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PREVALÊNCIA E FATORES ASSOCIADOS DAS DISFUNÇÕES MUSCULOESQUELÉTICAS RELACIONADAS À *PERFORMANCE* MUSICAL EM VIOLINISTAS

FREDERICO BARRETO KOCHEM

RIO DE JANEIRO

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Dissertação de Mestrado apresentada ao Programa de Pós-Graduação *Stricto Sensu* em Ciências da Reabilitação do Centro Universitário Augusto Motta como requisito parcial para obtenção do título de Mestre em Ciências da Reabilitação.

Orientador: Prof. Dr. JULIO GUILHERME SILVA

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Rio de Janeiro
2014

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“A música é capaz de reproduzir, em sua forma real,
a dor que dilacera a alma e o sorriso que inebria”.

Ludwig van Beethoven (1770 – 1827)

RESUMO

INTRODUÇÃO: A música é capaz de transmitir diversas emoções associadas ao lazer e bem-estar. No entanto, tais aspectos prazerosos podem omitir os riscos ocupacionais aos quais o musicista está exposto durante seu fazer musical. A carreira de músico instrumental profissional exige grande produtividade, demonstrada através de uma complexa combinação de habilidades. Além disso, são submetidos a 1300 horas anuais de prática musical extenuante em instrumentos não ergonômicos. Tais características tornam o musicista um trabalhador com risco elevado para o desenvolvimento de lesões musculoesqueléticas, especialmente os violinistas. Este estudo investigou a prevalência e os fatores associados das disfunções musculoesquelética relacionadas à *performance* musical (DMRPM) em musicistas residentes e atuantes no Estado do Rio de Janeiro. **MATERIAIS E MÉTODOS:** Este trabalho foi composto por uma revisão sistemática e um estudo transversal. A revisão sistemática buscou avaliar a qualidade metodológica dos estudos transversais acerca da prevalência de DMRPM em instrumentistas de corda friccionada. Para isso, utilizou-se como ferramenta a Escala de Loney. Já o estudo transversal foi composto por uma amostra de 106 violinistas oriundos de oito cidades do Estado do Rio de Janeiro. Foram coletados dados a respeito das características sociodemográficas e musicais, sintomatologia dolorosa e funcionalidade dos membros superiores através do DASH e do Questionário Nórdico de Sintomas Musculoesqueléticos. As associações entre os acometimentos musculoesqueléticos e os possíveis preditores foram analisadas por meio de regressão logística binária. **RESULTADOS:** A revisão sistemática evidenciou que a prevalência de DMRPM em instrumentistas de corda fricciona é elevada, variando de 64,1% a 90%. Contudo, apenas oito dos 34 artigos selecionados para avaliação da qualidade metodológica atingiram níveis satisfatórios de qualidade. O estudo transversal mostrou que 86,8% dos violinistas entrevistados referiram ao menos uma região dolorosa nos últimos 12 meses e 77,4% na última semana. Estes sintomas foram responsáveis pela interrupção momentânea da atividade musical em 8,1% dos musicistas. Mais de 50% dos violinistas apresentavam disfunção nos membros superiores de acordo com o módulo opcional do DASH. As mulheres mostraram-se mais propensas a desenvolveram disfunções musculoesqueléticas (OR 4,4; IC 1,9 – 10,0; p<0,001). Além disso, músicos mais velhos apresentaram mais chances de referirem dor nos últimos sete dias (OR 3,3; IC 1,05 – 10,97; p=0,04) e também obtiveram pontuação maior no DASH (OR 1,8; IC 1,1 – 3,1; p=0.,1). Outros fatores associados encontrados foram IMC, tempo de estudo musical por semana e o escore do DASH. **CONCLUSÃO:** Os violinistas fluminenses apresentam uma alta prevalência de DRMPM, principalmente as mulheres e os músicos mais velhos. Como consequência, estes profissionais foram obrigados a interromperem temporariamente sua atividade artística devido à dor. Embora este acometimento ser observado em orquestras de todo o mundo, a área da saúde do músico ainda carece de estudos com boa qualidade metodológica.

Palavras-chave: Disfunção Musculoesquelética; Violinistas; Doenças Ocupacionais; Prevalência.

ABSTRACT

INTRODUCTION: Music can bring out emotions associated with leisure and well-being. However, it is difficult for the audience to imagine that the musicians are subject to occupational risks during their musical practice. A professional musical career requires development of complex tasks and high productivity. Moreover, musicians are subjected to 1300 hours per year of strenuous musical practice in non-ergonomic instruments. For these reasons, instrumental musicians are subject to a high risk of developing musculoskeletal diseases, especially violinists. This study aimed investigates the prevalence of Playing-related Musculoskeletal Disorders (PRMD) in musicians living and working in the state of Rio de Janeiro. **METHODS:** This study consisted of a systematic review and a cross-sectional study. The systematic review aimed to assess the methodological quality of cross-sectional studies on the prevalence of PRMD among string players. To achieve this goal the Loney Scale was used. The cross-sectional study included 106 violinists from eight cities of the State of Rio de Janeiro. Sociodemographic and musical characteristics data, pain symptoms and upper limbs functionality were collected using the DASH and the Standardized Nordic Questionnaire. The associations between musculoskeletal complaints and possible predictors were analyzed by binary logistic regression. **RESULTS:** Systematic review showed that the prevalence of PRMD in string players is alarming high, ranged from 64.1% to 90%. However, only eight of 34 selected studies had achieved satisfactory methodological quality score. The cross-sectional study showed that 86.8% of violinists reported at least one painful area in the last 12 months and 77.4% in the last week. These symptoms were responsible for the momentary interruption of musical activity in 8.1% of musicians. More than 50% of violinists showed dysfunctional upper limbs according to the DASH optional module. Women were more likely to develop musculoskeletal disorders (OR 4.4, CI 1.9 - 10.0, p <0.001). In addition, older musicians were more likely to refer pain in the last seven days (OR 3.3, CI 5.1 - 10.97; p = 0:04) and also had higher scores on the DASH (OR 1.8, CI 1.1 - 3.1; p = 0.01). Other associated factors were BMI, artistic practice in hours per week and the final score of the DASH questionnaire. **CONCLUSION:** violinists living and working in the state of Rio de Janeiro have a high prevalence of PRMD, especially women and older musicians. For this reason, these professionals were forced temporarily to interrupt his artistic activities due to pain. Although studies have shown the alarming prevalence of PRMD all over the world, the Performing Arts Medicine still lacks studies of good methodological quality.

Keywords: Violin Player; Playing-related Musculoskeletal Disorders (PRMD); Prevalence; Occupational Diseases.

LISTA DE SIGLAS

95% CI – 95% *Confidence Interval*

BMI – *Body Mass Index*

DASH - *Disabilities of the Arm, Shoulder and Hand*

DASH-PAM - *Disabilities of the Arm, Shoulder and Hand Performing Arts Module*

DMRPM - Disfunções Musculoesqueléticas Relacionadas à *Performance* Musical

IMC - Índice de Massa Corporal

NIOSH - *National Institute of Occupational Safety and Health*

OR - *Odds Ratio*

PRISMA - *Preferred Reporting Items for Systematic Reviews and Meta-Analysis*

PRMD - *Playing-Related Musculoskeletal Disorders*

QNSM - Questionário Nórdico de Sintomas Musculoesqueléticos

RULA - *Rapid Upper Limb Assessment*

SD – *Standard Deviation*

SNQ - *Standardized Nordic Questionnaire*

STROBE - *STrengthening the Reporting of OBservational studies in Epidemiology*

USA – *United States of America*

YAQ - *Young Peoples Activity Questionnaire*

SUMÁRIO

INTRODUÇÃO

A música é capaz de transmitir diversas emoções associadas ao lazer e bem-estar. No entanto, tais aspectos prazerosos podem omitir os riscos ocupacionais aos quais o musicista está exposto durante seu fazer musical (MONACO et al., 2012). A carreira de músico instrumental profissional exige grande produtividade, demonstrada através de uma complexa combinação de habilidades, como destreza, musicalidade, expressão emocional, resistência muscular, precisão, concentração e consciência corporal (DOMMERHOLT, 2009; MOURA et al., 2000). Em média são 1300 horas anuais de prática musical extenuante em instrumentos não ergonômicos. Ademais, os músicos são submetidos à fortes pressões exercidas pelos maestros, à expectativa do público sobre as apresentações e à concorrência profissional (LAITINEN, 2003; KOK et al., 2013). Tais características tornam o musicista um trabalhador com risco elevado para o desenvolvimento de lesões musculoesqueléticas (LIMA, 2007). Segundo Hansen e Reed (2006), as consequências decorrentes destas lesões podem ser substanciais, causando dor e, inclusive, importantes limitações funcionais. A recorrência destes acometimentos pode culminar no comprometimento permanente da atividade artística ou até mesmo no encerramento precoce da carreira musical.

Os primeiros relatos na literatura especificamente direcionada aos músicos ocorreram no final do Século XVIII (DOMMERHOLT, 2009). Acredita-se que o primeiro caso relatado de disfunção musculoesquelética tenha sido do famoso pianista Robert Schumann (1810 – 1856), sendo este obrigado a abandonar sua a carreira como instrumentista para tornar-se compositor (ALTENMÜLLER, 2005). Contudo, só a partir da década de 1980 houve um maior interesse em compreender as alterações neuromusculoesqueléticas decorrentes da prática musical. Isto ocorreu devido ao crescente número de musicistas que apresentavam distúrbios musculoesqueléticos e à criação de diversas sociedades ao redor do mundo preocupadas com a saúde do músico (DAWSON, 2003; DAWSON, 2013; HARMAN, 2010).

As orquestras sinfônicas são divididas por naipes, ou seja, grupos de instrumentos musicais específicos. O naipe das cordas é composto pelos violinos, violas, violoncelos e contrabaixos. Já as flautas, oboés, clarinetes e fagotes formam o naipe das madeiras. Outros instrumentos de sopro como trompete e trombone pertencem aos metais. O último

agrupamento é o da percussão (ABRÉU-RAMOS & MICHEO, 2007). Os instrumentistas com maior representatividade dentro das orquestras são os violinistas, correspondendo a cerca de 35% do total de músicos. Por isso, indubitavelmente são os profissionais mais cobrados, pois carregam todo o impacto emotivo da mensagem musical (PETRUS & ECHTERNACHT, 2004).

Estudos realizados com musicistas profissionais de orquestra demonstraram que os violinistas são mais suscetíveis ao desenvolvimento de sintomas musculoesqueléticos do que outros músicos, principalmente pelas atitudes posturais estressantes requeridas (ACKERMANN et al., 2012; DAENEN et al., 2010). Os sintomas mais referidos pelos violinistas abrangem: dor, tensão músculo-ligamentar, fraqueza muscular e diminuição do controle motor, especialmente nos membros superiores (FRY, 1988). Lima (2007) afirma que os sintomas começam a aparecer à medida que o músico aumenta a duração dos estudos e a intensidade que os mesmos exigem, sendo geralmente a dor a primeira queixa destes artistas. Segundo Zaza (1998), os sintomas musculoesqueléticos relacionados à *performance* musical duram em média 2 a 5 anos e afetam com maior frequência os membros superiores, coluna vertebral e musculatura facial, tornando-se dolorosos, crônicos e incapacitantes. A prevalência mundial destas queixas em instrumentistas, segundo a literatura encontrada, varia entre 42% e 93%, revelando um grande número de profissionais acometidos (ACKERMANN et al., 2012; FRY, 1986; KIM et al., 2012; KOK et al., 2013; LEAVER et al., 2011; OLIVEIRA & VEZZÁ, 2010; RANELLI et al., 2008).

Acredita-se que a etiologia dos referidos sintomas seja multifatorial, relacionando-se a postura adotada incorretamente, a técnica instrumental não ergonômica, uso de força excessiva e tempo de repouso insuficiente (HANSEN & REED, 2006). Além disso, Mühlen e Frank (2007) acrescentam a forma e o tamanho do instrumento, a duração dos estudos, as condições do local de trabalho e o preparo físico do instrumentista. Já Costa e Abrahão (2004) relatam que a compressão exercida pelo instrumento no ombro do violinista aliada ao esforço mental gerado durante a atuação musical e a ansiedade de palco são elementos que podem levar ao adoecimento relacionado ao trabalho. Outros fatores que exigem do violinista um esforço físico maior do que aquele habitual, segundo Andrade e Fonseca (2000), são momentâneos, tais como o período de adaptação a um novo instrumento, a proximidade de provas para orquestras e a participação em congressos e festivais.

