under African Skies* (11-13 October 2019).

22 July 2019

Veronica Luksich — **Date**

Organising Committee Chairperson

Dancing Under African Skies

10.3. Original MPIIQ Questionnaire

Musculoskeletal Pain Intensity and Interference Questionnaire for Musicians

1. What is your age? _____ years
2. Gender: ☐ Male ☐ Female
3. What instrument do you play in the orchestra? _____
4. With respect to your position in the orchestra, do you work: ☐ Full time ☐ Part time
5. For how many years have you played your instrument? _____ years
6. For how many years have you played professionally in an orchestra? _____ years

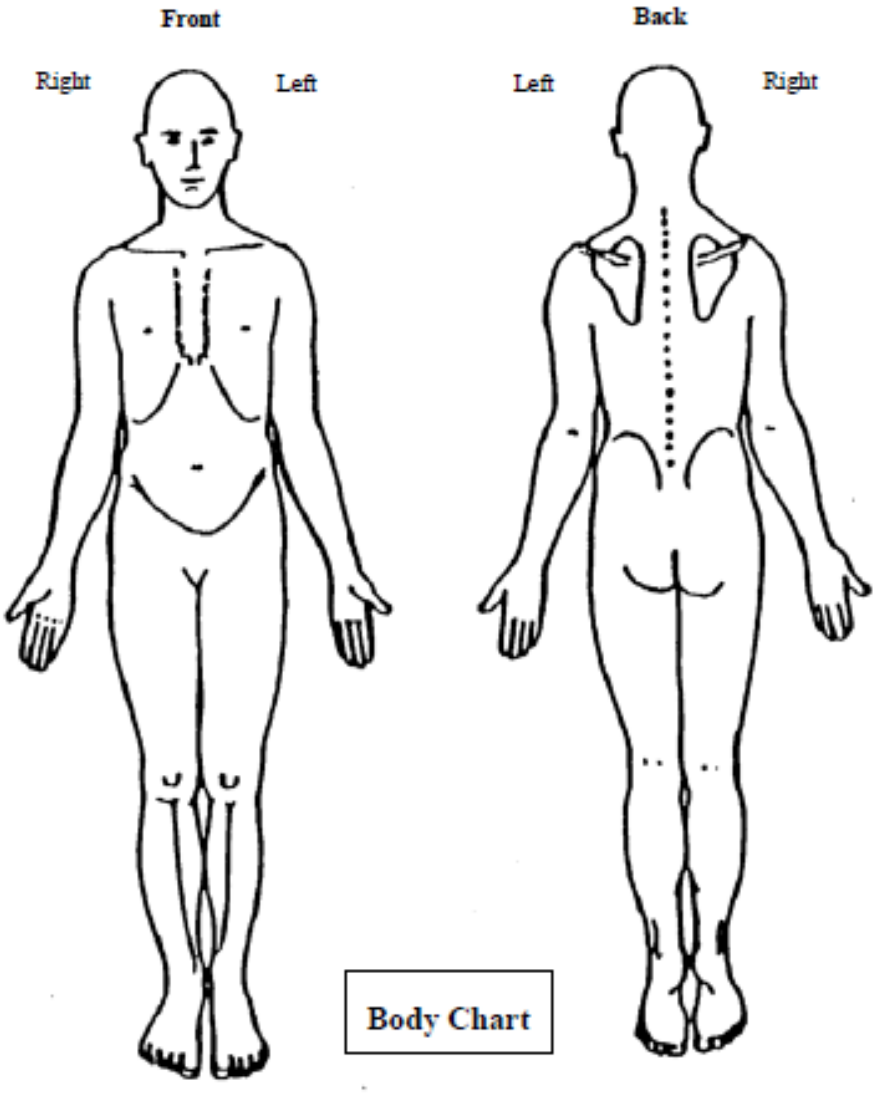
7. On average, how many hours per week do you spend playing your instrument **in the orchestra** (this includes rehearsals, performances, recordings)? _____ **hours per week**
8. On average, how many hours per week do you spend playing your instrument **outside** orchestra duties (this includes individual practice, chamber music, solo performances, demonstration when teaching, gigs, other)? _____ **hours per week**

Playing-related musculoskeletal problems are defined as "pain, weakness, numbness, tingling, or other symptoms that interfere with your ability to play your instrument at the level to which you are accustomed". This definition does not include mild transient aches and pains.

9. Have you **ever** had pain/problems that have interfered with your ability to play your instrument at the level to which you are accustomed? ☐ Yes ☐ No
10. Have you had pain/problems that have interfered with your ability to play your instrument at the level to which you are accustomed **during the last 12 months**? ☐ Yes ☐ No
11. Have you had pain/problems that have interfered with your ability to play your instrument at the level to which you are accustomed **during the last month (4 weeks)**? ☐ Yes ☐ No
12. **Currently (in the past 7 days)**, do you have pain/problems that interfere with your ability to play your instrument at the level to which you are accustomed? ☐ Yes ☐ No

If your answer to questions 11 and/or 12 is YES, please continue. Otherwise stop here, and hand your survey back or post it back using the stamped addressed envelope provided.

