2016 INTERNATIONAL SYMPOSIUM
Make it! Not Break it! Creating the Resilient Performing Artist and Athlete

July 7 - 10, 2016
Weill Cornell Medical Center
New York-Presbyterian

Jointly provided by Postgraduate Institute for Medicine and Performing Arts Medicine Association
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July 7, 2016

Dear Friends:

It is a great pleasure to welcome everyone to the Performing Arts Medicine Association’s 2016 International Symposium.

New York is home to a thriving performing arts community, and in order to ensure that artists continue to make lasting contributions to the cultural vibrancy of our city, it is vital that they have access to the outstanding medical services needed to maintain their health. Since 1989, the Performing Arts Medicine Association has been a trusted advocate for performing artists across the five boroughs, improving access to quality care and educational programming that can help improve their wellbeing. Bringing together a network of medical professionals, artists, educators, and administrators to raise awareness of the medical needs of musicians, dancers, and actors, PAMA has strengthened the global performing arts community and helped lead the way to a brighter and healthier future. The 2016 International Symposium is a great opportunity for attendees to learn more about the latest innovations and advancements being made in this field of medicine, and I applaud PAMA for continuing to improve the health of performing artists in our city and beyond.

On behalf of all New Yorkers, I offer my best wishes for a wonderful symposium and an enjoyable stay in our great city.

Sincerely,

Bill de Blasio
Mayor
Welcome to New York and to the 2016 International PAMA Symposium. This momentous event will combine the fields of performing arts medicine, sports medicine, and medical education to address artists and performers health issues.

We have had an amazing response to our first year in New York. Attendees from around the world are gathering for the greater good of the performing artist.

Thank you!
PAMA is an organization comprised of dedicated medical professionals, artists educators, and administrators with the common goal of improving the health care of the performing artist. The Performing Arts Medicine Association was founded in 1989. Members join from around the world.

The members of PAMA are professionals in fields that include research, education, and clinical practice. Many have written books and articles to inform and educate other professionals and performers. For PAMA is an organization comprised of dedicated medical professionals, artists educators, and administrators with the common goal of improving the health care of the performing artist. The Performing Arts Medicine Association was founded in 1989. Members join from around the world.

**Membership Benefits**
- Subscription to the quarterly peer-reviewed Medical Problems of Performing Artists
- Discount registration fee for the annual Symposium.
- Listing in PAMA membership directory (optional) ---very helpful when referring patients.
- Sponsorship of Alice G. Brandfonbrener Award for the best paper by a young investigator.
- Opportunities for networking and involvement in various committees.
- Access to comprehensive bibliography of relevant articles, books, and tapes

**PAMA Mission Statement**
The Performing Arts Medicine Association is committed to:
- Promoting the highest quality of care to all performing artists and bringing to that care an appreciation of the special needs of performing artists.
- Developing educational programs designed to enhance the understanding and prevention of medical problems related to the performing arts.
- Promoting communication among all those involved in the health care and well being of performing artists.
- Fostering research into the etiology, prevention, treatment, and rehabilitation of medical problems of performing artists

For more information and to join as a PAMA Member visit our website www.artsmed.org
PAMA 2017

Call for Abstracts

Abstracts are Due
November 1, 2016

This July we will begin accepting abstracts for the 35th annual PAMA Symposium on Medical Problems of Performing Artists. We encourage the submission of research-based abstracts. Educational abstracts as well as proposals for workshops will also be accepted.

Abstracts submitted to PAMA will be reviewed by the Symposium Program Committee. The abstract submission system is designed to make submitting abstracts more uniform. Please visit our website for further details at:

www.artsmed.org/symposium

Apply for Symposium Awards

There are two annual awards available to students and young professionals interested in pursuing their studies and career in performing arts medicine. Check the PAMA website to learn about these opportunities:

• Alice G. Brandonbriner Young Investigator Award
• Martin Brandonbriner Scholarship

PAMA members are encouraged to review the guidelines and share this information with eligible young people who seek to make PAM a part of their careers. The deadline for submissions is November 1, 2016.

www.artsmed.org
Activities, Logistics, and Announcements

Registration Desk
The registration desk is located outside of Uris Auditorium, on the first floor at the 1300 York building. If you need assistance during the symposium, please see Dorry Allen, Manager of Member Services, at the registration desk Thursday through Sunday. Julie Massaro, PAMA Executive Director, will also be available to answer questions and assist you, as needed.

