

## Playing-Related Musculoskeletal Disorders among Classical and Irish Traditional Musicians

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### Abstract

#### *Aim*

This study aims to assess playing-related musculoskeletal disorders (PRMDs) among classical and Irish traditional third level music students in Ireland.

#### *Methods*

All Irish third level music departments were invited to participate, and questionnaires were distributed. Analyses utilised a combination of frequency distributions and contingency tables. Hypotheses were tested using chi-square and Fisher's exact tests.

#### *Results*

120 participants responded: 85 (71%) of whom were female. 103 participants were classical and 17 traditional musicians. The median age was 19 years.

#### Classical

The most common instruments were keyboard (47; 46%) and string (30; 29%). 63 (61%) reported a history of PRMDs. 37 (36%) reported a one-week prevalence. Lifetime prevalence affected string players more than keyboardists (83% versus 51%;  $p < 0.05$ ). Females were more frequently affected (67% versus 47%,  $p < 0.05$ ). Neck involvement was associated with instrument (50% strings versus 15% keyboardists;  $p < 0.01$ ). A history of PRMDs was associated with playing difficulty (85% versus 45%;  $p < 0.001$ ) and restricted practice time ( $p < 0.05$ ) within the last week.

#### Traditional

Twelve (71%) of this cohort were female. Twelve different instruments were reported. Nine (53%) respondents had experienced PRMDs.

### *Discussion*

High rates of PRMDs were reported, with increased prevalence among string instrumentalists. PRMDs caused negative consequences for musicians, indicating the need for targeted interventions.

## Introduction

Musicians engage in repetitive motions for many hours each day and are at risk of developing playing-related musculoskeletal disorders (PRMDs).<sup>1</sup> The prevalence, risk factors and consequences of PRMDs have been investigated internationally.<sup>2-5</sup> The lifetime prevalence of PRMDs among classical musicians internationally ranges from 62-93%.<sup>5</sup> Classical musicians experience both a higher twelve month prevalence (89.2% versus 77.9%) and point prevalence (62.7% versus 42.7%) of musculoskeletal complaints compared to non-musicians,<sup>6</sup> and report greater healthcare usage than non-musicians (46.3% versus 29.8%).<sup>7</sup> Anatomical regions affected by PRMDs vary by instrument played, the neck and shoulders being most frequently affected.<sup>5</sup>

Irish traditional musicians constitute a distinctive cohort of players. Dunn and Pettigrew recognised that these folk musicians “play in unique postural, social, environmental and cultural contexts and may experience pain and injury in a fashion different to their western art counterparts.”<sup>8</sup> Porter *et al.* reported a 36.7% point prevalence among Irish traditional musicians, with 34.2% of participants reporting a previous history of PRMDs.<sup>9</sup> Prior to this study, the prevalence of PRMDs among classical musicians in Ireland had not been investigated. Consequently, a comparison of PRMDs between classical and Irish traditional musicians had not taken place.

Risk factors for PRMDs include female gender (97% year prevalence versus 83% males),<sup>3</sup> playing a string instrument ( $p= 0.007$ , Odds Ratio [OR] 4.692),<sup>1</sup> a history of previous PRMDs ( $p= 0.042$ , OR 2.522),<sup>1</sup> somatising tendency (OR raised 2.5- to 5.5-fold),<sup>10</sup> low mood (OR raised 1.2- to 2.8-fold),<sup>3,4,10</sup> and sudden substantial increases in playing time (increasing prevalence from 28% to 80%).<sup>11</sup>

The impacts of PRMDs on the lives of musicians are wide-ranging. Paarup *et al.* showed that 73% of orchestral musicians reported a changed or impaired way of playing their musical instrument due to musculoskeletal symptoms; 55% reported impaired function outside of work; 53% had difficulty in leisure time activities; and 49% reported difficulty sleeping.<sup>3</sup> Leaver *et al.* reported that throughout a 12 month period, 51-56% of orchestral musicians experienced pain in their neck, low back and shoulder,<sup>10</sup> with 10-20% reporting ‘disabling’ pain in one of these regions. While PRMDs are not considered to be medically serious or life-threatening, they negatively impact on the emotional, social and financial wellbeing of affected musicians.<sup>12,13</sup> Wynn *et al.* reported that 12% of PRMD sufferers gave up their music profession permanently.<sup>14</sup> An association between severity of PRMDs and music performance anxiety has been reported, as well as a complex relationship between depression and PRMDs.<sup>15</sup> Consequently, interventions aimed at preventing and treating PRMDs are indicated. While physical rehabilitation programmes have been developed in this regard, they have not proven to be any more effective than regular

exercise, or to have a significant beneficial medium-term effect on the prevalence and frequency of musculoskeletal disorders in musicians.<sup>16,17</sup>