O meio musical ainda carece de ações que visem à promoção da saúde e prevenção desde o início da formação do instrumentista. Os conservatórios e universidades de música devem tornar curriculares tais disciplinas, objetivando um melhor desempenho do musicista, proteção para lesões futuras e preparação para a demanda profissional subsequente (ZANDER et al., 2010). O conhecimento sobre a rotina e as demandas físicas dos instrumentistas ainda é muito escasso, principalmente entre os profissionais da saúde. No entanto, é de suma importância compreender as cargas de trabalho da atuação musical para uma melhor avaliação das queixas, e consequentemente, tratamento adequado destes artistas. Ademais, são necessários subsídios acerca do acometimento de músicos brasileiros, já que estes apresentam hábitos culturais e musicais distintos daqueles que atuam na Europa e América do Norte.

Portanto, este trabalho objetivou identificar a prevalência de disfunções musculoesqueléticas relacionadas à *performance* musical e seus fatores associados que acometem violinistas residentes e atuantes no Estado do Rio de Janeiro.

1 FUNDAMENTAÇÃO TEÓRICA

1.1 O Violino e sua História

O violino é um instrumento musical de corda friccionada, que surgiu na Itália no início do século XVI (DONOSO et al., 2008). Era considerado popular, sem posição social ou prestígios, sendo utilizado principalmente para acompanhar danças e cantigas (BRITO & BRITO, 2009).

O som de tal instrumento é produzido através da vibração de suas cordas. Para isto, é necessário um acessório chamado arco, feito em madeira e com cerca de 150 fios de crina de cavalo. O som produzido pelas cordas é transmitido ao corpo oco do violino, sendo este a sua caixa de ressonância. Os artesãos responsáveis pela confecção do instrumento são conhecidos como *luthiers* (DAMAS, 2012). O mais famoso destes artesãos foi Antonio Giacomo Stradivari (1644 – 1737), cujos instrumentos possuíam qualidade sonora e beleza estética insuperáveis (BRITO & BRITO, 2009). A forma do violino permanece praticamente inalterada desde sua criação, o que demonstra o alto nível artístico e tecnológico alcançado pelos *luthiers* há mais de 250 anos (DONOSO et al., 2008).

O violino moderno apresenta alguns acessórios que auxiliam na interface com o instrumentista. A espaleira funciona como um suporte para o violino no ombro esquerdo do músico. Já a queixeira adapta o formato do violino à conformação anatômica do queixo do instrumentista, ajudando na estabilização e equilíbrio do instrumento durante o fazer musical (Figura 1) (VEZZÁ, 2013).

Figura 1. Partes do violino.
Fonte: <http://www.mundomax.com.br/blog/instrumentosmusicais/o-violino/>. Acesso em: 13 maio 2013.

1.2 – Posturas e Movimentos Envolvidos na *Performance* Musical do Violino

A postura adotada para execução do violino foi analisada pelos autores Berque e Gray (2002). Observou-se que o peso do violino deve ser suportado na fossa supraclavicular esquerda e o violinista realiza flexão lateral da cabeça com rotação para a esquerda, supinação do antebraço esquerdo, além de seu ombro direito estar caído, abduzido e rodado internamente com pronação do antebraço direito.

Os violinistas apresentam uma grande demanda física em ambos os membros superiores. Enquanto o cotovelo e punho direitos alternam constantemente entre flexão-extensão, para controlar os movimentos do arco, a mão esquerda está em um desvio ulnar excessivo com os dedos abduzidos, sendo responsável por posicioná-los com precisão no braço do violino (Figura 2) (BOWIE et al., 2000).

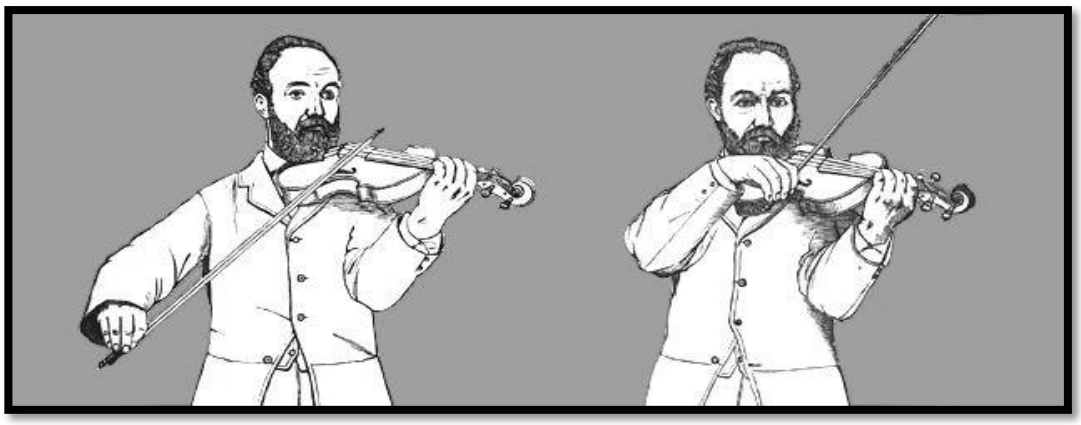

Figura 2. Postura ao tocar violino. Pode-se observar a alternância entre flexoextensão do membro superior direito enquanto seu contralateral apresenta características de sustentação do peso do instrumento. **Fonte:** HONEYMAN, 1882.

1.3 – Disfunções Musculoesqueléticas Relacionadas à *Performance* Musical

A saúde do trabalhador só pode ser mantida caso as exigências do trabalho não excedam as suas limitações energéticas e cognitivas, para que se excluam situações de estresse, riscos de acidentes e doenças ocupacionais (IIDA, 2005). As Disfunções Musculoesqueléticas Relacionadas à *Performance* Musical (DMRPM) podem ser consideradas um conjunto de sinais e sintomas neuro-osteomioarticulares provocados pela atividade de tocar um instrumento musical (LAMONTAGNE & BÉLANGER, 2012). Segundo Zaza et al. (1998), define-se DMRPM como qualquer "... dor, fadiga, perda de controle, formigamento e outros sintomas que interfiram na habilidade de tocar um

instrumento musical no nível que o músico está acostumado à fazê-lo". Incluem tendinites, tenossinovites, epicondilites, síndromes do desfiladeiro torácico, do túnel do carpo e do pronador redondo, neuropatias periféricas e distonia focal (RANELLI et al., 2008). Os estudos têm evidenciado que a prevalência de sintomas musculoesqueléticos em instrumentistas é alta (Tabela 1).

Tabela 1. Prevalência de DMRPM em diversos estudos.

AUTOR/ANO	AMOSTRA (n)	FAIXA ETÁRIA	PREVALÊNCIA DE DMRPM
FRY, 1986	485	19 – 70 anos	42%
SADEGHI et al., 2004	78	Não referido	53%
RANELLI et al., 2008	731	7 – 17 anos	67%
OLIVEIRA & VEZZÁ, 2010	69	15 – 49 anos	93%
LEAVER et al., 2011	243	23 – 64 anos	86%
PAARUP et al., 2011	342	20 – 79 anos	88,5%
ACKERMANN et al., 2012	306	15 – 69 anos	57,5%
KIM et al., 2012	86	Não referido	50%
KOK et al., 2013	83	18 – 30 anos	89,2%

Os sintomas começam a aparecer à medida que o músico aumenta a duração dos estudos e a intensidade que os mesmos exigem. Geralmente, a dor é a primeira queixa destes artistas, seguida de fraqueza muscular, diminuição da agilidade, dificuldade de coordenação e precisão (LIMA, 2007). Segundo Mühlen e Frank (2007), os principais fatores associados ao desenvolvimento destas disfunções em violinistas são:

- ✓ **A forma e o tamanho do instrumento:** para uma execução fiel de obras clássicas usam-se ainda hoje instrumentos que foram criados há séculos sem o pensamento ergonômico adequado, obrigando o músico a adotar posturas extremas;
- ✓ **A técnica empregada pelo músico:** todos os violinistas utilizam uma quantidade de força e movimentos durante seu fazer musical, que somadas à habilidade motora adquirida, tem-se a técnica individual do instrumentista;
- ✓ **O tempo de trabalho dedicado ao instrumento:** o repertório estudado influi diretamente no tempo de prática necessário para uma boa execução. Existem épocas em que a demanda por repertório é maior, como no início do semestre em conservatórios, cursos de férias ou oficinas, além de preparação para concertos e concursos;

- ✓ **As condições climáticas e de espaço do local de trabalho:** as salas de ensaio e estudo devem ser bem ventiladas e com iluminação suficiente para a leitura da partitura;
- ✓ **O comportamento de estudo e ensaio:** a adoção de hábitos como tempo de estudo excessivo, poucos intervalos, ausência de aquecimento e prática exagerada de dedilhados complexos podem contribuir para o aparecimento mais rápido de disfunções;
- ✓ **Os fatores psicológicos:** deve-se estar atento quanto à pressão e expectativa, tanto do músico como do público, a ansiedade de palco, a labilidade emocional e também a concorrência;
- ✓ **As condições corporais do músico:** o despreparo físico dos instrumentistas para a grande demanda de força requerida diariamente.

2 JUSTIFICATIVA

Estudos têm apontado uma elevada prevalência de disfunções musculoesqueléticas relacionadas à *performance* musical em instrumentistas de orquestra, especialmente em violinistas. Estes acometimentos podem ser responsáveis por prejudicar permanentemente a atividade artística ou até mesmo ocasionar o encerramento precoce da carreira musical. No entanto, ainda são escassos dados acerca da prevalência de tais desordens em violinistas brasileiros, que apresentam características próprias como alta jornada de trabalho, poucas oportunidades de emprego formal e forte pressão psicológica. Por este motivo, o presente trabalho apresenta relevância ao preencher uma lacuna na literatura, mas principalmente ao contribuir para o desenvolvimento de ações objetivando melhora da qualidade de vida destes profissionais.

3 OBJETIVOS

3.1 Objetivo Geral

Investigar a prevalência e fatores associados às Disfunções Musculoesqueléticas Relacionadas à *Performance* Musical que acometem violinistas residentes e atuantes no Estado do Rio de Janeiro.

3.2 Objetivos Específicos

- ✓ Desvelar o estado-da-arte acerca da prevalência das Disfunções Musculoesqueléticas Relacionadas à *Performance* Musical e seus fatores associados;
- ✓ Identificar a prevalência destas disfunções em violinistas;
- ✓ Analisar os principais fatores associados deste acometimento e seus impactos na atividade musical;
- ✓ Avaliar a qualidade metodológica de artigos acerca da prevalência das Disfunções Musculoesqueléticas Relacionadas à *Performance* Musical em músicos de corda friccionada.

4 ORGANIZAÇÃO DA DISSERTAÇÃO

As seções "*Materiais e Métodos*", "*Resultados*", "*Discussão*" e "*Conclusão*" serão apresentadas nos manuscritos a seguir, conforme organização descrita abaixo:

O **manuscrito I** de título "***Prevalence of Playing-related Musculoskeletal Disorders in String Players: a systematic review***" corresponde a uma revisão sistemática acerca da prevalência de Disfunções Musculoesqueléticas Relacionadas à *Performance* Musical em músicos de corda friccionada. Este foi submetido ao *Journal of Manipulative and Physiological Therapeutics*.

O **manuscrito II** de título "***Prevalence and Associated Factors of Playing-related Musculoskeletal Disorders in Violin Players***" corresponde a um estudo transversal que buscou identificar a prevalência e os fatores associados das Disfunções Musculoesqueléticas Relacionadas à *Performance* Musical em violinistas atuantes e residentes no Estado do Rio de Janeiro. Este foi submetido ao *Archives of Physical Medicine and Rehabilitation*.

5 MANUSCRITOS

5.1 Manuscrito I – Submetido ao *Journal of Manipulative and Physiological Therapeutics* (Comprovante – Anexo 6).

PREVALENCE OF PLAYING-RELATED MUSCULOSKELETAL DISORDERS IN STRING PLAYERS: A Systematic Review

ABSTRACT

OBJECTIVES: This systematic review aimed to assess the methodological quality of articles about prevalence of Playing-Related Musculoskeletal Disorders (PRMD) in string players. Furthermore, one of the objectives was to identify the rate of prevalence and risk factors of PRMD.