Pre-conference Certificate Course, July 5 - 6:

**Tuesday, July 5th:** Day 1 of the Pre-conference Certificate Course will be in the Belfer Research Building, Room 302 A-C for the Morning session. Lunch will be in the Griffis Faculty Lounge. The afternoon session for Health Professionals will be in the Belfer Research Building, Room 302 A/B. The afternoon session for Educators will be in Belfer Research Building, Room 302C.

**Wednesday, July 6th:** Day 2 will split at the start with the Health Professionals in Belfer Research Building, Room 302 A/B and the Educators in Room 302 C. Lunch will be in the Griffis Faculty Lounge. Starting at 3:00 pm we will come back together, all attendees in Room 302 A-C. The certification test begins at 4:15 pm in Room 302 A-C.

Symposium Meeting Rooms
The main plenary session will take place in Uris Auditorium (1300 York). We will be feeding a live stream to a secondary room, the Weill Auditorium located just above the Uris Auditorium on the second floor.

Workshops:
The symposium workshops will take place in the Belfer Research building (across the street from the Uris building). All workshops will either be on the 2nd or 3rd floor of the Belfer building. Please see the schedule for room assignments. Remember to dress comfortably for movement workshops.

Breaks and Posters
The poster sessions will occur during scheduled breaks. Posters will be set up on the second floor of the Belfer building. Coffee and tea will be available during break periods. Plan to visit the poster sessions each day and speak with the authors.

Coffee will be available each morning starting at 7:30 am in Griffis Faculty Club. Refreshments are only available in this area during this time. No refreshments are allowed inside of the Uris Auditorium, so enjoy your coffee before going in for the first session.

Lunch is on your own. There is a snack bar and coffee shop on the first floor of the Belfer building. If you are going to a special event during the lunch break, a few select pre-made food items will be available for quick purchase by PAMA attendees only at the snack bar.

A/V and Stage Needs:
If you need the assistance of David Allen, A/V Production Manager, advise Dorry or Julie at the Registration Desk. Or speak directly to David during session during breaks.
Your Cooperation
Please be respectful to our presenters and to one another. Turn off your phones. Please avoid texting or checking email during presentations. Your professionalism is appreciated during question and answer periods.

Welcome Reception
The reception is on Thursday at 6:00 pm. It is located in the Belfer building, second floor, on the outdoor courtyard. There will be a lovely jazz combo playing while we enjoy appetizers and socialize. Family and guests are invited to join.

PAMA Annual General Meeting – The meeting will occur in the Uris Auditorium on Sunday at 10:00 am after the conclusion of the symposium.

Committee Meetings- All committee meetings will take place on Friday and Saturday mornings, in the Belfer Research Building, meeting rooms 214 & 216 at 7:00 am. Please join a meeting if you are interested in a committee.
   - **Friday Meetings:** Education Committee (214)
   - **Saturday Meetings:** Research Committee (214) Membership Committee (216)

Broadway Theatre Tickets
If you ordered tickets from PAMA to see a Broadway show, the tickets will be available for pick-up at the symposium registration desk. This is a change from our original announcement that tickets would be held at will-call. Please see the registration desk for your tickets. We are no longer selling tickets for the shows.

Cultural Options – New York is rich with cultural opportunities. Here are a few museums and attractions:
   - Solomon R. Guggenheim Museum - 1071 5th Ave
   - The Metropolitan Museum - 1000 5th Ave
   - Lincoln Center for the Performing Arts - 10 Lincoln Center Plaza
   - Jazz at Lincoln Center - 3 Columbus Cir
   - Museum of Arts and Design - 2 Columbus Cir
   - Weill Recital Hall - Carnegie Hall - 881 7th Ave
   - Birdland Jazz Club - 315 W 44th St
   - New York Public Library - 5th Ave at 42nd St
New York-Presbyterian Hospital/Weill Cornell Medical Center Campus Map