Consensus has not been reached on how to assess musicians' PRMDs. The term "Playing-Related Musculoskeletal Disorders" was first developed by Zaza and Farewell to standardise the methods used to discuss and assess musculoskeletal complaints among musicians.<sup>1</sup> Systematic reviews recommend utilising the term PRMDs alongside established, validated questionnaires such as the Standardised Nordic Questionnaire (SNQ),<sup>18</sup> and the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire.<sup>5,19,20</sup>

This study presents a particular opportunity to contribute to research on PRMDs in Ireland. It is the largest study to date assessing the prevalence, risk factors and consequences of PRMDs among young Irish-based musicians, and the first study in the literature to compare PRMDs between classical and Irish traditional musicians.

This study aims to assess and compare PRMDs among classical and traditional third level music students in Ireland. The specific objectives of this study are to determine the prevalence of PRMDs among these cohorts, and to establish both the risk factors and consequences associated with PRMDs in these groups.

This research project investigates whether there are statistically significant differences in the prevalence rate of PRMDs between classical and Irish traditional third level music students in Ireland.

## Methods

This quantitative, cross-sectional study targeted classical and Irish traditional music students enrolled in third level courses. Data were collected between the 6<sup>th</sup> of January and the 9<sup>th</sup> of February 2020. Strict inclusion and exclusion criteria were implemented for participation in the study. Participants must be between 18-30 years. Singers and conductors were excluded, as were participants with a systemic illness contributing to musculoskeletal pain.

Nine Irish third level music departments were invited, by email or phone call, to participate in this study. Four institutions consented to involvement in the study following approval by their respective research ethics committees. Three of the consenting institutions facilitated the author's attendance at lectures to recruit participants. Paper questionnaires were distributed and collected from these participants. The fourth institution distributed a link to the online version of the questionnaire among their music students.

Two of the remaining five institutions gave consent for participation in the study. Unfortunately, the sudden closure of Irish educational institutions announced on 12<sup>th</sup> March 2020 in response to the COVID-19 pandemic impeded data collection from these institutions.

A questionnaire was adapted from international research instruments, with permission given by Kok *et al.*<sup>11</sup> The questionnaire collected basic sociodemographic data, information on previous music training experience, and data on general health status. The study document incorporated both the Nordic Musculoskeletal Questionnaire (NMQ) and the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire. Zaza's definition of PRMDs was provided in the questionnaire, which described PRMDs as "pain and other symptoms that are chronic, beyond your control and that interfere with your ability to play your instrument at the usual level."<sup>12</sup> A body chart was used to illustrate the anatomical sites affected by PRMDs. Participants were asked to report the anatomical sites affected by PRMDs over the previous week, four weeks, three months and one year. The extent to which PRMDs negatively impacted on participants' ability to play their instrument over the previous week was also surveyed.

Ethical approval was secured from the Social Research Ethics Committee (SREC), University College Cork. Information and consent forms were provided at the start of the questionnaire. No personal identifiers were collected, providing anonymity for participants; consequently, written informed consent was not requested. A description of the study's purpose, and contact details for support services, were provided at the end of the questionnaire.

Both the online and paper formats of the questionnaire were piloted with a group of music graduates in October 2019. Feedback was gathered from this cohort and analysed to explore the accessibility and clarity of the questionnaire. This also allowed the author to plan and test data analytic methodologies.

Analyses were predominantly based on a combination of frequency distributions and contingency tables. Hypotheses were tested using chi-square and Fisher's exact tests. The SPSS version 26 software package was used for statistical analysis. Instruments were grouped into three categories: keyboard (piano and organ), string (violin, viola, cello and double bass) and "other."