13. On the body chart, SHADE IN each of the areas where you experience pain/problems. Put an X on the ONE area that HURTS the most.



Body Chart

Musculoskeletal Pain Intensity and Interference Questionnaire for Musicians

The next four questions relate ONLY to PAIN. Please answer with reference to the ONE area that you **marked with an X** on the body chart. Otherwise go to Question 18.

14. Please rate your pain by circling the one number that best describes your pain at its **worst** in the last week.

0	1	2	3	4	5	6	7	8	9	10
No pain										Pain as bad as you can imagine

15. Please rate your pain by circling the one number that best describes your pain at its **least** in the last week.

0	1	2	3	4	5	6	7	8	9	10
No pain										Pain as bad as you can imagine

16. Please rate your pain by circling the one number that best describes your pain on **average** in the last week.

0	1	2	3	4	5	6	7	8	9	10
No pain										Pain as bad as you can imagine

17. Please rate your pain by circling the one number that tells how much pain you have **right now**.

0	1	2	3	4	5	6	7	8	9	10
No pain										Pain as bad as you can imagine

The remainder of the survey relates to both PAIN and/or PROBLEMS.

For each of the following, circle the one number that describes how, during the past week, **pain/problems have interfered** with your:

18. Mood

0 1 2 3 4 5 6 7 8 9 10

Does not interfere — Completely interferes

19. Enjoyment of life

0 1 2 3 4 5 6 7 8 9 10

Does not interfere — Completely interferes

For each of the following, during the past week, as a result of your **pain/problems**, did you have any **difficulty** (please circle ONE number):

20. Using your usual technique for playing your instrument?

0 1 2 3 4 5 6 7 8 9 10

No difficulty — Unable

21. Playing your musical instrument because of your symptoms?

0 1 2 3 4 5 6 7 8 9 10

No difficulty — Unable

22. Playing your musical instrument as well as you would like?

0 1 2 3 4 5 6 7 8 9 10

No difficulty — Unable

Thank you for your participation.
Please hand your survey back or post it back using the stamped addressed envelope provided.

10.4. Questionnaire

Musculoskeletal pain & injuries in South African, competitive, Ballroom and Latin American dancers

Dear Dancer,

My name is Megan Maddocks and I am a Masters' student in the Department of Exercise Science and Sports Medicine at Wits University.

There is very little research on Ballroom and/or Latin American dancers. With its increasing popularity as well as the move towards the Olympics, it is becoming more and more important to find out more about this group of sports men & women. This is the first research project of South African Ballroom and Latin American dancers and it will add to global knowledge on pain and problems that Ballroom and Latin American dancers experience so that

We understand the potential risks of Ballroom and/or Latin American dancing

We can start figuring out WHY dancers suffer these problems

Medical professionals can better understand and treat Ballroom and Latin American dancers.

I would like to invite you to participate in this study by completing a questionnaire which will ask you about any physical pain and/or injuries you may or may not be experiencing, as well as other dance related things like your shoes, the floors you dance on as well as what you do when you are in pain or experiencing problems.

What is involved

It will only take 15 minutes.

It can be done on your cell phone or on a laptop provided at the competition.

You only need to fill it in once.

You can withdraw (not complete the survey) at any time, without reason.

You will not be reimbursed or paid for your participation in this study.

This survey will be done on a voluntary basis.

There is no consent form required as consent is implied because this is a self-administered questionnaire. Children (under 18 years old), however, are required to have their parents/guardian's sign consent.

Risks – None.

Benefits – There is no direct benefit to you.

Anonymity:
No identifiable information (Name, Surname, ID number, date of birth, competition number, contacts details) will be asked for; therefore, your identity will remain unknown.

The information you provide in this survey will not affect your participation in this competition. Nor will it affect any employment opportunities. Only the main researcher and supervisor will have access to the raw data (completed surveys).

Only the combined final results of this project will be made public and available to the competition organisers, national bodies and scientific community.

The results will be reported as numbers, frequencies, percentages etc – with no mention to any particular individual.

Contact Details
Researcher: Megan Maddocks – 072 046 5001 - megmaddocks@gmail.com
Supervisor: Adjunct Professor D Constantinou - Demitri.Constantinou@wits.ac.za

You are welcome to contact either of us with queries relating to this study.

Alternately, for complaints regarding ethical activities, please contact: HREC (Medical) contact details: Prof Clement Penny, Tel 011 717 2301, email Clement.Penny@wits.ac.za.

Ms Z Ndlovu/ Mr Rhulani Mkansi Administrative Officers 011 717 2700 / 2656 / 1234 / 1252
zanele.ndlovu@wits.ac.za; Rhulani.mkansi@wits.ac.za.

Thank you for taking the time to read this information, and for being involved!