Uris Auditorium - 1300 York Avenue
- Registration desk (pre-conference and symposium) located just outside Uris Auditorium
- Symposium lectures

Belfer Research Building - 413 E 69th St
- Pre-conference Course
- Symposium Break Out Sessions

Griffis Faculty Club - down the hall from Uris Auditorium
- Pre-conference Course Lunch
- Symposium early morning coffee (available at 7:30 am only)
Thank you to the 2016 Planning Committee:

**CO-CHAIRS**

**John Chong, MD, FRCPC**  
Musicians’ Clinics of Canada  
Hamilton, Ontario

**Jennie Morton, BSc**  
Healthy Performers  
Huntington Beach, California

**George Shybut, MD**  
Wellington Orthopaedics  
Cincinnati, Ohio

**COMMITTEE MEMBERS**

**Marc Brodsky, MD**  
Stamford Hospital  
Stamford, Connecticut

**Lucinda Halstead, MD**  
Medical University of South Carolina  
Mount Pleasant, SC

**Nancy Kadel, MD**  
Group Health Physicians  
Seattle, WA

**Jeff Russell, PhD, AT**  
Ohio University  
Athens, OH

Welcome the Planning Committee Chairs for 2017:

**Jason Hu, MD**  
NewYork-Presbyterian/Queens  
Fresh Meadows, NY

**Susan Raeburn, PhD**  
Private Practice  
Oakland, CA

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**Acknowledgements**

PAMA would like to thank the Planning Committee, John Chong, MD, George Shybut, MD, Jennie Morton, BSc (Hons), MS, Nancy Kadel, MD, and Marc Brodsky, MD for their dedication and hard work over this past year to create an incredible symposium program.

PAMA gratefully acknowledges Weill Cornell Medical Center and Weill Cornell’s Center for the Performing Artist, Dr. Michael G. Stewart for hosting our Symposium.

Thank you to Nancy Amigron, Program Manager at Weill Cornell’s Center for the Performing Artist for all of her tireless hard work helping us put all of the details together on site for this program.

A special thank you to our Athletes and the Arts partners, Jim Whitehead, ASCM CEO, Randy Dick, Athletes and the Arts Champion, and Steve Karageanes, film maker extraordinaire for bringing together our Athletes and the Arts Ambassador and guests Amy Yakima, Leanne Cope, and Bobbi Lancaster.

It is with great appreciation that PAMA recognizes the many volunteers who have helped to make the symposium run more smoothly.

To our attendees, we appreciate your participation and continued support of the performing arts medicine community.
New this Year - Research Booth

Visit the Research Booth located on the second floor of the Belfer Research Building along side the poster presentations.

Bring a research project to discuss with one of the Research Committee members! A sign-up form will be located at the registration desk.

We look forward to talking with you.

Esther Chou, MEd, AT, CSCS
Research Committee
Congratulations

J. Matt McCrary, BS, BFA, Sydney Medical School, The University of Sydney has been selected as the Alice G. Brandfonbrener Young Investigator Award winner for 2016. His winning submission presentation is on Friday at 3:30 pm in the main plenary session.

The winner of the Martin Brandfonbrener Scholarship Award for 2016 is Shelaina Anderson, BSc of Edmonton, Alberta Canada.

Congratulations to both winners.
We will have a message board for attendee use near the registration desk.

If you need to leave a message for another attendee, please visit us at the registration desk.

Remember also to stop by once or twice a day to see if any messages have been left for you.

Faculty of Music, University of Toronto
Toronto, ON, Canada

Call for papers, venue and details will be announced. www.artsmed.org

PAMA Canadian Regional Meeting
SAVE THE DATE!
Feb. 11-12, 2017

PAMA Staff

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Overview

Medical Problems of Performing Artists

Make it! Not Break it! Creating the Resilient Performing Artist and Athlete

July 7 - 10, 2016

Weill Cornell Medical Center
New York-Presbyterian
New York, New York

After participating in this Symposium, attendees will be able to improve the care of performing artists/athletes and advance the work of performing arts/sports medicine as a field by:

- Explain current determinants of health including socio-economic, gender and racial inequalities in arts and entertainment/sports potentially leading to problems that contribute to injuries and illness in performing artists/athletes of all genres.
- Apply emerging research and treatment options emphasizing concepts of neuroplasticity for hearing health, neuro-musculoskeletal/vocal health and psychological health.
- Identify specific treatment implications for the performing arts/sports clinician.
- Incorporate education and information about the potential health risks of human performance in the care of both student and professional performing artists and athletes.
- Organize and integrate content from our partner organizations including ACSM, MTNA, and others in the Athletes and the Arts collaboration.
- Provide assessment tools for physicians, educators and health professionals to accurately evaluate the issues affecting the health of the performing artist.