## Results

A total of 186 music students participated in completing the study questionnaire. Following the application of inclusion and exclusion criteria, 120 valid responses were identified (*table 1*). Of the 66 participants excluded, 27 were singers, 26 specialised in musical styles outside of the scope of this study, 11 were outside the age range required for inclusion, and two reported having a systemic illness which impacted on their musculoskeletal health.

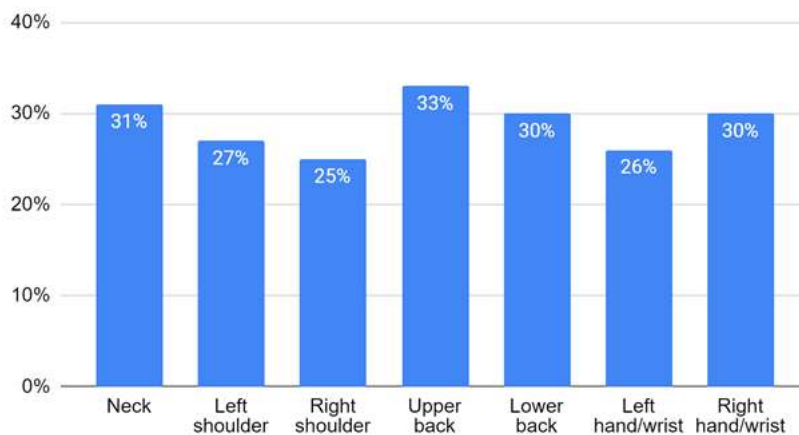
*Table 1 Profile of study participants:*

<b>Variable</b>	<b>Measure</b>	<b>Number</b>	<b>%</b>
Participants	Number	120	100%
Gender	Female	85	71%
	Male	35	29%
Style	Classical	103	86%
	Irish Traditional	17	14%
Instrument	Keyboard	47	39%
	String	30	25%
	Other	43	36%
Handedness	Right	101	85%
	Left	13	11%
	Ambidextrous	5	4%
Age	Median	19 years	
	Range	18 to 28 years	

103 participants (86%) were classical musicians, while the other 17 (14%) participants specialised in Irish traditional music. 85 of all respondents (71%) were female. The median age was 19 years (range 18-28). The most common instruments played were keyboard (47 instrumentalists; 46%) followed by string (30 instrumentalists; 29%) The remaining 26 instrumentalists were grouped into the “other” category.

*Classical cohort*

The lifetime prevalence of PRMDs reported was 63 (61%). 37 (36%) reported PRMDs in the past week. 83% of string instrumentalists reported a lifetime prevalence of PRMDs, versus 51% of keyboardists ( $p < 0.05$ ). The one-week prevalence of PRMDs was not related to instrument type. The 12-month prevalence of PRMDs varied by anatomical site (*figure 1*).



*Figure 1: Classical musicians' 12-month PRMDs prevalence by anatomical site*

There was a significant relationship found between the musical instrument played and the anatomical site affected by PRMDs (*table 3*).

*Table 2: Experience of PRMDs among classical musicians*

Variable	Frequency	Percentage
PRMDs history	63	61%
PRMDs last week	37	36%
PRMDs last year	47	46%

<b>Anatomical site</b>		
Head	8	8%
Mouth Jaw	8	8%
Neck	17	17%
Left shoulder	17	17%
Right shoulder	16	16%
Upper back	22	21%
Lower back	19	18%
Left elbow	3	3%
Right elbow	6	6%
Left hand/wrist	12	12%
Right hand/wrist	19	18%
Left hip upper/leg	1	1%
Right hip upper/leg	1	1%
Left knee	1	1%
Right knee	2	2%
Left foot/ankle	1	1%
Right foot/ankle	2	2%

Females were more likely to report a history of PRMDs than males (67% versus 47%,  $p<0.05$ ). Neck trauma was reported more frequently by female players (37% versus 17%;  $p<0.05$ ), as was lower back trauma (37% versus 13%;  $p<0.05$ ) and right-hand musculoskeletal disorders (37 versus 13%;  $p<0.05$ ).