METHODS: In this study, cross-sectional studies describing separate string player's data published in five different languages between January 1, 1980 and January 31, 2014 were included. The following databases were searched: MEDLINE, SCIELO and LILACS. In addition, other sources and reference lists of published papers were searched. The Loney Scale was used by two independent reviewers to evaluate the methodological quality; and, only studies that achieved high scores were included.

RESULTS: Of 1,910 retrieved articles, 34 cross-sectional studies were selected for methodological assessment. However, only eight studies had achieved a satisfactory methodological quality score. The prevalence rate of PRMD was alarmingly high, ranging from 64.1% to 90 %. Women and older musicians were more affected. There seems to be a predominance of symptoms in the left upper limb in violinists and violists, whereas cellists and bassists report injuries in the right upper limb.

CONCLUSIONS: Professional and amateur string players are subject to develop PRMD. Low response rates were the most observed source of bias, and there is still a lack of publications with high methodological quality in the literature.

OTHER: No specific funding was given for this systematic review.

Keywords: String instrument players; Playing-Related Musculoskeletal Disorders (PRMD); Prevalence; Occupational Diseases.

INTRODUCTION

Music can bring out emotions associated with leisure and well-being. However, it is difficult for the audience to imagine that the musicians are subject to occupational hazards as they play and perform. Playing an instrument is a very complex task, and a professional musical career carries with it high physical and psychological demands[2]. On average, instrumentalists play 1,300 hours annually in non-ergonomic postures associated with conductor's pressure, performance anxiety and competitive work environment[3,4]. Furthermore, musicians have to practice individually and frequently teach and perform in chamber groups[5]. For these reasons, instrumental musicians are subject to a high risk of developing musculoskeletal diseases[6].

The clinical symptoms include pain and functional limitations. These injuries can compromise their ability to continue playing their instrument(s) permanently and can even end one's career prematurely[7]. Publications that report on health problems and complaints of musicians date back to 18th century[8]. One of the first reported cases was Robert Schumann's focal dystonia. A brilliant pianist in his younger years, he was forced by the disease to interrupt his instrumental career to become a composer[9]. Despite these early reports, it was only in the 1980s that Performing Arts Medicine emerged as a medical specialty. This increased interest was due to an alarmingly high number of injured musicians and the creation of journals concentrating on these artists' problems[10-12].

Many definitions of occupational diseases have been debated in the literature. Presently, the most accepted term used for music-related injuries is Playing-Related Musculoskeletal Disorders (PRMD)[13]. The concept of PRMD is any: " … pain, weakness, lack of control, numbness, tingling, or other symptoms that interfere with your ability to play your instrument at the level you are accustomed to"[14]. Recent studies have indicated high prevalence rates of PRMD ranging from 44.7% to 93%, especially in string players[15-20].

Symptoms begin to appear when the musician increases the intensity and duration of his/her musical practice. Usually, pain is the artist's first complaint[4]. It is believed that the etiology of PRMD is multifactorial and can be associated to poor posture, non-ergonomic instrument techniques, use of excessive force and insufficient rest[7]. In addition, the aspects of instrument shape and size, the duration of rehearsals and workplace environment can contribute to the development of PRMD[21].

Conservatories and music colleges need early actions aiming at health promotion and prevention of PRMD. These activities will prepare musicians for subsequent professional demands, protect them from further injuries and improve their performance[22]. Also, it is essential that health professionals understand the instrumentalists' routine and workloads for precise evaluation of their complaints and appropriate treatment of PRMD[23].

Thus, the aim of this systematic review was to assess the methodological quality of articles about prevalence of Playing-Related Musculoskeletal Disorders in string players. A further objective was to identify the prevalence rate and risk factors of PRMD.

METHODS

This systematic review was described in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA)[24].

Eligibility Criteria

In this study, cross-sectional (prevalence) studies were included that were published between January 1, 1980 and January 31, 2014 and that described separate string player's data. Also, eligible studies must have described the data collection methods and were accepted articles published in English, Portuguese, French, Italian and Spanish. Aiming to increase the methodological rigor of this systematic review, only studies that had achieved a score $\geq$ 6 points according Loney Scale were included. Papers without abstracts were excluded.

Search Strategy

The following databases were searched in November 2013 to February 2014: MEDLINE, SCIELO and LILACS. In addition, other sources and reference lists of published papers were searched. The used search terms were: Musicians; Musculoskeletal; Musculoskeletal disease; Prevalence; Frequency; Incidence; Orchestra; Pain; Playing-Related Musculoskeletal Disorders (PRMD); String players; Instrumentalists.

Study Selection

The initial search returned 1,910 published abstracts. Then, 177 potentially relevant papers were identified, and 42 duplicates were excluded. The second stage of the selection strategy involved the examination of each of the 135 screened abstracts and the application of eligibility criteria. In the next stage, 68 full-article texts were assessed, and 34 studies were excluded. Finally, 34 articles were selected for methodological quality assessment. However,

only eight studies that had fulfilled a minimum of 6 Loney Scale[25] points were included (*n* = 8). Two investigators independently performed all stages (Fig 1).

Data Extraction

The following information was extracted: author's name, publication year, country, sample size, number of string players included, description of data collection methods, prevalence rate, response rate, string player outcomes and risk factors associated to PRMD.

Assessment of Methodological Quality

The assessment of methodological quality was performed using the Loney Scale[25]. Loney et al. (1998)[25] elaborated a guideline for critical appraisal of published articles concerning a health condition prevalence or incidence. This scale consists of eight questions subdivided in three domains: validity of the study methods, interpretation, and applicability of the results[26]. Two independent evaluators participated in this step, and disagreements were resolved by consensus. The maximum score possible was 8 and the studies were classified as: poor methodological quality (0 – 2 points), regular methodological quality (3 – 5 points) and good methodological quality (6 – 8 points).

RESULTS

A total of 1,910 citations were retrieved. These papers were assessed for eligibility in several stages as outlined in Flow Diagram (Fig 1). The most frequent reasons for exclusion of articles were: no string players' data and samples composed of only violinists. Finally, 34 reports were selected for methodological quality assessment, with 28 English-language studies, 3 Portuguese-language studies, 1 Spanish-language study, 1 Italian-language study and 1 French-language study.

The studies' methodological quality was shown to be regular (Table 1). Twenty-three of 34 evaluated articles using the Loney Scale[25] were classified as regular methodological quality[1,4,18-20,23,27-32,35-42,48,50,51], three studies as poor methodological quality[5,17,49] and eight as good methodological quality[6,33,34,43-47]. The main methodological faults, according to the Loney Scale, were: inadequate response rate (29 papers), biased health outcome (27 papers), absence of confidence intervals and detailed subgroups (25 papers) and non-standardized criteria for measurement of health outcome (21 papers).

The sample size of the included articles ranged from 39 to 731 professional orchestra musicians and music students[6,33,34,43-47]. These artists reported ages ranging from 7 to 69 years-old and the average length of time practicing music ranged from 4.7 to 26.5 years. Most of the study samples were composed of string players, except for one article where pianists prevailed[33]. Regarding the PRMD, the prevalence rate was measured during different times. Three studies found PRMD lifetime prevalence rate ranging from 77% to 89.5%[33,45,46]. For 12-month prevalence, four articles detected a rate ranging from 64.1% to 90%[6,34,43,44]. Only one study evalueted the musician's complaints over the last week and the prevalence rate found was 76.4%[47].

DISCUSSION

Instrumentalists are workers exposed to several occupational hazards during their artistic practice, particularly the risk of developing Playing-Related Musculoskeletal Disorders. The consequences of these injuries can result in permanent performance impairment or can even end one's musical career prematurely[5-7]. However, there is still a lack of publications with high methodological quality in the literature, and these studies have been given little emphasis with regards to reducing the potential sources of bias. For this reason, only eight of 34 selected articles to methodological quality assessment achieved satisfactory scores according to the Loney Scale (≥ 6 points) (Table 2).

The prevalence rate of PRMD ranged from 64,1% and 90%, and most musicians reported symptoms in the last 12 months prior to data collection[6,34,43,44]. According to Kaufman-Cohen & Ratzon (2011)[43], 66% of the 39 string players surveyed reported upper-limb pain in the last year. In a study by Steinmetz et al. (2014)[46], which involved a sample of 408 instrumental musicians with 229 string players, it was observed that 90.3% of upper string players (violinists and violists) and 90.6% of lower string players (cellists and bassists) reported more than five painful body areas due to artistic practice. Likewise, Abréu-Ramos & Micheo (2007)[45] found that 93.3% of lower string players reported presence of PRMD at some point in their careers, and 83.6% of musicians surveyed believed that the cause of these injuries was their musical activity.

The most commonly affected body regions among string players were upper limbs and vertebral column. According to Kaufman-Cohen & Ratzon (2011)[43], 61% of musicians reported shoulder pain. However, there seems to be a predominance of symptoms in the upper left limb in upper string players, whereas lower string players report injuries in the upper right limb. Similarly, the results found by Ranelli, Straker & Smith (2011)[33] corroborate this hypothesis. Violin and viola players reported mostly pain

in the neck, followed by the left shoulder, left elbow and left hand. In contrast, the most frequent pain regions among cellists and bassists were the lumbar spine, right shoulder, right elbow, right hand and the left elbow. One possible explanation for this difference is that the left arm of upper string players has the function to sustaining the weight of the instrument with a predominance of static postures. In addition, presence of symptoms in the right arm of lower string players can be related to the bow handgrip and bowing techniques[33,45]. However, there is a discrepancy between these musculoskeletal symptoms and clinical findings in the same regions which shows the fluctuating nature of musculoskeletal injuries[47].

The development of PRMD occurs for a variety of reasons[44]. According to Leaver, Harris & Palmer (2011)[6], there are occupational and non-occupational factors. The results of their study with 243 musicians have shown that non-occupational factors such as gender, age, somatizing tendency (using the Brief Symptom Inventory) and mood (using the Short-Form-36 Questionnaire) are reliable predictors of pain. Women were more often affected than men, especially regarding neck pain (OR 2.0, CI 1.2 – 3.3, $p < 0.05$) and shoulder pain (OR 2.2, CI 1.3 – 3.8, $p < 0.05$). Older musicians commonly reported elbow pain, particularly those aged from 40 to 50 years (OR 3.3, CI 1.3 – 7.9, $p < 0.05$) and those older than 50 years of age (OR 4.1, CI 1.6 – 9.8, $p < 0.05$). A high somatizing score was a predictor of pain in all body regions with an Odds Ratio ranging from 2.5 for wrist pain (CI 1.2 – 4.9, $p < 0.05$) to 5.5 for shoulder pain (CI 2.7 – 11.0, $p < 0.05$). Also, a low mood score was related to neck pain (OR 2.8, CI 1.6 – 4.9, $p < 0.05$) and shoulder pain (OR 2.1, CI 1.2 – 3.6, $p < 0.05$). Corroborating these findings, Paarup et al. (2011)[34] observed that most of the analyzed painful regions in women were statistically significant for 12-month prevalence (OR 6.5, CI 2.3 – 18.2, $p < 0.0001$) and weekly prevalence (OR 3.0, CI 1.9 – 4.5, $p < 0.0001$). According to Steimetz et al. (2014)[46],

performance anxiety also was a significant factor associated to PRMD development in neck (OR 1.67, CI 1.00 – 2.78, $p < 0.05$), left shoulder (OR 1.99, CI 1.28 – 3.09, $p < 0.05$), right elbow (OR 1.85 / CI 1.12 – 3.06 / $p < 0.05$), left elbow (OR 2.18 / CI 1.28 – 3.72 / $p < 0.05$), right wrist (OR 1.95, CI 1.21 – 3.14, $p < 0.05$) and left wrist (OR 1.99, CI 1.28 – 3.09, $p < 0.05$). The amount time spent playing or practicing one's musical instrument seems to be related to the presence of pain[46]. As reported by Ranelli, Straker & Smith (2011)[33], the increase of one hour in musician's training causes a rise of 5% to 7% in the PRMD Odds Ratio of lifetime prevalence ($p = 0.014$) and monthly prevalence ($p = 0.001$).

An important source of bias found among the included articles was the response rate, which ranged from 23% to 90.4%. Studies with low response rates are prone to selection bias, resulting from the fact that musicians that have experienced PRMD are more interested in taking part than asymptomatic ones. Due to the absence of a gold standard for a diagnosing method for PRMD and the considerable variability of musician's age and occupation, it is difficult to compare the results found in the included studies. Since cross-sectional studies only make associations between risk factors and outcomes, and no causal inferences can be drawn, they should be interpreted with caution.