Target Audience

The PAMA symposium is designed to meet the research and practice needs of physicians, therapists, athletic trainers, educators, artistic directors, and other health care and performing arts professionals who seek to improve the well-being of performing artists.
Continuing Education Credit

Physician Continuing Medical Education

Accreditation Statement
This activity has been planned and implemented in accordance with the accreditation requirements and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint providership of Postgraduate Institute for Medicine and Performing Arts Medicine Association. The Postgraduate Institute for Medicine is accredited by the ACCME to provide continuing medical education for physicians.

Credit Designation
The Postgraduate Institute for Medicine designates this live activity for a maximum of 18.5 AMA PRA Category 1 Credit(s)™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Nursing Continuing Education

Credit Designation
This educational activity for 18.1 contact hours is provided by Postgraduate Institute for Medicine. (If applicable, for APRNs, live activity) Pharmacotherapy contact hours for Advance Practice Registered Nurses will be designated on your certificate.

Accreditation Statements
Postgraduate Institute for Medicine is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center’s Commission on Accreditation.

California Board of Registered Nursing (Note: Only required when a LIVE activity will occur within the borders of the state of California.)

Provider approved by the California Board of Registered Nursing, Provider Number 13485, for 18.1 contact hours.

Disclosure of Conflicts of Interest
This statement will be distributed to attendees onsite.
Credit Instructions

1. Go to www.cmeuniversity.com

2. Register or Login (will take less than 1 minute)

3. Type in “11564” at the top of the page, “Find Post-Test/Evaluation by Course”, click enter

4. Click on activity title when it appears

5. Choose the type of credit you would like

6. Complete online Evaluation

7. Receive an immediate CME Certificate to download and/or print for your files

A statement of credit will be issued only upon receipt of a completed activity evaluation form and will be emailed to you within three weeks (if applicable). If you have any questions regarding the CME certification for this activity, please contact Postgraduate Institute for Medicine at: inquiries@pimed.com or (303) 799-1930.
Please note that sessions and presenters are subject to change. If changes are made, a schedule will be available onsite.

### Plan Your Route

- **A TRAIN** - Athletes and the Arts
- **B TRAIN** - Biology and Technology
- **C TRAIN** - Clinical Care of the Performing Artist and Athlete
- **D TRAIN** - Determinants of Health
- **E TRAIN** - Education and Prevention
- **F TRAIN** - Fun in New York City
- **G TRAIN** - Governance and Committees

**Students and Young Professionals** – look for this icon to find topics and sessions to check out.

### Thursday, July 7, 2016

**7:30 AM**
Registration Opens

**8:00 AM**
**Welcome to the International PAMA Symposium**
Nancy Kadel, MD, PAMA President; John Chong, MD, Conference Committee Co-Chair; George Shybut, MD, Conference Committee Co-Chair; Jennie Morton, BSc (Hons), MS, Conference Committee Co-Chair