Yours in Dance,

Megan

I delcare that	◯ I have not completed this survey before (this is my first time doing this), and would like to continue ◯ I HAVE completed this survey before.
Current age (at competition)	_____

Consent	◯ I AGREE to participate ◯ I do not wish to participate
Parental Consent: My parent or guardian helped me with this and	◯ GRANTS THEIR PERMISSION for me to participate ◯ does not wish for me to participate

BASIC INFORMATION	
Gender	◯ Male ◯ Female
Height (cm)	_____
Weight (kg)	_____
BMI	_____
Nationality	◯ South African ◯ Not South African
Home province	◯ Eastern Cape ◯ Free State ◯ Gauteng ◯ KwaZulu-Natal ◯ Limpopo ◯ Mpumalanga ◯ North West ◯ Northern Cape ◯ Western Cape

GENERAL DANCE INFORMATION

What is your main style of dance?

- ◯ Ballroom / Standard
- ◯ Latin American
- ◯ Both Ballroom & Latin
- ◯ Smooth
- ◯ Rhythm
- ◯ Both Smooth & Rhythm
- ◯ All of them (B, LA, S, R)
- ◯ Other

How many years have you danced this/these style/s?

_____
(Years)

How many years have you competed in this/these style/s?

_____
(Years)

Do you dance....

◯ Full Time (professionally/as my job) ◯ Part Time (recreationally/as my sport)

Which competition category do you dance in?

- ◯ Competitive
- ◯ Pro-Am
- ◯ Both

Competitive Subdivision:

- ◯ Bronze
- ◯ Silver
- ◯ Gold
- ◯ Novice & Pre-Champ (Rising Star)
- ◯ Champs
- ◯ Professional
- ◯ Multiple Categories (Professionals/Teachers)

Which section do YOU compete in YOURSELF?

- ◯ Bronze
- ◯ Silver
- ◯ Gold
- ◯ Novice & Pre-Champ (Rising Star)
- ◯ Champs
- ◯ Professional
- ◯ None - I just partner

Pro-Am Subdivision:

- ◯ Bronze 1
- ◯ Bronze 2
- ◯ Bronze 3
- ◯ Silver 1
- ◯ Silver 2
- ◯ Silver 3
- ◯ Gold 1
- ◯ Gold 2
- ◯ Gold 3 (Gold Final)
- ◯ Open Gold / Novice / Pre-Champ / Champ
- ◯ Multiple Categories (Professionals/Teachers)

Which section do YOU compete in YOURSELF?	◯ Bronze 1 ◯ Bronze 2 ◯ Bronze 3 ◯ Silver 1 ◯ Silver 2 ◯ Silver 3 ◯ Gold 1 ◯ Gold 2 ◯ Gold 3 (Gold Final) ◯ Open Gold / Novice / Pre-Champ / Champ ◯ None - I just partner
On average, how many hours per week do you spend dancing this style for rehearsals and preparing for competitions? (including solo-practice, high-level teaching, technique classes, etc)	_____ (Hours per week)
On average, how many hours per week do you spend dancing this style outside of competition preparation? (Jobs, shows, social dancing, low-level teaching, other).	_____ (Hours per week)

DANCE-RELATED PAIN, PROBLEMS & INJURIES

Dance-related musculoskeletal problems are defined as "pain, weakness, numbness, tingling, or other symptoms that interfere with your ability to dance your style at the level to which you are accustomed".
This definition does not include mild transient aches and pains.

Have you ever had pain/problems/injuries that have interfered with your ability to dance at the level to which you are accustomed? (EVER)	◯ Yes ◯ No
Have you had pain/problems/injuries that have interfered with your ability to dance at the level to which you are accustomed during the LAST 12 MONTHS?	◯ Yes ◯ No
Have you had pain/problems/injuries that have interfered with your ability to dance at the level to which you are accustomed during the LAST MONTH (4 WEEKS)?	◯ Yes ◯ No
CURRENTLY (IN THE PAST 7 DAYS), do you have pain/problems/injuries that interfere with your ability to dance at the level to which you are accustomed?	◯ Yes ◯ No
If your answer to the last 2 questions is YES, please continue. Otherwise stop here,	◯ Continue ◯ End Survey

PAIN ONLY

On the body chart, select ONE area that HURTS the most. (Pain only)

If your pain is central neck or back, please select both sides.

On the body chart, select ONE area that HURTS the most. (Pain only)

If your pain is central neck or back, please select both sides.