Limitations

This study has some limitations to be considered. The search strategy used may not have retrieved all relevant papers. To minimize this potential source of bias, searches were conducted in multiple databases, with thorough hand-searching and checking reference lists. Another limitation concerns the language in which the articles were published. This systematic review included studies in five different languages, but

relevant publications in German, Croatian and Dutch languages may have been discarded due to the authors not being fluent in these languages.

CONCLUSION

Musicians are workers subject to develop Playing-related Musculoskeletal Disorders, especially string players. The PRMD prevalence rate is alarmingly high, ranging from 64.1% to 90%. These impairments are associated with intrinsic musician factors such as gender, age and psychosocial characteristics, or related to extrinsic ones such as work environment and instrument shape. However, there is still a lack of high methodological quality studies about Performing Arts Medicine. Future research should be conducted using reliable and validated measurement instruments, identifying and avoiding sources of bias, mainly low response rates and appropriate statistical tests. Thus, preventive actions and therapeutics methods focused in musicians will be designed and performed.

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TABLES

Table 1. Selected Studies for Methodological Quality Assessment.

Author / Year	Country	Sample	Prevalence	Loney Scale Score
PAARUP et al. (2012)[47]	Denmark	n= 216	76,4%	7 (Good)
PAARUP et al. (2011)[34]	Denmark	n= 342	90%	7 (Good)
LEAVER; HARRIS; PALMER (2011)[6]	England	n= 243	86%	6 (Good)
RANELLI; STRAKER; SMITH (2011)[33]	Australia	n= 731	77%	6 (Good)
STEINMETZ et al. (2014)[46]	Germany	n= 408	89,5%	6 (Good)
ABRÉU-RAMOS & MICHEO (2007)[45]	Puerto Rico	n= 75	81,3%	6 (Good)
KAUFMAN-COHEN & RATZON (2011)[43]	Israel	n= 59	83%	6 (Good)
YEUNG et al. (1999)[44]	Hong Kong	n= 39	64%	6 (Good)
STEINMETZ et al (2014)[36]	Germany	n= 408	47%	5 (Regular)
ACKERMANN; DRISCOLL; KENNY (2012)[39]	Australia	n= 377	84%	5 (Regular)
ZETTERBERG et al. (1998)[31]	Sweden	n= 227	89%	5 (Regular)
KOK et al. (2013)[4]	Netherlands	n= 83	89,2%	5 (Regular)
BARTON et al. (2008)[18]	USA	n= 97	64,9%	5 (Regular)
ÁLVAREZ et al. (2007)[40]	Spain	n= 48	68,7%	5 (Regular)
FOTIADIS et al. (2013)[37]	Greece	n= 147	81,6%	5 (Regular)
MONACO et al. (2012)[1]	Italy	n= 65	50,7%	5 (Regular)
TRELHA et al. (2004)[41]	Brazil	n= 45	77,8%	5 (Regular)
KANEKO; LIANZA; DAWSON (2005)[38]	Brazil	n= 241	65%	4 (Regular)
BRANDFONBRENER (2009)[19]	USA	n= 330	79%	4 (Regular)
ROSET-LLOBET et al. (2000)[23]	Spain	n= 1639	77,9%	4 (Regular)
BURKHOLDER & BRANDFONBRENER (2004)[29]	USA	n= 314	84,4%	4 (Regular)
GUPTILL; ZAZA; PAUL (2000)[32]	USA	n= 108	87,7%	4 (Regular)
MIDDLESTADT & FISHBEIN (1989)[35]	USA	n= 1378	66%	4 (Regular)
JOUBREI et al. (2001)[48]	France	n= 141	76,6%	3 (Regular)
MAZZONI et al. (2006)[20]	Brazil	n= 29	93%	3 (Regular)
LARSSON et al. (1993)[51]	USA	n= 660	77%	3 (Regular
BROWN (1997)[30]	USA	n= 36	66%	3 (Regular)
CALDRON et al. (1986)[42]	USA	n= 250	59%	3 (Regular)
FRY (1987)[28]	Australia	n= 1249	9,3%	3 (Regular)
ANDRADE & FONSECA (2000)[50]	Brazil	n= 419	88%	3 (Regular)
MATHEWS & MATHEWS (1993)[27]	England	n= 29	55,1%	3 (Regular)
DAWSON (2001)[17]	USA	n= 329	44,7%	2 (Poor)
LEDERMAN (2003)[49]	USA	n= 1353	64%	2 (Poor)
FRY (1986)[5]	Australia	n= 485	64%	1 (Poor)

Table 2. Included Articles Description.

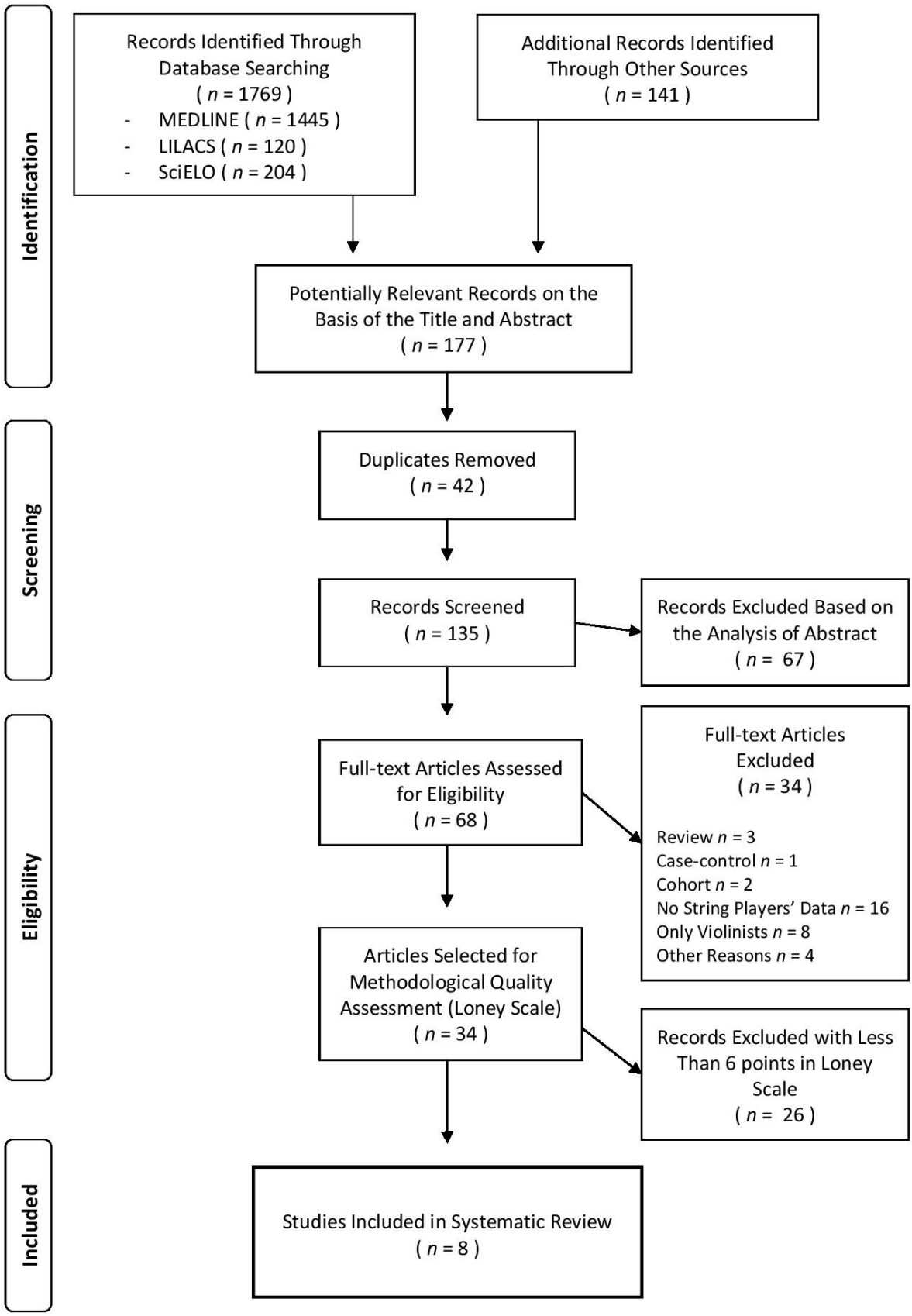
Author / Year	Total Sample	String Players	Methods	Prevalence	String Players Outcomes	Conclusion	Loney Score
PAARUP et al. (2012) [47]	*n* = 216 **Age** 20 – 69 years	*n* = 136 (62%)	The musicians rated their complaints on an examiner blinded scheme to assess the prevalence of perceived symptoms. Later, these subjects were examined for clinical findings in the neck, back and upper limbs.	76,4% (Weekly)	75% of upper strings players and 80% of lower string players presented clinical findings in the neck.	The most common of perceived symptoms areas were neck, back and shoulders. There was a discrepancy between perceived symptoms and clinical findings. Should not be considered a diagnostic stand-alone test.	7 points
PAARUP et al. (2011) [34]	*n* = 342 **Age** 37 – 50 years	*n* = 208 (60%)	The questionnaire was designed to assess the prevalence of Playing-related Musculoskeletal Disorders. 441 musicians from six symphony orchestras were invited, with 342 answering the questionnaire (response rate 78%).	90% (Annual)	Lower strings players had a significantly higher odds ratio for suffering from symptoms in neck and back for more than 30 days.	Compared to a sample of the general workforce, symphonic musicians had a higher prevalence of musculoskeletal problems.	7 points
LEAVER, HARRIS, PALMER (2011) [6]	*n* = 243 **Age** 23 – 64 years	*n* = 151 (62%)	A questionnaire concerning mental health, musculoskeletal complaints, physical activities at work and musical habits was used. Fourteen orchestras were invited (response rate 51%).	86% (Annual)	The Odds Ratio of low back pain was 50% lower in brass than string players.	Somatizing tendency was the primary risk factor, but stage fright has less impact.	6 points
RANELLI, STRAKER, SMITH (2011) [33]	*n* = 731 **Age** 7 – 17 years	*n* = 199 (27%)	Instrumental music students of government schools were invited. The Young Peoples Activity Questionnaire (YAQ) was used to assess Playing-related Musculoskeletal Disorders.	77% (Lifetime)	Upper string players reported problems in the neck and left upper limb. Lower string players reported problems in the right upper limb.	Gender, age, playing time and instrument played were associated with prevalence of reported symptoms in children musicians.	6 points

STEINMETZ et al. (2014) [46]	*n* = 408 **Age** Mean = 43,9 Years (SD ± 10,3)	*n* = 229 (56%)	Although 720 professional orchestral musicians were approached, only 408 were included in the sample (response rate 57%). A questionnaire was designed for socio-demographic and physical data.	89,5% (Lifetime)	String players, particularly violinists, were the most affected instrument group with 50% of musicians indicating more than five pain regions.	Female gender and stage fright were proven to be predictors of musculoskeletal pain.	6 points
ABRÉU-RAMOS & MICHEO (2007) [45]	*n* = 75 **Age** Mean = 37,9 Years (SD ± 9,9)	*n* = 47 (62%)	The musicians answered a questionnaire concerning demographic data, musical habits and Playing-related Musculoskeletal Disorders. Later, an upper-body clinical examination was performed.	81,3% (Lifetime)	Violin and viola players reported a high percentage of neck and left shoulder pain. However, cello and bass players expressed a higher prevalence of right upper limb symptoms.	Musicians have a high prevalence of upper-body musculoskeletal problems. String players and female were the most commonly affected groups.	6 points
KAUFMAN-COHEN & RATZON (2011) [43]	*n* = 59 **Age** 26 – 66 years	*n* = 39 (66%)	The Standardized Nordic Questionnaire, Disabilities of the Arm, Shoulder and Hand (DASH) and NIOSH Generic Job Stress Questionnaire were used. The Rapid Upper Limb Assessment (RULA) was used for clinical examination.	83% (Annual)	61% of the string players reported shoulder pain. The RULA score was significantly higher among strings in comparison to wind.	The RULA score and the perceived physical environment were the two strongest statistical predictors for musculoskeletal problems.	6 points
YEUNG et al. (1999) [44]	*n* = 39 **Age** Not Reported	*n* = 25 (64%)	The questionnaire was designed to obtain demographic data, playing habits, musculoskeletal complaints and non-playing-related musculoskeletal complaints information.	64,1% (Annual)	The most common areas of complaints were shoulder/upper arm (52%) and neck (32%).	Younger and less experienced musicians were more likely to develop symptoms. Regular exercises appear as a preventive factor.	6 points

FIGURE CAPTION

Fig. 1- PRISMA Flow Diagram.