**8:30 AM**
**Global Vision of Performing Arts Medicine**
Michael G. Stewart, MD, MPH

**9:00 AM**
**Athletes and the Arts: Future Possibilities**
Jim Whitehead, BA
<table>
<thead>
<tr>
<th>Time</th>
<th>Event Description</th>
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<tbody>
<tr>
<td>9:30 - 10:00 AM</td>
<td>Poster Session - Networking – Break</td>
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<tr>
<td>10:00 - 11:30 AM</td>
<td><strong>PLENARY</strong></td>
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<tr>
<td>10:00 AM</td>
<td>Survey Research in the Performing Arts</td>
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<td><em>Esther Chou, MEd, AT, CSCS</em></td>
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<tr>
<td>10:15 AM</td>
<td>&quot;It Hurts When I Play&quot;: A Systematic Review of Incidence and Prevalence of Instrumental Musicians'</td>
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<td>Playing-related Musculoskeletal Injuries Across the Lifespan</td>
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<td><em>Christine Guptill, BMus, PhD, OT</em></td>
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<tr>
<td>10:30 AM</td>
<td>The Prevalence of Generalized Joint Hypermobility and Joint Hypermobility Syndrome in a Cohort of</td>
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<td>Elite Australian Dancers</td>
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<td><em>Cliffton Chan, PhD, BPhysio(HonsI), GDMusic</em></td>
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<tr>
<td>10:45 AM</td>
<td>Acquired Sound Doses and Hearing Health of Music Student Interns</td>
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<td><em>Sheri Cook-Cunningham, PhD (presented by Natalie Benafield, AuD CCC-A)</em></td>
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<tr>
<td>11:00 AM</td>
<td>Musculoskeletal Injury and Pain in Drum Corps Participants</td>
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<td><em>Melissa Hatheway, BME (with Alyssa McPherson, MS, LAT, ATC, OTC, CSCS)</em></td>
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<tr>
<td>11:15 AM</td>
<td>Noise Exposure of Healthcare Personnel Working with Marching Band</td>
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<td><em>Jeffrey Russell, PhD, AT, FLADMS</em></td>
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<tr>
<td>10:00 - 10:45 AM</td>
<td><strong>WORKSHOPS</strong></td>
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<td>Noninvasive Pelvic Floor Evaluation and Treatment in Performers</td>
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<td><em>Steven Karageanes, DO, FAOASM</em></td>
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<td>The Performance Anxiety Toolbox: Techniques, Tools and Treatments For All Performers to Start</td>
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<td>Using NOW!</td>
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<td><em>Patrick Gannon, PhD</em></td>
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<td>A Turnout Measurement System and it's Functional Application for Assessment and Treatment of</td>
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<td>Dance Injuries for Clinicians</td>
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<td><em>Gayanne Grossman, PT, EdM, BFA</em></td>
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<tr>
<td>10:45 - 11:30 AM</td>
<td><strong>WORKSHOPS</strong></td>
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<td>Physiotherapy Treatment of Upper String Players with Thoracic Outlet Syndrome</td>
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<td><em>Regina Campbell, PT</em></td>
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<td>Brief Treatment for Performance Anxiety</td>
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<td><em>David Sternbach, MM, MSW</em></td>
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<td>Motor Control Training for the Hip: A Movement Session</td>
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<td><em>Sally Donaubauer, PT, DPT, OCS</em></td>
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<tr>
<td>11:30 - 1:30 PM</td>
<td>Lunch</td>
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<td>Special Event – DCI Marching Band Demonstration (PAMA Bus to Field)</td>
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<td>1:30 - 3:00 PM</td>
<td><strong>PLENARY</strong>&lt;br&gt;&lt;br&gt;<strong>Neuroplasticity of Motor Control: Part 1</strong>&lt;br&gt;&lt;br&gt;<em>Steven J Frucht, MD</em>&lt;br&gt;1:30 PM - 2:00 PM  &lt;br&gt;<strong>The Use of Real-time Magnetic Resonance Imaging in Performing Arts Research: Application to Brass Performance and Movement Disorders</strong>&lt;br&gt;<em>Peter Iltis, PhD</em>&lt;br&gt;2:00 PM - 2:30 PM  &lt;br&gt;<strong>Quantification of Instability of Tone Production in Embouchure Dystonia</strong>&lt;br&gt;<em>André Lee, MD (Alice G. Brandfonbrener Young Investigator Award Applicant)</em>&lt;br&gt;2:30 PM  &lt;br&gt;<strong>TataTataTakaTaka - Tonguing Performance on Wind Instruments - Visualization and Benchmarks</strong>&lt;br&gt;<em>Matthias Bertsch, PhD</em>&lt;br&gt;2:45 PM</td>
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<tr>
<td>1:30 - 2:15 PM</td>
<td><strong>WORKSHOPS</strong>&lt;br&gt;&lt;br&gt;<strong>Self-Management of Myofascial Pain Syndrome</strong>&lt;br&gt;<em>Jonathan Reynolds, PT, PhD</em>  &lt;br&gt;<strong>A Physiotherapeutical Approach to Functional Voice Disorders in Singers</strong>&lt;br&gt;<em>Heike Schemmann, MSc PT, BSc PT</em>  &lt;br&gt;<strong>Principles of Strength and Conditioning in Performing Arts</strong>&lt;br&gt;<em>Katie Rodrick, MS, ATC, PTA, CSCS</em></td>
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<tr>
<td>2:15 - 3:00 PM</td>
<td><strong>WORKSHOPS</strong>&lt;br&gt;&lt;br&gt;<strong>Mindfulness Practices: Healthy Approaches for Treating Bipolar Disorder &amp; Sensory-Processing Sensitivity in Performing Artists</strong>&lt;br&gt;<em>Kathline Colvin, PhD</em>  &lt;br&gt;<strong>Team Approach to Integrated Performing Arts Medicine: Case Studies</strong>&lt;br&gt;<em>Jayme Dowdall, MD</em>  &lt;br&gt;<strong>A Holistic Approach to Warming Up the Dancer</strong>&lt;br&gt;<em>Michelle Strong BS, MFA</em>  &lt;br&gt;<strong>3:00 - 3:30 PM</strong>&lt;br&gt;<strong>Poster Session - Networking – Break</strong></td>
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<tr>
<td>3:30 - 5:00 PM</td>
<td><strong>PLENARY</strong>&lt;br&gt;&lt;br&gt;<strong>Clinical Care on Broadway</strong>&lt;br&gt;<em>David Weiss, MD</em>&lt;br&gt;3:30 - 4:15 PM  &lt;br&gt;<strong>INAP/O - A Special Physical Therapy Outpatient Clinic for Musicians - the Next 356 Patients</strong>&lt;br&gt;<em>Christoff Zalpour, Prof. Dr. med.</em>&lt;br&gt;4:15 PM  &lt;br&gt;<strong>Concussion Knowledge of Theater Personnel</strong>&lt;br&gt;<em>Brooke Kapple, BS</em>&lt;br&gt;4:30 PM  &lt;br&gt;<strong>Outsmart Your Genes: The Epigenetic Approach to Peak Performance</strong>&lt;br&gt;<em>Lillie Rosenthal, DO</em>&lt;br&gt;4:45 PM</td>
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</tbody>
</table>
WORKSHOPS  3:30 - 4:15 PM