---

pain_checkboxez_1

- ☐ Toes (R_plant)
- ☐ Toes (L_plant)
- ☐ LessMTPJs_Plant (Right)
- ☐ LessMTPJs_Plant (Left)
- ☐ 1MTPJ_Plantar (Right)
- ☐ 1MTPJ_Plantar (Left)
- ☐ LatMF_Plant (Right)
- ☐ LatMF_Plant (Left)
- ☐ MLA_Plant (Right)
- ☐ MLA_Plant (Left)
- ☐ Heel_Plant (Right)
- ☐ Heel_Plant (Left)
- ☐ AJ_Top (Right)
- ☐ AJ_Top (Left)
- ☐ LatMal (Right)
- ☐ LatMal (Left)
- ☐ LatMF_Lat (Right)
- ☐ LatMF_Lat (Left)
- ☐ DorsMF_Top (Right)
- ☐ DorsMF_Top (Left)
- ☐ 1MTPJ_Dors (Right)
- ☐ 1MTPJ_Dors (Left)
- ☐ Toenails (Right)
- ☐ Toenails (Left)
- ☐ Toes (R_dors)
- ☐ Toes (L_dors)
- ☐ Heel_Post (Right)
- ☐ Heel_Post (Left)
- ☐ AJ_Inside (Right)
- ☐ AJ_Inside (Left)
- ☐ MedMal (Right)
- ☐ MedMal (Left)
- ☐ DorsMF_Inside (Right)
- ☐ DorsMF_Inside (Left)
- ☐ MLA_Med (Right)
- ☐ MLA_Med (Left)
- ☐ 1MTPJ_Med (Right)
- ☐ 1MTPJ_Med (Left)
- ☐ Toes (R_med)
- ☐ Toes (L_med)
- ☐ Toenails_IOF (Left)
- ☐ Toenails_IOF (Right)

You have selected foot or ankle. Please specify where on the foot or ankle it hurts the most.

Be as accurate as possible. For example - if your big toe joint hurts all over then please selected it on every view. If it only hurts underneath, then only select it on the bottom view.

The next four questions relate ONLY to PAIN.
Please answer with reference to the ONE area selected above.
Otherwise go to the next section.
(Click on the scale or slide the block)

Please rate your pain AT ITS WORST in the last week.

No Pain — Pain as bad as you an imagine

(Place a mark on the scale above)

Please rate your pain AT ITS LEAST in the last week.

No Pain — Pain as bad as you an imagine

(Place a mark on the scale above)

Please rate your pain ON AVEREAGE in the last week.

No Pain — Pain as bad as you an imagine

(Place a mark on the scale above)

Please rate how much pain you have RIGHT NOW.

No Pain — Pain as bad as you an imagine

(Place a mark on the scale above)

Are you able to dance in this weekend's competition?

- ◯ Yes - no problems
- ◯ Yes - with difficulty
- ◯ No - and I had already registered
- ◯ No - but I hadn't registered yet

Have you / Will you take pain killers / medication to help you get through the competition?

- ◯ Yes
- ◯ No

For how long have you been unable to dance / out of action?

- ◯ < 2 days
- ◯ 2-7 days
- ◯ 1-2 weeks
- ◯ 2-4 weeks
- ◯ > 4 weeks

PAIN / PROBLEMS / INJURIES

The remainder of the survey relates to all PAIN and/or PROBLEMS and/or INJURIES.

On the body chart, select ALL of the areas where you have experienced PAIN and/or PROBLEMS and/or INJURIES in the last week.

On the body chart, select ALL of the areas where you have experienced PAIN and/or PROBLEMS and/or INJURIES in the last week.

---

checkboxez

- ☐ Toes (R_plant)
- ☐ Toes (L_plant)
- ☐ LessMTPJs_Plant (Right)
- ☐ LessMTPJs_Plant (Left)
- ☐ 1MTPJ_Plantar (Right)
- ☐ 1MTPJ_Plantar (Left)
- ☐ LatMF_Plant (Right)
- ☐ LatMF_Plant (Left)
- ☐ MLA_Plant (Right)
- ☐ MLA_Plant (Left)
- ☐ Heel_Plant (Right)
- ☐ Heel_Plant (Left)
- ☐ AJ_Top (Right)
- ☐ AJ_Top (Left)
- ☐ LatMal (Right)
- ☐ LatMal (Left)
- ☐ LatMF_Lat (Right)
- ☐ LatMF_Lat (Left)
- ☐ DorsMF_Top (Right)
- ☐ DorsMF_Top (Left)
- ☐ 1MTPJ_Dors (Right)
- ☐ 1MTPJ_Dors (Left)
- ☐ Toenails (Right)
- ☐ Toenails (Left)
- ☐ Toes (R_dors)
- ☐ Toes (L_dors)
- ☐ Heel_Post (Right)
- ☐ Heel_Post (Left)
- ☐ AJ_Inside (Right)
- ☐ AJ_Inside (Left)
- ☐ MedMal (Right)
- ☐ MedMal (Left)
- ☐ DorsMF_Inside (Right)
- ☐ DorsMF_Inside (Left)
- ☐ MLA_Med (Right)
- ☐ MLA_Med (Left)
- ☐ 1MTPJ_Med (Right)
- ☐ 1MTPJ_Med (Left)
- ☐ Toes (R_med)
- ☐ Toes (L_med)
- ☐ Toenails_IOF (Left)
- ☐ Toenails_IOF (Right)

You have selected foot or ankle.
Please select ALL of the areas where you have experienced PAIN and/or PROBLEMS and/or INJURIES, in your feet/ankles in the last week.