FIGURE 1.


Identification
Screening
Eligibility
Included
Records Identified Through Database Searching (n = 1769)
- MEDLINE (n = 1445)
- LILACS (n = 120)
- SciELO (n = 204)
Additional Records Identified Through Other Sources (n = 141)
Potentially Relevant Records on the Basis of the Title and Abstract (n = 177)
Duplicates Removed (n = 42)
Records Screened (n = 135)
Records Excluded Based on the Analysis of Abstract (n = 67)
Full-text Articles Assessed for Eligibility (n = 68)
Full-text Articles Excluded (n = 34)
Review n = 3
Case-control n = 1
Cohort n = 2
No String Players' Data n = 16
Only Violinists n = 8
Other Reasons n = 4
Articles Selected for Methodological Quality Assessment (Loney Scale) (n = 34)
Records Excluded with Less Than 6 points in Loney Scale (n = 26)
Studies Included in Systematic Review (n = 8)

5.2 Manuscrito II – Submetido ao *Archives of Physical Medicine and Rehabilitation* (Comprovante – Anexo 7).

PREVALENCE AND ASSOCIATED FACTORS OF PLAYING-RELATED MUSCULOSKELETAL DISORDERS IN VIOLIN PLAYERS

ABSTRACT

OBJECTIVE: To investigate the prevalence and associated factors of PRMD among violinists from the State of Rio de Janeiro, Brazil.

METHODS: The cross-sectional study included 106 violinists from eight cities of the State of Rio de Janeiro. Socio-demographic and musical characteristic data, pain symptoms and upper-limb functionality were collected using the DASH and the Standardized Nordic Questionnaire. The associations between musculoskeletal complaints and possible predictors were analyzed by binary logistic regression.

RESULTS: Of the 106 surveyed violin players, 86.8% reported at least one painful area in the last 12 months and 77.4% in the last week. These symptoms were responsible for the momentary interruption of musical activity in 8.1% of musicians. More than 50% of violinists showed dysfunctional upper limbs according to the DASH optional module. Women were more likely to develop musculoskeletal disorders (OR 4.4, CI 1.9 - 10.0, p <0.001). In addition, older musicians were more likely to report pain in the last seven days (OR 3.3, CI 5.1 - 10.97; p = 0:04) and also had higher scores on the DASH (OR 1.8, CI 1.1 - 3.1; p = 0.01). Other associated factors were BMI, artistic practice in hours per week and the final score of the DASH questionnaire.

CONCLUSION: Violinists living and working in the state of Rio de Janeiro have a high prevalence of PRMD, especially women and older musicians.

Keywords: Violin Player; Playing-Related Musculoskeletal Disorders (PRMD); Prevalence; Occupational Diseases.

INTRODUCTION

Playing a musical instrument is one of the most complex tasks that humans can perform[1]. To achieve this goal, the development of various skills is necessary from childhood, such as dexterity, musicality, emotional expression, accuracy and concentration[2-4]. The professional musician routine requires strenuous practice in non-ergonomic instruments and these artists are subjected to psychological pressure from conductors and audience[5]. For this reason, musicians are workers at high risk of developing Playing-Related Musculoskeletal Disorders (PRMD)[6]. These may be responsible for permanent impairment of artistic activity or even culminate in the premature end of a career[7].

Symphonic orchestras are composed of more than 70 members and violin players represent about 35% of all musicians. Consequently, these artists are the workers held most accountable workers because they carry all the emotional impact of the musical message[9]. The violin is a string instrument which originated in the early 16th century in Italy. The sound of this instrument is produced by rubbing the bow across the strings making them vibrate[10]. Thus, the violinist must adopt a predetermined posture and present great physical demand in both upper limbs. While the right elbow and wrist constantly alternate between flexion and extension to control the arc movements, the left hand presents an excessive ulnar deviation to position the fingers precisely on the violin fingerboard[11].

Recent studies have shown a high prevalence of PRMD among orchestral musicians, especially violin players, ranging from 42% to 93%[12-16]. The etiology of these disorders appears to be multifactorial including intrinsic factors – such as gender, musical

habits and insufficient break periods – and extrinsic ones – such as instrument shape, work environment and repertoire[17,18].

Knowledge about musicians working life and physical demands are still very limited, particularly among health professionals. However, it's extremely important to understand the workloads musical performance presents to provide for better physical assessment and the appropriate treatment of these artists[19]. Therefore, this study aims to investigate the prevalence of Playing-Related Musculoskeletal Disorders (PRMD) among violin players residing in the state of Rio de Janeiro, Brazil. A further objective is to compare socio-demographic and musical data by gender.

METHODS

This paper was described in accordance with the Strengthening the Reporting of Observational studies in Epidemiology (STROBE)[20] Statement.

Study Design and Sample

This research is characterized as a cross-sectional study consisting of a cluster sample.

The sample was composed of 106 violinists residing in the State of Rio de Janeiro, Brazil and data collection was conducted from December 2013 to June 2014. The selection of cities and orchestra participants was randomized aiming to avoid origin bias. Firstly, those cities that had orchestras were inserted as potential fields of study and were divided by regions. After randomization, 10 orchestras from eight distinct cities were selected. Then, the orchestras' artistic administrations were contacted in order to explain the objectives and research procedure. Later, a lecture was performed during the rehearsals for the participants' recruitment and distribution the questionnaire and consent forms to those interested in participating. The questionnaires were collected on the same day; and, to avoid faulty data, each questionnaire was checked upon delivery. If there were double or blank answers, the violin player was informed to perform corrections.

Eligibility Criteria

Violinists eligible for the study were required to present at the moment of data collection a minimum of two years of musical studies, a minimum of three hours per week of reported instrumental practice, and must have considered the violin his/her main instrument. Musicians with prior history or orthopedic surgery in upper limbs and spine or those with disabling comorbidities were excluded.

Measurement Methods

A self-administered questionnaire containing 23 questions was designed to collect independent variables. For the pain and musculoskeletal disabilities assessment two instruments were used: Standardized Nordic Questionnaire (SNQ) and Disabilities of the Arm, Shoulder and Hand (DASH).

Independent Variables

All participants reported socio-demographic data (gender, age, height, weight, Body Mass Index (BMI), education, smoking habit, alcohol consumption and physical activity, musical characteristics, years of study, weekly instrumental practice and violin accessories used) and the presence of painful symptoms and musculoskeletal disorders related to musical performance.

Dependent Variables

The SNQ aims to analyze and standardize the measurement of musculoskeletal symptoms in order to ensure the sound comparison of different studies[21]. This questionnaire consists of a human representation divided into nine anatomical regions. So, the respondent must have reported the presence of pain in each region in the last 12 months and 7 days[22]. The SNQ was adapted to and validated for the Brazilian population[23].

The DASH questionnaire aims to evaluate upper limb function and the occurrence of musculoskeletal symptoms[24]. This instrument is structured with 30 self-administered questions and has an optional performing arts module[13]. Finally, the questionnaire presents a score ranging from 0 – absence of dysfunction – to 100 – severe dysfunction[25].

According to Orfale et al. (2005)[26], the SNQ was adapted to and validated for the Brazilian population and is considered reliable.

Sample Size Determination

To calculate the sample size, the prevalence of PRMD was estimated at 65% with relative precision of 25% and 0.1% significance level. Thus, the minimum necessary number of musicians was 93.

Statistical Methods

Socio-demographic data were analyzed using descriptive statistics with measures of central tendency (mean and median) and measures of dispersion (standard deviation (SD), minimum and maximum values). Associations between dependent and independent variables were estimated using logistic regression. Prevalence odds ratio were calculated with 95% confidence interval and the level of significance was $p < 0.05$. Statistical analyzes were performed using IBM SPSS© version 20.0 for Microsoft Windows©.

Ethical Considerations

This study was approved by the Research Ethics Committee of the University Center Augusto Motta/UNISUAM (CAEE: 22965313.5.0000.5235). All musicians received and signed the consent form and the participation was voluntary.

RESULTS

Socio-Demographic and Musical Characteristics

All ten selected orchestras agreed to participate. Altogether, 130 violin players were approached and 106 of these signed the consent form (81.5%). The sample consisted of 57 male musicians (53.8%) and 49 female (46.2%) with an average age of 23.9 years (SD ± 9.9). Right-handed violinists prevailed and more than half of the sample had already entered or completed college. Regarding the BMI of these artists, 56.6% of respondents had an adequate weight (18.5 – 25 Kg/m^2), 11.3% were underweight (< 18.5 Kg/m^2) and 32.1% were classified as overweight or obese (> 25 Kg/m^2). The practice of physical activity in the last three months was reported by 65.1% of respondents, especially walking and recreational cycling (32.1%).

The average of violin instrumental experience was 12.1 years (SD ± 10) and an average of 23.3 playing hours per week (SD ± 12.2) was reported. Comparing collected data by gender, there was no statistical difference in the variables "age" and "playing time per week", as shown in Table 1. Besides the violin, 64.2% of musicians reported playing other musical instruments, essentially piano (17%) and viola (13.2%).

Prevalence of PRMD

The results obtained by SNQ revealed that 86.8% of the violin players had at least one painful region in the last 12 months and 77.4% in the last week from data collection (Table 2). The most frequently affected regions in both periods were neck, thoracic area, right and left shoulders and left wrist/hand (Fig 1). These impairments were responsible for absenteeism and momentary interruption of musical activity by 8.1% of respondents (SD ± 4.1). However, despite the large number of affected musicians only 10.3% of these (SD ± 4.2) consulted healthcare professionals for diagnosis and treatment of symptoms.

The DASH questionnaire and its performing arts module (DASH-PAM) were applied aiming to verify the presence of musculoskeletal disabilities on the upper limbs. The mean DASH score obtained was 10.6 points (SD ± 8.6) while the optional module presented a higher mean score of 17.6 points (SD ± 19.8). According to the American Academy of Orthopedic Surgeons[27], the normative average scores of this instrument are 10.1 points (SD ± 14.6) for the main DASH questionnaire and 9.75 points (SD ± 22.7) for the DASH-PAM. In this way, 42.5% and 51.9% of the sample are above these normative values presented musculoskeletal disabilities, according to the results of the DASH questionnaire and the DASH-PAM respectively.

Associated Factors of PRMD

The main associated factors related to the development of PRMD were gender, age, BMI, playing time per week and DASH and DASH-PAM final scores. Results showed that women are more likely than men to report musculoskeletal symptoms related to musical performance in neck, thoracic area, right elbow and right wrist/hand (Table 3). In addition, women musicians are more likely to report more painful regions in the last 12 months (OR 2.2; CI 1.0 – 4.8; $p = 0.04$), according to SNQ results. Still referring to the gender factor, women presented more chances to develop musculoskeletal disabilities (OR 4.4; CI 1.9 – 10.0; $p < 0.001$) according to the DASH score.

Regarding the age factor, the results indicated that older musicians were more likely to complain about musculoskeletal symptoms in the last 7 days (OR 3.3; CI 1.05 – 10.97; $p = 0.04$) and also obtained higher scores on the DASH questionnaire (OR 1.8; CI 1.1 – 3.1; $p = 0.01$). Concerning the BMI factor, musicians with BMI < 25 Kg/m^2 were more likely to present left hand pain in the last year (OR 1.88; CI 1.03 – 3.46; $p = 0.02$). The results showed

that musicians who played less than 21 hours per week reported more right hand pain in the last 7 days (OR 2.2; CI 1.09 – 4.63; $p = 0.02$).

According to the DASH score, violinists who obtained more than 10.1 points were more likely to develop PRMD in the last 12 months (OR 3.7; CI 1.6 – 8.6; $p = 0.002$) and in the last 7 days (OR 3.6; CI 1.1 – 11.3; $p = 0.02$). Also, the results of DASH-PAM revealed that violin players who scored more than 9.75 points were 4 times more likely to present symptoms in the last 12 months (CI 1.8 – 9.2; $p = 0.001$) and 8 times more likely in the last 7 days (CI 1.7 – 38.9; $p = 0.007$). Other analyzed factors as smoking, regular alcohol consumption, use of violin accessories and physical activity were not statistically significant.