There was no evidence of a significant impact of either lifestyle factors, such as smoking and alcohol consumption, or non-PRMD medical history, upon the prevalence of PRMDs. Participants who reported a previous history of PRMDs had a significantly higher likelihood of reporting difficulty in playing their instrument within the last week because of arm, shoulder, or hand pain (85% versus 45%;  $p<0.001$ ). A history of PRMDs also restricted average expected weekly practice time ( $p<0.05$ ).

#### *Traditional cohort*

There were seventeen respondents in the traditional music group, twelve (71%) of whom were female. Twelve different instruments were played by these 17 respondents. Nine (53%) of this cohort had experienced PRMDs compared to the 61% affected classical players, representing a non-significant difference. The nine Irish traditional musicians were comprised of two concertina



players, two flute players, and individual instances of bodhran, bouzouki, harp, tin whistle and uilleann pipes. The most frequent anatomical site affected by PRMDs among this cohort was the hand/wrist (*table 3*). Due to the limited number of Irish traditional musicians involved, it was not possible to carry out further statistically significant comparisons of PRMDs between this group and the classical cohort.

*Table 3: Experience of PRMDs among Irish traditional musicians*

<b>Variable</b>	<b>Frequency</b>	<b>Percentage</b>
PRMDs history	9	53%
PRMDs last week	5	29%
PRMDs last year	4	24%
<b>Anatomical site</b>		
Head	1	6%
Mouth/Jaw	-	-
Neck	1	6%
Left shoulder	2	12%
Right shoulder	1	6%
Upper back	-	-
Lower back	1	6%
Left elbow	-	-
Right elbow	-	-
Left hand/wrist	2	12%
Right hand/wrist	4	24%
Left hip/upper leg	-	-
Right hip/upper leg	-	-
Left knee	-	-
Right knee	-	-
Left foot/ankle	-	-
Right foot/ankle	-	-

## **Discussion**

This study establishes the prevalence of PRMDs among classical and Irish traditional musicians in third level education in Ireland.

The lifetime prevalence of PRMDs among classical musicians was reported at 61%. While this figure may appear low when compared to the international lifetime prevalence of 62-93%, our participants had a limited age range. Many participants in this study may subsequently develop PRMDs at some point in their careers. As such, the prevalence of PRMDs among musicians of all ages in Ireland may be even higher than described in this study.

This study design was enhanced by the utilisation of both the NMQ and DASH questionnaires. These internationally validated research tools facilitated the assessment of the musculoskeletal health of musicians in a way that allowed direct comparison with international research.

Risk factors identified for the development of PRMDs included playing a string instrument and female gender. This is in line with international research and provides a rationale for the implementation in Ireland of interventions developed internationally to prevent, treat, and palliate PRMDs. Similarly, any effective interventions developed in Ireland could be recommended internationally.

The role of gender when dealing with PRMDs is highlighted by several associated findings in this study. These include the more than 2/3rd majority of female students in both classical and traditional styles, and the increased cumulative impact on the experience of PRMDs reported by female participants.

Concern regarding selection bias was countered by the comparatively low prevalence of PRMDs found among the classical musician cohort when compared to international research.

This research provides the first comparison of classical and Irish traditional musicians' experiences of PRMDs. The relatively low participation rate from Irish traditional musicians poses an unexpected challenge in facilitating a comprehensive comparison. While Ireland has a large population of traditional musicians, very few third level music courses offer training in this style of performance, thus limiting the population size of this cohort. The evolving COVID-19 pandemic response necessitated the partial closure of all third level institutions in March 2019, impeding participant recruitment and data collection.

The high level of trauma reported in this research project will hopefully result in the appropriate response mechanisms being developed within educational institutions, with the overriding purpose of preventing profound PRMD morbidity. Future research should aim to establish effective interventions which prevent and mitigate the impact of PRMDs among musicians.

This study established that most musicians in Irish third level institutions have experienced PRMDs. Substantial negative consequences of PRMDs for musicians were reported. The scale of such disorders emphasises the need for the development of appropriate preventive and treatment interventions to mitigate the prevalence and impact of PRMDs.

**Declarations of Conflicts of Interest:**

None declared.

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