During the past week, how has pain/problems/injuries interfered with your MOOD?

Does not interfere — Completely interferes

(Place a mark on the scale above)

During the past week, how has pain/problems/injuries interfered with your ENJOYMENT OF LIFE?

Does not interfere — Completely interferes

(Place a mark on the scale above)

During the past week, as a result of your pain/problems/injuries, did you have any difficulty:

...Dancing your style of dance because of your symptoms?

No difficulty dancing — Unable to dance

(Place a mark on the scale above)

...Using your usual technique for your style of dance?

No difficulty dancing — Unable to dance

(Place a mark on the scale above)

...Dancing your style of dance as well as you would like?

No difficulty dancing — Unable to dance

(Place a mark on the scale above)

OTHER DANCING AND OTHER ACTIVITIES

Do you participate in any other styles of dance?

- ○ Yes
- ○ No

Which styles? (You can choose more than one)

☐ Acrobatics ☐ Ballet ☐ Freestyle ☐ Hip Hop ☐ Irish ☐ Jazz / Modern / Contemporary
☐ Salsa/Tango/Social dancing ☐ Spanish ☐ Tap ☐ Theatre Dance ☐ Other

Which other dance styles?

In an AVERAGE week, how much time do you spend doing the following?
(Turn your cell phone landscape)

	I don't do this	< 1 hr	1-2 hrs	3-4 hrs	5-6 hrs	7-8 hrs	9-10 hrs	>10 hrs
Ballroom and/or Smooth	○	○	○	○	○	○	○	○
Latin American and/or Rhythm	○	○	○	○	○	○	○	○
Other forms of dance (combined)	○	○	○	○	○	○	○	○
Strength/weight training	○	○	○	○	○	○	○	○
Pilates and/or Yoga	○	○	○	○	○	○	○	○
Running (road/trail/other)	○	○	○	○	○	○	○	○
Cycling (road/MTB/other)	○	○	○	○	○	○	○	○
Other	○	○	○	○	○	○	○	○

What other activities do you do?

FOOTWEAR & FLOORS

What is your street shoe size? (UK)

_____

What is your current dance shoe size? (UK)

_____

Currently, how many pairs of REHEARSAL / PRACTICE shoes do you use?

◯ 1 pair ◯ 2-3 pairs ◯ 4-5 pairs ◯ 6-8 pairs ◯ >8 pairs

How old are your current REHEARSAL / PRACTICE shoes?

◯ Less than 3 months ◯ 4-6 months ◯ 7-9 months ◯ 10-12 months ◯ 13-18 months
◯ 19 months - 23 months ◯ 2-3 years ◯ 4-5 years ◯ Older than 5 years

How old are your NEWEST REHEARSAL / PRACTICE shoes?

◯ Less than 3 months ◯ 4-6 months ◯ 7-9 months ◯ 10-12 months ◯ 13-18 months
◯ 19 months - 23 months ◯ 2-3 years ◯ 4-5 years ◯ Older than 5 years

How old are your OLDEST REHEARSAL / PRACTICE shoes? (That you still use)

◯ Less than 3 months ◯ 4-6 months ◯ 7-9 months ◯ 10-12 months ◯ 13-18 months
◯ 19 months - 23 months ◯ 2-3 years ◯ 4-5 years ◯ Older than 5 years

How often do you replace your REHEARSAL / PRACTICE shoes?

◯ Less than 3 monthly ◯ 4-6 monthly ◯ 7-9 monthly ◯ 10-12 monthly ◯ 13-18 monthly
◯ 19 months - 23 months ◯ 2-3 years ◯ 4-5 years ◯ Longer than 5 years

What brands do you use for REHEARSAL / PRACTICE? (You can choose more than one.)

(You can choose more than one brand)

☐ Aida ☐ Bloch ☐ Capezio ☐ DanceWell ☐ Freed of London ☐ HNS ☐ International Dance Shoes (brand) ☐ Sansha ☐ SoDanca ☐ SupaDance ☐ Topline ☐ Other ☐ I don't know

Please specify the brand of shoe you use.

_____

Do you wear different shoes for your competitions? ◯ Yes ◯ No

Currently, how many pairs of COMPETITION shoes do you use?

◯ 1 pair ◯ 2-3 pairs ◯ 4-5 pairs ◯ 6-8 pairs ◯ >8 pairs

How old are your current COMPETITION shoes?

◯ Less than 3 months ◯ 4-6 months ◯ 7-9 months ◯ 10-12 months ◯ 13-18 months
◯ 19 months - 23 months ◯ 2-3 years ◯ 4-5 years ◯ Older than 5 years

How old areyour NEWEST COMPETITION shoes?

◯ Less than 3 months ◯ 4-6 months ◯ 7-9 months ◯ 10-12 months ◯ 13-18 months
◯ 19 months - 23 months ◯ 2-3 years ◯ 4-5 years ◯ Older than 5 years

How old are your OLDEST COMPETITION shoes? (That you still use.)