DISCUSSION

The results of this study revealed an alarmingly high prevalence of PRMD among violin players, especially in the neck, thoracic area and upper limbs. More than 50% of the musicians reported 4 or more concomitant painful regions in the last year. Consequently, some violinists were forces to momentarily stop their artistic activity due to pain. The main associated factors were gender, age, BMI, playing time per week and DASH scores.

Recent studies have shown a high global prevalence of PRMD in orchestral musicians corroborating the finding of the present study[5,16,28,29]. Steinmetz et al. (2014)[16] identified the prevalence of musculoskeletal symptoms among 408 German musicians and 89.5% of these reported pain related to their musical performance in the last year. More than 40% of the surveyed artists had five or more painful regions, especially violinists. A Dutch research study conducted by Kok et al. (2013)[5] with 83 orchestral musicians found a prevalence rate of PRMD of 89.2% in the last 12 months and the most affected areas were the neck, shoulders, elbows, wrists/hands and thoracic spine. Leaver et al. (2011)[28] assessed the presence of musculoskeletal complaints in 243 British elite musicians and 86% of these reported painful episodes, mainly in the neck, shoulders and lower back. There was also a greater female involvement.

Paarup et al. (2011)[29] verified that women were more likely to develop PRMD in the last 12 months (OR 6.5; CI 2.3 – 18.2; $^{p} < 0.001$) and in the last week (OR 3.0; CI 1.9 – 4.5; $p < 0.001$). According to Dawson (2001)[30], this increased susceptibility may be related to three different factors. First, women have about 15% less muscle strength when compared to men. A second factor is related to the size of the hands, proportionally smaller in females, causing local stress depending on the instrument size. Finally, these factors can affect the endurance and muscle strength interfering in musical performance.

Besides these factors, Barton et al. (2008)[31] and Fillingim (2003)[32] include the higher prevalence of joint hypermobility among women and hormonal aspects.

Regarding to the age factor, the results showed that older musicians are more likely to complain of musculoskeletal symptoms in the last 7 days (OR 3.3; CI 1.05 – 10.97; p = 0.04). Corroborating this finding, Leaver at el. (2011)[28] observed that musicians over 50 years old were more affected by elbow pain (OR 4.1; CI 1.6 – 9.8). According to Abreu-Ramos & Micheo (2007)[8] besides the aging issues, this fact can be explained because older musicians are usually section leader, which require that they play more difficult passages and for longer periods when compared to their coworkers.

The Body Mass Index (BMI) was also a perceived associated factor in the development of PRMD. In this study 56.6% of respondents had adequate weight (18.5 – 25 Kg/m^2), 11.3% underweight (< 18.5 Kg/m^2) and 32.1% of these were classified as overweight or obese (> 25 Kg/m^2). Ackermann et al. (2012)[12] observed similar results in research with 377 Australian orchestral musicians on which 37.5% of these were classified as overweight or obese. According to Zaza & Farewell (1997)[33], an increase of BMI is associated with higher chances to developing musculoskeletal disorders related to musical activity. The present study evidenced that violinists who had a BMI < 25 Kg/m^2 were more likely to report painful symptoms in the left hand (OR 1.88; CI 1.03 – 3.46; p = 0.02). A possible explanation can be justified in the relationship of lower BMI and lower muscular tropism. The upper left limb of the violin player has a more static action supporting the instrument weight. Thus, a low BMI may result in a lower muscle endurance interfering in the artistic performance.

Regarding the playing time per week, our findings pointed that violin players who practice less than 21 hours per week were more affected by right hand pain in the last 7 days

(OR 2.2; CI 1.09 – 4.63; ^{p} = 0.02). A likely reason for this is the fact that the surveyed violinists who played more than 21 hours per week reported more instrumental experience (mean 12.3 years; SD ± 7.5) than those with lower weekly practice (mean 11.9 years; SD ± 11.7). Thus, expert musicians have more technical domain of the instrument which can positively influence the development of PRMD.

The DASH questionnaire and DASH-PAM final scores shown to be associated with the presence of musculoskeletal pain in the last 12 months and 7 days. According to the American Academy of Orthopedic Surgeons[27], the normative values of these instruments are 10.1 points and 9.75 points, respectively. Our results evidenced that those violin players who obtained more than 10.1 points - DASH Questionnaire - were three times more likely to develop PRMD. Likewise, violinists with more than 9.75 points – DASH-PAM – showed up to eight times more likelihood to report musculoskeletal pain related to musical performance. Consistent with the Monaco et al. (2012)[17] study with 65 professional musicians from the *Teatro dell'Opera* in Rome, it was observed that DASH-PAM better discriminates symptomatic musicians than the DASH questionnaire.

Strengths and Limitations

This is the first study that approached violinists from different orchestras and cities in the State of Rio de Janeiro, one of the largest cultural centers of Latin America. Moreover, it allows a comparison of the involvement of these artists with professional all over the world. Another strength point is related to the randomization of cities and participating orchestras, reducing the selection bias. However, this research study had some limitations. Firstly, a cross-sectional design does not provide causal relationships between outcomes and the associated factors. Furthermore, all data collection performed by self-administered questionnaires is subject to recall bias. In an attempt to minimize this, questions concerning

events or conditions that had occurred within a maximum of 12 months were prioritized. Anonymity was guaranteed to all participants aiming to prevent interferences in the work environment due to participation.

The implementation of longitudinal studies is suggested in order to understand the causal and temporal dimensions of each risk factor related to the occurrence of musculoskeletal disorders among musicians. Future research should give attention to the use of reliable and appropriate instruments to musicians' population and take steps to minimize biases, particularly low response rates. Only then will the development of preventive and interventionist actions be possible.

CONCLUSION

The prevalence of Playing-Related Musculoskeletal Disorders among Brazilian violin players is alarmingly high both in the last 12 months (86.8%) and 7 days (77.4%). The most reported painful regions were neck, thoracic spine and upper limbs. As a consequence, some violinists were forced to interrupt their musical activity due to musculoskeletal pain. The main associated factors related to PRMD were gender, age, BMI, playing time per week and the DASH final scores. Therefore, it is necessary to develop prevention and health promotion actions starting with early musician education, aiming to improve performance, increase protection from future injuries, and improve preparation for subsequent professional demand.

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TABLES

Table 1. Comparison of sociodemographic and musical characteristics by gender.

	Men (*n* = 57)			Women (*n* = 49)			U Test
Variables	**Mean**	**95% CI**	**SD**	**Mean**	**95% CI**	**SD**	**Sig.***
Age (years)	24	22 – 26	±8.5	23	19 - 26	±11.3	$p = 0.09$
BMI (Kg/m^2)	24.4	23.1 – 25.6	±4.6	22.6	21.3 – 23.9	±4.5	$p = 0.01$
Musical Practice (years)	12.8	10.6 – 15.1	±8.4	11.2	7.8 – 14.5	±11.6	$p = 0.02$
Playing Time (h/week)	22.6	20.0 – 25.3	±10.0	26.3	22.2 – 30.4	±14.2	$p = 0.26$

Notes: * Mann-Whitney U Test for two independent samples.

Table 2. Number of painful regions according to SNQ.

	Last 12 Months		Last 7 Days	
Categories	**N**	**%**	**N**	**%**
Painless	14	13.2	24	22.6
1 to 3 Painful Regions	36	34.0	48	45.3
4 to 6 Painful Regions	40	37.7	25	23.6
7 to 9 Painful Regions	13	12.3	7	6.6
10 to 12 Painful Regions	3	2.8	2	1.9
Total	106	100.0	106	100.0

Table 3. Prevalence Odds Ratio for musculoskeletal symptoms by gender.

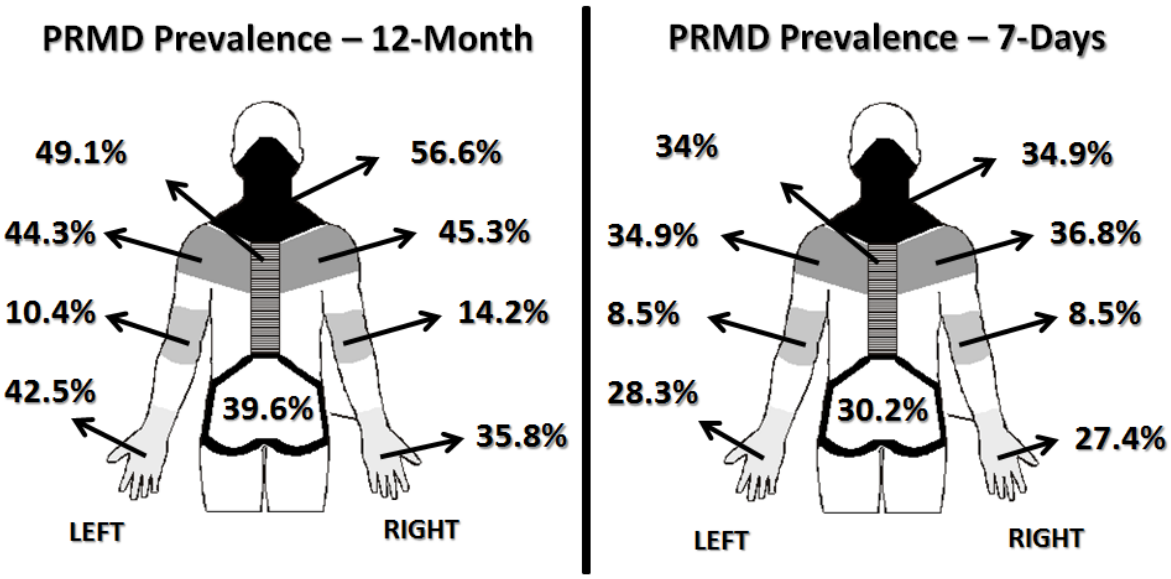
		Last 12 Months		Last 7 Days	
	Men (*n*=57)	**Women (*n*=49)**		**Women (*n*=49)**	
Painful Region	**OR**	**OR (95% CI)**	**Sig.**	**OR (95% CI)**	**Sig.**
Neck	1.0	**2.2** (1.0 – 5.0)	***p* = 0.04**	**2.7** (1.1 – 6.1)	***p* = 0.01**
Thoracic Spine	1.0	2.1 (0.9 – 4.6)	*p* = 0.05	**2.9** (1.2 – 6.9)	***p* = 0.01**
Right Shoulder	1.0	1.5 (0.7 – 3.3)	*p* = 0.27	1.9 (0.8 – 4.2)	*p* = 0.11
Left Shoulder	1.0	1.6 (0.7 – 3.5)	*p* = 0.20	1.9 (0.8 – 4.3)	*p* = 0.11
Right Elbow	1.0	**3.8** (1.1 – 12.9)	***p* = 0.03**	4.5 (0.9 – 23.2)	*p* = 0.06
Left Elbow	1.0	2.2 (0.6 – 8.0)	*p* = 0.23	2.5 (0.5 – 10.6)	*p* = 0.21
Right Wrist/Hand	1.0	**2.4** (1.0 – 5.5)	***p* = 0.02**	**3.6** (1.4 – 9.1)	***p* = 0.005**
Left Wrist/Hand	1.0	1.4 (0.6 – 3.0)	*p* = 0.38	1.7 (0.7 – 4.2)	*p* = 0.17
Lower Back	1.0	0.7 (0.3 – 1.7)	*p* = 0.57	1.4 (0.6 – 3.4)	*p* = 0.35

Notes: Odds Ratios are results of logistic regression. Values with statistical significance ($p < 0.05$) marked in bold.

FIGURE CAPTION

Fig. 1. PRMD prevalence rates divided by painful regions in the last 12 months and 7 days.

FIGURE 1.


PRMD Prevalence – 12-Month
49.1%
56.6%
44.3%
45.3%
10.4%
14.2%
42.5%
39.6%
35.8%
LEFT
RIGHT
PRMD Prevalence – 7-Days
34%
34.9%
34.9%
36.8%
8.5%
8.5%
28.3%
30.2%
27.4%
LEFT
RIGHT

6 CONSIDERAÇÕES FINAIS

Este estudo evidenciou que os violinistas fluminenses apresentam uma alta prevalência de disfunções musculoesqueléticas relacionadas à *performance* musical, principalmente as mulheres e os músicos mais velhos. As regiões mais acometidas são a coluna vertebral e os membros superiores em geral. Como consequência, estes profissionais foram obrigados, em algum momento de suas carreiras, a interromper temporariamente sua atividade artística devido à dor. Apesar de este acometimento ser observado em orquestras de todo o mundo, a área da saúde do músico ainda carece de estudos com boa qualidade metodológica, como demonstrou os resultados encontrados pela revisão sistemática. Portanto, sugere-se que pesquisas futuras atentem-se ao uso de instrumentos de coleta de dados confiáveis e válidos para a população de musicistas, além de adotarem medidas para a minimização de vieses, especialmente aquele relacionado à baixa taxa de resposta. Assim, será possível o desenvolvimento de ações preventivas e intervencionistas objetivando melhora da qualidade de vida destes trabalhadores.