◯ Less than 3 months ◯ 4-6 months ◯ 7-9 months ◯ 10-12 months ◯ 13-18 months
◯ 19 months - 23 months ◯ 2-3 years ◯ 4-5 years ◯ Older than 5 years

How often do you replace your COMPETITION shoes?

◯ Less than 3 monthly ◯ 4-6 monthly ◯ 7-9 monthly ◯ 10-12 monthly ◯ 13-18 monthly
◯ 19 months - 23 months ◯ 2-3 years ◯ 4-5 years ◯ Longer than 5 years

What is the brand / make of your COMPETITION shoe?

(You can choose more than one brand)

☐ Aida ☐ Bloch ☐ Capezio ☐ DanceWell ☐ Freed of London ☐ HNS ☐ International Dance Shoes
☐ Sansha ☐ SoDanca ☐ SupaDance ☐ Topline ☐ Other ☐ I don't know

Please specify the brand of shoe you use.

_____

Why do you use more than 1 pair of shoes? (You can choose more than one answer)

☐ Longevity (to make them last longer)
☐ Different shoes for different STYLES
☐ Specific shoes for SPECIFIC DANCES (within in one style)
☐ Different heel heights for different STYLES
☐ Specific heel height for SPECIFIC DANCES (within in one style)
☐ Different heel heights for different PARTNERS
☐ Other

Please elaborate:

What is the AVERAGE height of the heel you use for?
(Turn your cell phone landscape)

	Bare-foot	Socks	Flat - < ½" (1.5cm)	½" (1.5cm)	1" (3cm)	1.5" (4cm)	2" (5cm)	2.5" (6.5cm)	3" (8cm)	3.5" (9cm)	4" (10cm)
Ballroom &/ Smooth REHEARSAL	○	○	○	○	○	○	○	○	○	○	○
Ballroom &/ Smooth COMPETITIONS	○	○	○	○	○	○	○	○	○	○	○
Latin American &/ Rhythm REHEARSAL	○	○	○	○	○	○	○	○	○	○	○
Latin American &/ Rhythm COMPETITIONS	○	○	○	○	○	○	○	○	○	○	○
Other Styles of Dance	○	○	○	○	○	○	○	○	○	○	○
Work	○	○	○	○	○	○	○	○	○	○	○
A night out	○	○	○	○	○	○	○	○	○	○	○
Casual outing	○	○	○	○	○	○	○	○	○	○	○
At Home	○	○	○	○	○	○	○	○	○	○	○

What kind of floors do you dance on? (You can choose more than one answer per row)	Sprung floor (wood)	Un-sprung (wood/vinyl)	Tiles / Concrete	I don't know	Other
Rehearsal	☐	☐	☐	☐	☐
Competition	☐	☐	☐	☐	☐
Other Dance Styles	☐	☐	☐	☐	☐

What other floors to you dance on?

_____

SEEKING MEDICAL ATTENTION

If you have (dance-related) physical pain, problems or injuries, do you seek medical attention?

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Very Often
- ○ Always

Who would be the first person/practitioner you would go to?

(Select one)

☐ General Practitioner ☐ Physiotherapist ☐ Biokineticist ☐ Chiropractor ☐ Sports Physician
☐ Podiatrist ☐ Dietitian ☐ Homeopath ☐ Massage Therapist ☐ Other

In general, was your pain/problem/injury diagnosed? (Were you told exactly what was wrong)

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Very Often
- ○ Always

Please specify

_____

In general, do you feel the person you selected above understood your dance activities and requirements?

- ○ Not at all / Never
- ○ Not really / Rarely
- ○ Sort Of / Sometimes
- ○ Yes, Mostly / Very Often
- ○ Yes, Completely / Always

In future, would you go back to the person you selected above for a dance-related pain/problem/injury?

- ○ Yes
- ○ No

Why not?
(you can select more than once answer)

- ☐ I can manage things myself
- ☐ I don't know who to go to
- ☐ I don't trust that medical professionals understand dancers
- ☐ I cannot afford to seek medical attention
- ☐ Other

In general, do you think there is a lack of "Dance Specialists" in healthcare?