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APÊNDICES

Apêndice A – Ficha para Caracterização da Amostra

FICHA PARA CARACTERIZAÇÂO DA AMOSTRA

1- Idade: _____ anos

2- Gênero: ☐Masculino / ☐ Feminino

3- Escolaridade: ☐ Ensino fundamental / ☐Ensino médio / ☐Superior incompleto / ☐ Superior completo / ☐ Especialista / ☐ Mestre / ☐ Doutor / ☐ Pós-doutorado

4 – Altura: _____ metros **(Aproximado)**

5- Peso: _____ Kg **(Aproximado)**

6- Lado Dominante: ☐ Destro / ☐ Canhoto / ☐ Ambidestro

7- Você considera o violino seu instrumento principal? ☐ Sim / ☐ Não

8 – Você toca outro instrumento? ☐ Sim Qual: _____ / ☐ Não

9 - Há quantos anos você estuda violino: _____ anos

10 - Quantas horas por semana aproximadamente você toca violino? (Incluindo estudo individual e prática de orquestra): _____ horas

11- Você utiliza a espaleira durante seus estudos e prática orquestral? ☐ Sim / ☐ Não

12- Você já fez alguma cirurgia ortopédica na coluna e/ou membros superiores?

☐ Sim / ☐ Não

13 - Você acredita que tenha alguma doença que o impeça de tocar violino?

☐ Sim / ☐ Não

14 - Qual o seu nível de estresse antes de uma apresentação?

☐ Baixo ☐ Médio ☐ Alto

15 – Qual a maneira que você mais utiliza para carregar o case do seu instrumento? (Apenas 1 opção)

☐ Pela alça na mão direita

☐ Pela alça na mão esquerda

☐ No ombro direito

☐ No ombro esquerdo

☐ Com duas alças como mochila

16 – Nos últimos três meses você praticou algum esporte?

☐ Sim / ☐ Não **(Se Não, ignore itens 17, 18 e 19)**

17 – Qual o esporte ou exercício físico que você mais pratica? (Apenas 1 opção)

☐ Caminhada	☐ Hidroginástica	☐ Basquetebol
☐ Caminhada em esteira	☐ Ginástica em geral	☐ Voleibol
☐ Corrida	☐ Natação	☐ Tênis
☐ Corrida em esteira	☐ Artes márcias e luta	☐ Outros
☐ Musculação	☐ Bicicleta	
☐ Ginástica aeróbica	☐ Futebol	

18 – Você pratica este exercício ou esporte pelo menos uma vez por semana?

☐ Sim / ☐ Não

19 – No dia que você pratica este exercício ou esporte, quanto tempo dura esta atividade?

☐ Menos que 10 minutos	☐ Entre 30 e 59 minutos
☐ Entre 10 e 29 minutos	☐ Uma hora ou mais

20 – Você fuma?

☐ Sim, diariamente / ☐ Sim, ocasionalmente (menos que diariamente) / ☐ Não **(Se Não, ignore item 21)**

21 – Quantos cigarros por dia?

☐ 1 – 4 / ☐ 5 – 9 / ☐ 10 – 14 / ☐ 15 – 19 / ☐ 20 – 29 / ☐ 30 – 39 / ☐ 40 ou mais

22 – Você costuma consumir bebidas alcóolicas?

☐ Sim / ☐ Não **(Se não, ignore item 23)**

23 – Com que frequência você costuma consumir bebidas alcóolicas?

☐ 1 a 2 dias por semana	☐ Todos os dias
☐ 3 a 4 dias por semana	☐ Menos que um dia por semana
☐ 5 a 6 dias por semana	☐ Menos que um dia por mês

Apêndice B – Termo de Consentimento Livre e Esclarecido

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

Título do Projeto: Prevalência e Fatores Associados das Disfunções Musculoesqueléticas Relacionadas à *Performance* Musical em Violinistas

Pesquisador Responsável: Frederico Barreto Kochem

Instituição a que pertence o Pesquisador Responsável: Centro Universitário Augusto Motta (UNISUAM) – Mestrado em Ciências da Reabilitação

Telefone para contato: (24) 98156-9166 (Frederico Kochem - Fisioterapeuta) / (21) 3868-5063 (Mestrado em Ciências da Reabilitação UNISUAM)
E-mail: frederico_kochem@hotmail.com

Prezado(a) violinista, o Sr.(a) está sendo convidado(a) a participar da pesquisa "Prevalência e Fatores Associados das Disfunções Musculoesqueléticas Relacionadas à *Performance* Musical em Violinistas", que visa compreender quais alterações no sistema muscular e ósseo que ocorrem no seu corpo devido à prática musical com o violino. Sabe-se que a rotina do músico profissional é muito desgastante, tornando os instrumentistas trabalhadores muito expostos à lesões devido ao exercício profissional. Abaixo segue uma descrição detalhada desta pesquisa para que você possa avaliar se irá ou não participar como voluntário.

Objetivo da Pesquisa: verificar a presença ou não de problemas musculares e articulares como dor e/ou dormência relacionadas ao ato de tocar violino e fatores que podem contribuir para o aparecimento dessas queixas.

Procedimentos do Estudo: Você preencherá dois questionários. O primeiro é chamado DASH, que tem como objetivo avaliar como está o funcionamento e se há queixas de origem musculoesquelética nos membros superiores. Esses dados identificarão as dificuldades durante a realização de atividades do dia-a-dia. O questionário tem 30 questões, onde você dará um valor para cada atividade realizada com o membro superior nos últimos dias. Os valores são de 1 a 5, onde 1 (não houve dificuldade) e 5 (dificuldade muito grande).

O segundo a ser preenchido chama-se Questionário Nórdico de Sintomas Musculoesqueléticos. Ele é composto por uma figura que representa o corpo humano dividido em nove áreas. Seu objetivo é verificar a presença de queixas musculoesqueléticas nos últimos 12 meses e na última semana. As respostas são "sim" ou "não" referente à perguntas se você já teve alguma queixa como dor ou dormência. O tempo total previsto da nossa pesquisa será de aproximadamente 25 minutos para ambos os questionários.

Desconfortos ou riscos: o presente estudo não representa nenhum risco à saúde do músico. Contudo, o único desconforto pode ser o preenchimento dos questionários para algumas questões de vida pessoal. A qualquer momento você poderá interromper sua participação, ou retirar seu consentimento, se sentir necessidade.

Benefícios esperados: você não terá nenhum benefício direto pela participação neste estudo, contudo os resultados obtidos ajudarão na compreensão dos problemas físicos que os violinistas apresentam, bem como colaborarão para o aperfeiçoamento dos profissionais da saúde sobre às condições de saúde dos instrumentistas.

Acompanhamento e Assistência: a qualquer etapa do estudo, para esclarecimento de dúvidas, os entrevistados terão acesso aos pesquisadores no endereço: Praça das Nações, 34 -

Bonsucesso, Rio de Janeiro, CEP 21041-010 ou através do telefone: (24) 98156-9166 (Frederico Kochem) e (21) 3868-5063 (Mestrado em Ciências da Reabilitação UNISUAM).

Confidencialidade: Garantimos que todas as informações a serem recebidas durante o estudo não identificarão nenhum participante e o sigilo da sua participação. Os dados serão utilizados pelos pesquisadores envolvidos no projeto para fins científicos e não será permitido o acesso a terceiros, garantindo assim proteção de seus dados. Além disso, em momento algum será divulgado o nome da orquestra em que o musicista atua. No término do estudo, você será informado sobre os resultados da pesquisa. Uma via deste termo ficará com você para que possa consultá-lo a qualquer momento.

Custos: Para participação na pesquisa o violinista não terá qualquer tipo de despesas pessoais em qualquer etapa da pesquisa, como também não haverá compensação financeira relacionada à sua participação. Caso você se sinta lesado por algum dano referente à esta pesquisa, o pesquisador responsável assume a garantia de indenização.

Este termo de consentimento livre e esclarecido segue as diretrizes estabelecidas pela Resolução 466/12 do Conselho Nacional de Saúde.

Eu, _____,

RG nº _____ declaro ter sido informado e concordo em participar, como voluntário, do projeto de pesquisa acima descrito. Ficaram claros para mim quais são os propósitos do estudo, os procedimentos a serem realizados e seus possíveis desconfortos, as garantias de sigilo e dos esclarecimentos permanentes. Ficou claro também que minha participação não aplica qualquer tipo de despesa. Poderei retirar o meu consentimento a qualquer momento antes, durante ou mesmo depois, sem penalidades, prejuízos ou perda de qualquer benefício que eu possa ter adquirido.

_____(cidade) ,_____ de _____ de _____

_____ _____

Nome do voluntário Assinatura do voluntário

_____ _____

Nome do avaliador Assinatura do avaliador

ANEXOS

Anexo 1 – Questionário *Disabilities of the Arm, Shoulder and Hand* (DASH)

Meça a sua habilidade de fazer as seguintes atividades na semana passada circulando a resposta apropriada abaixo:

	Não houve dificuldade	Houve pouca dificuldade	Houve dificuldade média	Houve muita dificuldade	Não conseguiu fazer
1. Abrir um vidro novo ou com a tampa muito apertada.	1	2	3	4	5
2. Escrever.	1	2	3	4	5
3. Virar uma chave.	1	2	3	4	5
4. Preparar uma refeição.	1	2	3	4	5
5. Abrir uma porta pesada.	1	2	3	4	5
6. Colocar algo em uma prateleira acima de sua cabeça.	1	2	3	4	5
7. Fazer tarefas domésticas pesadas (por exemplo: lavar paredes, lavar o chão).	1	2	3	4	5
8. Fazer trabalho de jardinagem.	1	2	3	4	5
9. Arrumar a cama.	1	2	3	4	5
10. Carregar uma sacola ou uma maleta.	1	2	3	4	5
11. Carregar um objeto pesado (mais de 5 kg).	1	2	3	4	5
12. Trocar uma lâmpada acima da cabeça.	1	2	3	4	5
13. Lavar ou secar o cabelo.	1	2	3	4	5
14. Lavar suas costas.	1	2	3	4	5
15. Vestir uma blusa fechada.	1	2	3	4	5
16. Usar uma faca para cortar alimentos.	1	2	3	4	5
17. Atividades recreativas que exigem pouco esforço (por exemplo: jogar cartas, tricotar).	1	2	3	4	5
18. Atividades recreativas que exigem força ou impacto nos braços, ombros ou mãos (por exemplo: jogar vôlei, martelar).	1	2	3	4	5
19. Atividades recreativas nas quais você move seu braço livremente (como pescar, jogar peteca).	1	2	3	4	5
20. Transportar-se de um lugar a outro (ir de um lugar a outro).	1	2	3	4	5
21. Atividades sexuais.	1	2	3	4	5

	Não afetou	Afetou pouco	Afetou Mediana mente	Afetou muito	Afetou Extrema Mente
22. Na semana passada, em que ponto o seu problema com braço, ombro ou mão afetaram suas atividades normais com família, amigos, vizinhos ou colegas?	1	2	3	4	5
	Não limitou	Limitou pouco	Limitou medianamente	Limitou muito	Não conseguiu fazer
23. Durante a semana passada, o seu trabalho ou atividades diárias normais foram limitadas devido ao seu problema com braço, ombro ou mão?	1	2	3	4	5

Meça a gravidade dos seguintes sintomas na semana passada.	Nenhuma	Pouca	Mediana	Muita	Extrema
24. Dor no braço, ombro ou mão.	1	2	3	4	5
25. Dor no braço, ombro ou mão quando você fazia atividades específicas.	1	2	3	4	5
26. Desconforto na pele (alfinetadas) no braço, ombro ou mão.	1	2	3	4	5
27. Fraqueza no braço, ombro ou mão.	1	2	3	4	5
28. Dificuldade em mover braço, ombro ou mão.	1	2	3	4	5
	Não houve dificuldade	Pouca dificuldade	Média dificuldade	Muita dificuldade	Tão difícil que você não pode dormir
29. Durante a semana passada, qual a dificuldade você teve para dormir por causa da dor no seu braço, ombro ou mão?	1	2	3	4	5
	Discordo totalmente	Discordo	Não concordo nem discordo	Concordo	Concordo totalmente
30. Eu me sinto menos capaz, menos confiante e menos útil por causa do meu problema com braço, ombro ou mão.	1	2	3	4	5