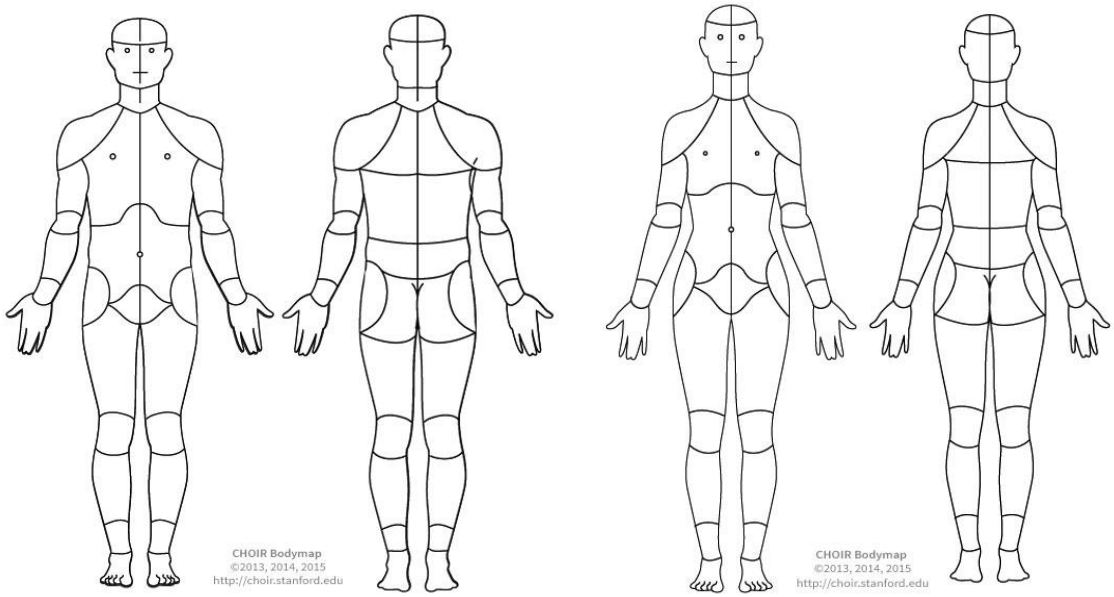
○ Yes ○ No

Do you think injury prevention strategies/workshops/classes would be valuable in preventing dance-related injuries?