As questões que seguem são a respeito do impacto causado no braço, ombro ou mão quando você toca um instrumento musical, pratica esporte ou ambos.
Se você toca mais de um instrumento, pratica mais de um esporte ou ambos, por favor, responda com relação ao que é mais importante para você.
Por favor, indique o esporte ou instrumento que é mais importante para você: ______________________________

❑ Eu não toco instrumentos ou pratico esportes (você pode pular essa parte)

Por favor circule o número que melhor descreve sua habilidade física na semana passada. Você teve alguma dificuldade para:

	Fácil	Pouco difícil	Dificuldade média	Muito difícil	Não conseguiu fazer
1. uso de sua técnica habitual para tocar instrumento ou praticar esporte?	1	2	3	4	5
2. tocar o instrumento ou praticar o esporte por causa de dor no braço, ombro ou mão?	1	2	3	4	5
3. tocar seu instrumento ou praticar o esporte tão bem quanto você gostaria?	1	2	3	4	5
4. usar a mesma quantidade de tempo tocando seu instrumento ou praticando o esporte?	1	2	3	4	5

As questões seguintes são sobre o impacto do seu problema no braço, ombro ou mão em sua habilidade de trabalhar (incluindo tarefas domésticas se este é seu principal trabalho)
Por favor, indique qual é [illegible] trabalho: ______________________________
❑ Eu não trabalho (v[illegible] essa parte)

Por favor, circu[illegible] eve sua habilidade fí[illegible] teve alguma dificuldade pa[illegible]

Estas Questões
Não São Necessárias

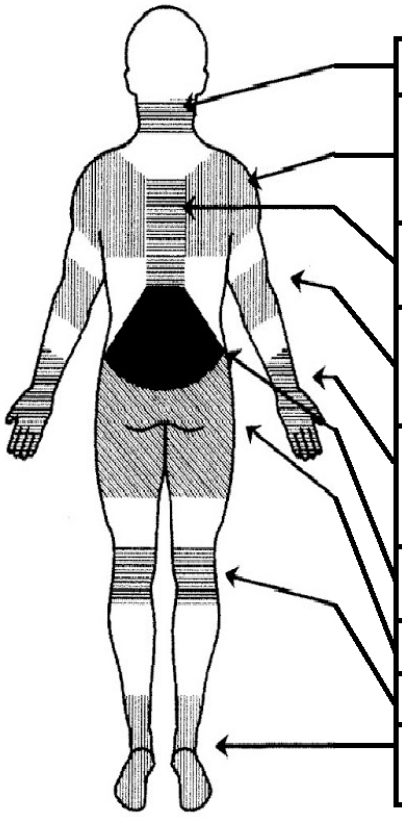
	[illegible]	[illegible]	[illegible]	[illegible] uito difícil	Não conseguiu fazer
1. uso de sua técnica habitual pa[illegible] trabalho?	[illegible]	[illegible]	[illegible]	4	5
2. fazer seu trabalh[illegible] dor em seu br[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5
3. fazer seu t[illegible] você gostaria?	1	2	[illegible]	[illegible]	5
4. usar a mesma qu[illegible] fazendo seu trabalho?	1	2	3	[illegible]	5

Questionário Nórdico de Sintomas Musculoesqueléticos

INSTRUÇÕES PARA PREENCHIMENTO

Marque apenas um "X" em cada questão.

Não deixe nenhuma questão em branco, mesmo se você não houver queixas.



	Nos últimos 12 meses, você teve problemas (como dor, formigamento/ dormência) em:	Nos últimos 7 dias, você teve algum problema em?	Nos últimos 12 meses, você consultou algum profissional da área da saúde (médico, fisioterapeuta) por causa dessa condição em:	Nos últimos 12 meses, você foi impedido(a) de realizar atividades normais (por exemplo: trabalho, atividades domésticas e de lazer) por causa desse problema em:
PESCOÇO	☐ Não ☐ Sim	☐ Não ☐ Sim	☐ Não ☐ Sim	☐ Não ☐ Sim
OMBROS Direito Esquerdo	☐ Não ☐ Sim ☐ Não ☐ Sim	☐ Não ☐ Sim ☐ Não ☐ Sim	☐ Não ☐ Sim ☐ Não ☐ Sim	☐ Não ☐ Sim ☐ Não ☐ Sim
PARTE SUPERIOR DAS COSTAS	☐ Não ☐ Sim	☐ Não ☐ Sim	☐ Não ☐ Sim	☐ Não ☐ Sim
COTOVELOS Direito Esquerdo	☐ Não ☐ Sim ☐ Não ☐ Sim	☐ Não ☐ Sim ☐ Não ☐ Sim	☐ Não ☐ Sim ☐ Não ☐ Sim	☐ Não ☐ Sim ☐ Não ☐ Sim
PUNHOS/MÃOS Direito Esquerdo	☐ Não ☐ Sim ☐ Não ☐ Sim	☐ Não ☐ Sim ☐ Não ☐ Sim	☐ Não ☐ Sim ☐ Não ☐ Sim	☐ Não ☐ Sim ☐ Não ☐ Sim
PARTE INFERIOR DAS COSTAS	☐ Não ☐ Sim	☐ Não ☐ Sim	☐ Não ☐ Sim	☐ Não ☐ Sim
QUADRIL/ COXAS	☐ Não ☐ Sim	☐ Não ☐ Sim	☐ Não ☐ Sim	☐ Não ☐ Sim
JOELHOS	☐ Não ☐ Sim	☐ Não ☐ Sim	☐ Não ☐ Sim	☐ Não ☐ Sim
TORNOZELOS/ PÉS	☐ Não ☐ Sim	☐ Não ☐ Sim	☐ Não ☐ Sim	☐ Não ☐ Sim

Anexo 3 – STrengthening the Reporting of OBservational studies in Epidemiology (STROBE)

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses

Results		
Participants	13	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
Outcome data	15	Report numbers of outcome events or summary measures
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

Anexo 4 – Critically Appraising Studies of Prevalence or Incidence of a Health Problem (LONEY et al., 1998)

TABLE 1

Guidelines for critically appraising studies of prevalence or incidence of a health problem

A. ARE THE STUDY METHODS VALID?

1. *Are the study design and sampling method appropriate for the research question?*
2. *Is the sampling frame appropriate?*
3. *Is the sample size adequate?*
4. *Are objective, suitable and standard criteria used for measurement of the health outcome?*
5. *Is the health outcome measured in an unbiased fashion?*
6. *Is the response rate adequate? Are the refusers described?*

B. WHAT IS THE INTERPRETATION OF THE RESULTS?

7. *Are the estimates of prevalence or incidence given with confidence intervals and in detail by subgroup, if appropriate?*

C. WHAT IS THE APPLICABILITY OF THE RESULTS?

8. *Are the study subjects and the setting described in detail and similar to those of interest to you?*

TABLE 2

Methodological scoring system used to rate studies reviewed[20]

Item		Score
1.	Random sample or whole population	1 point
2.	Unbiased sampling frame (i.e. census data)	1 point
3.	Adequate sample size (>300 subjects)	1 point
4.	Measures were the standard	1 point
5.	Outcomes measured by unbiased assessors	1 point
6.	Adequate response rate (70%), refusers described	1 point
7.	Confidence intervals, subgroup analysis	1 point
8.	Study subjects described	1 point
	Maximum score	**8 points**

Anexo 5 – Parecer do Comitê de Ética em Pesquisa

CENTRO UNIVERSITÁRIO AUGUSTO MOTTA/ UNISUAM

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: Disfunções Musculoesqueléticas em Violinistas
Pesquisador: Frederico Barreto Kochem
Área Temática:
Versão: 2
CAAE: 22965313.5.0000.5235
Instituição Proponente: Centro Universitário Augusto Motta/ UNISUAM
Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 468.190
Data da Relatoria: 13/11/2013

Apresentação do Projeto:
Trata-se de um projeto que visa verificar presença de disfnçoes musculo esqueléticas relacionada a prática de tocar violino. Trata-se de projeto bem descrito e embasado na literatura, além de facil execução. Os autores propoem-se em aplicar dois questionários, amplamente utilizado na literatura, adaptado e validado para a língua portuguesa.

Objetivo da Pesquisa:
O objetivo da pesquisa é identificar principais lesões relacionados a músicos que tocam violino e fatores relacionados a essas possíveis disfunções.

Avaliação dos Riscos e Benefícios:
Descritos no projeto.

Comentários e Considerações sobre a Pesquisa:
O projeto apresenta-se bem embasada na literatura e com justificativa e objetivos compatíveis com as ferramentas utilizadas, além disso, é de grande importância para a população em questão.

Considerações sobre os Termos de apresentação obrigatória:
As alterações sugeridas no parecer anterior foram completamente atendidas.

Recomendações:
Nenhuma recomendação a fazer.

Endereço: Praça das Nações nº 34
Bairro: Bonsucesso **CEP:** 21.041-010
UF: RJ **Município:** RIO DE JANEIRO
Telefone: (21)3882-9797 **E-mail:** comitedeetica@unisuam.edu.br

Conclusões ou Pendências e Lista de Inadequações:

O projeto está aprovado.

Situação do Parecer:

Aprovado

Necessita Apreciação da CONEP:

Não

Considerações Finais a critério do CEP:

O projeto está aprovado.

Cabe ressaltar que o pesquisador se compromete em anexar na Plataforma Brasil um relatório ao final da realização da pesquisa. Pedimos a gentileza de utilizar o modelo de relatório final que se encontra na página eletrônica do CEP-UNISUAM(http://www.unisuam.edu.br/index.php/ introducao-comite-etica-em-pesquisa). Além disso, em caso de evento adverso, cabe ao pesquisador relatar, também através da Plataforma Brasil.

RIO DE JANEIRO, 26 de Novembro de 2013

Assinador por:
Míriam Raquel Meira Mainenti
(Coordenador)

Endereço: Praça das Nações nº 34
Bairro: Bonsucesso **CEP:** 21.041-010
UF: RJ **Município:** RIO DE JANEIRO
Telefone: (21)3882-9797 **E-mail:** comitedeetica@unisuam.edu.br

Anexo 6 – Comprovante de Submissão Manuscrito I

Imprimir Fechar

De: **Julio Guilherme** (jglsilva@yahoo.com.br)
Enviada: terça-feira, 17 de março de 2015 18:05:48
Para: frederico_kochem@hotmail.com (frederico_kochem@hotmail.com)

Em Quarta-feira, 11 de Março de 2015 9:30, Journal of Manipulative and Physiological Therapeutics <ees.jmpt.0.2fd555.1f258609@eesmail.elsevier.com> escreveu:

Dear Prof. Julio Guilherme Silva,

Your submission entitled "PREVALENCE OF PLAYING-RELATED MUSCULOSKELETAL DISORDERS IN STRING PLAYERS: A Systematic Review" has been received by Journal of Manipulative and Physiological Therapeutics

You may check on the progress of your paper by logging on to the Elsevier Editorial System as an author. The URL is http://ees.elsevier.com/jmpt/.

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Kind regards,

Elsevier Editorial System
Journal of Manipulative and Physiological Therapeutics

Anexo 7 – Comprovante de Submissão Manuscrito II

Imprimir Fechar

De: **Julio Guilherme** (jglsilva@yahoo.com.br)
Enviada: terça-feira, 17 de março de 2015 17:52:04
Para: frederico_kochem@hotmail.com (frederico_kochem@hotmail.com)

Em Terça-feira, 17 de Março de 2015 17:46, Archives PMR <ees.archives-pmr.0.2ff905.79170e48@eesmail.elsevier.com> escreveu:

Dear Prof. Julio Guilherme Silva,

We have received your article "Prevalence and Associated Factors of Playing-Related Musculoskeletal Disorders in Violin Players" for consideration for publication in Archives of Physical Medicine and Rehabilitation.

Your manuscript will be given a reference number once an editor has been assigned.

To track the status of your paper, please do the following:

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2. Enter these login details:
Your username is: jgsilva@hucff.ufrj.br
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