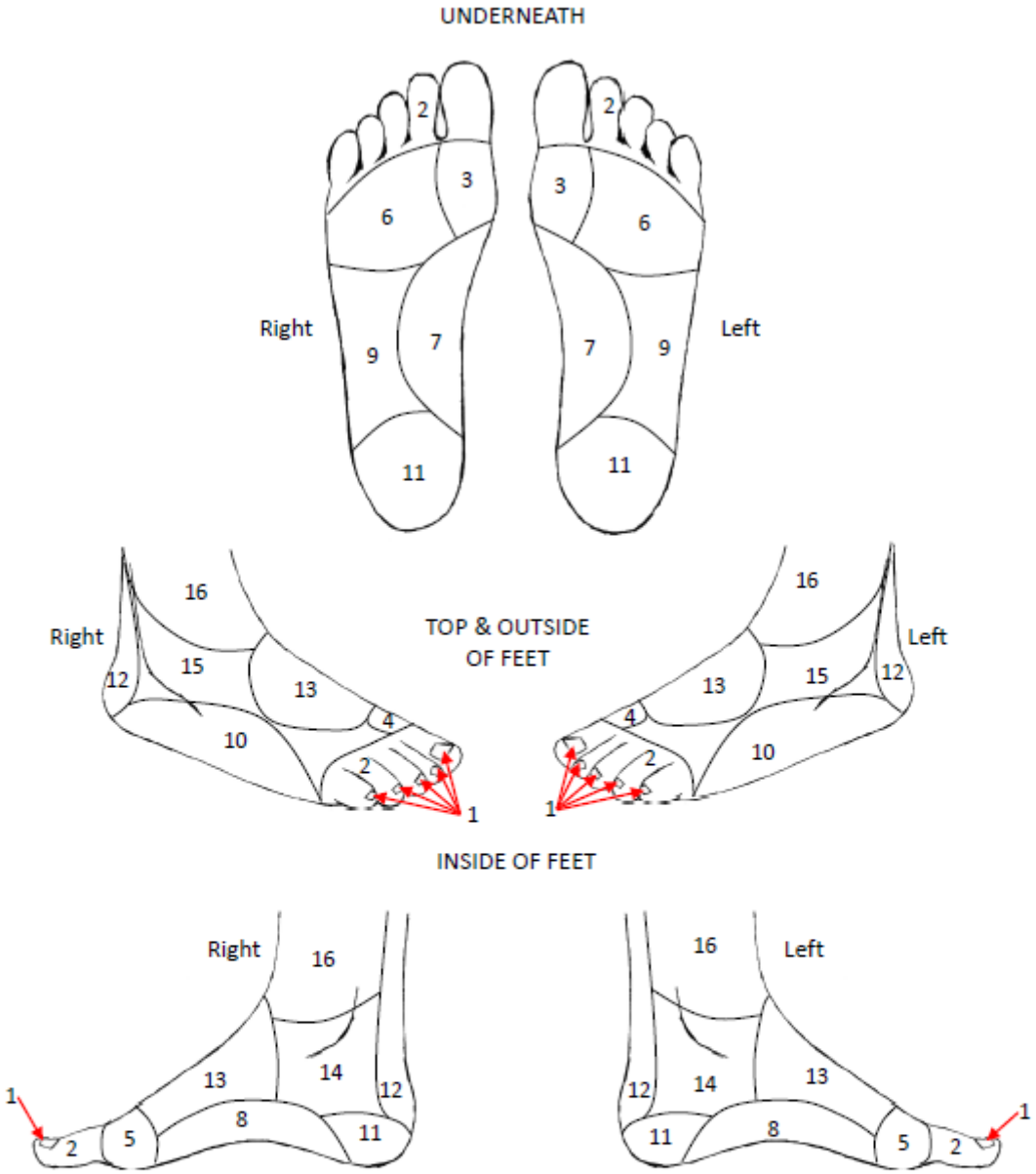
- ○ Yes
- ○ No

Please add any information you'd like to regarding seeking medical attention, your experience(s), the medical professional(s) etc... as a dancer / dance patient.

10.5. Body map used in data collection



10.6. Detailed Foot and Ankle Diagram used in data collection



1. Toenails
2. Toes
3. 1MTPJ - Plantar
4. 1MTPJ - Dorsal
5. 1MTPJ - Medial
6. Lesser MTPJs - Plantar
7. MLA - Plantar
8. MLA - Medial
9. Lateral midfoot - Plantar
10. Lateral midfoot - Lateral
11. Heel - Plantar
12. Heel - Posterior
13. Dorsal Midfoot
14. Medial Malleolar area
15. Lateral Malleolar area
16. Ankle Joint

10.7. Ethics Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

R14/49 Miss Megan Maddocks

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M190674

NAME: (Principal Investigator)	Miss Megan Maddocks
DEPARTMENT:	Centre for Exercise Science and Sport Medicine Dancing Under African Skies - Emperors Palace Rumba in the Jungle - Sun City
PROJECT TITLE:	The prevalence of musculoskeletal pain and injuries in South African,competitive, Ballroom and Latin American dancers
DATE CONSIDERED:	28/06/2019
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Prof D. Constantinou
APPROVED BY:	Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	17/09/2019

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

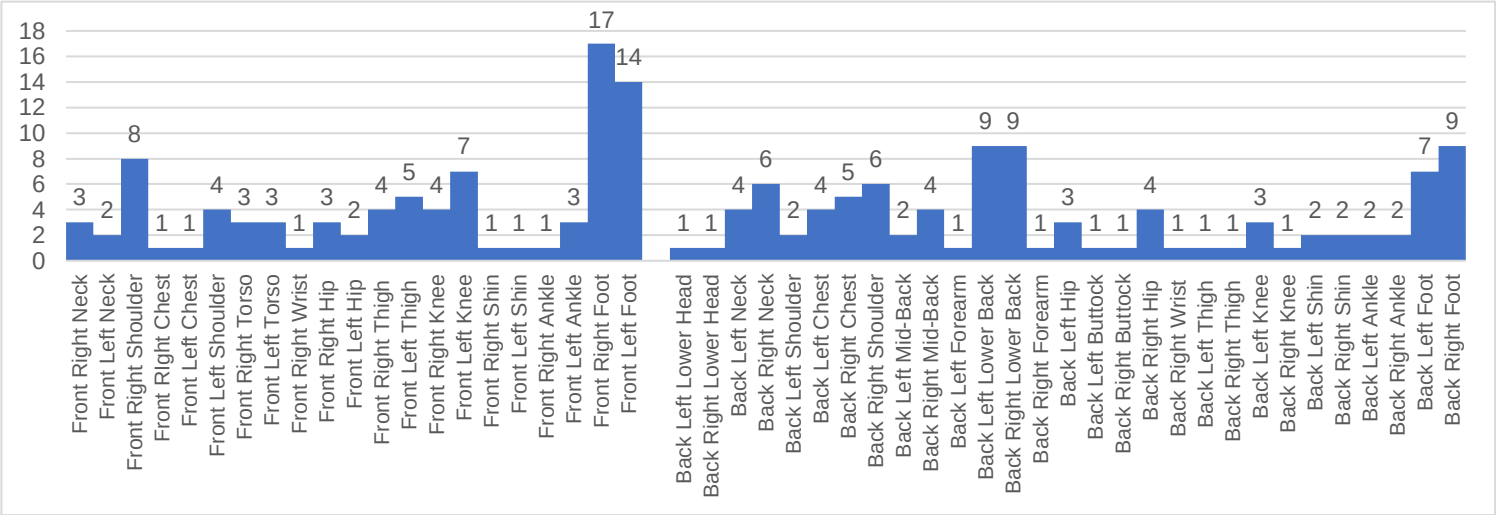
To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary on the Third Floor, Faculty of Health Sciences, Phillip Tobias Building, 29 Princess of Wales Terrace, Parktown, 2193, University of the Witwatersrand. I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in June and will therefore be due in the month of June each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature

Date 18 Septembr 2019

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

10.8. Graph showing all the body parts (ungrouped) for "select the one area that hurt the most".



10.9. Graph showing all the body parts (ungrouped) for "select all the area that hurt".