Performing Arts and Sports: Practitioners', Performers', and Administrators' Perspectives on Commonalities and Differences
Kate F. Hays, PhD (with Jim Whitehead, BA; Linda H. Hamilton, PhD; and David Murray, MM)

Doing Research: A Practical Workshop to Assist PAMA Researchers with Implementing their Research
Esther Chou, MEd, AT, CSCS

Strategies to Address Hearing Awareness and Preservation for the Student and Professional Musician
Benj Kanters, MM

5:00 PM

Athletes and the Arts Showcase - hosted by Randy Dick, MS
An intimate conversation with our Athletes and the Arts Ambassador - Amy Yakima (starring in Finding Neverland on Broadway)

6:00 PM

Welcome Reception - Everyone is welcome to attend!

Evening Program

Cultural Options around New York

Broadway Shows - Previous purchase required (pre-purchased tickets can be picked up at the PAMA registration desk)
7:00 pm - Finding Neverland - Lunt-Fontaine Theatre-205 W 46th St.
7:00 pm - Kinky Boots - Al Hirsfield Theatre - 302 West 45th St.

Thursday Poster Sessions

9:30 - 10:00 AM and 3:00 - 3:30 PM

Pep Band Member Noise Dosage and Noise-induced Hearing Loss Prevention: A Case Study
Evan Edwards, BM

The Perceptions of Injured Dancers by Uninjured Dancers in a University Setting
Moegi Yamaguchi, AT

Effectiveness of Plyometric Training on Collegiate Level Dancers' Vertical Jump Height and Horizontal Jump Distance
Carisa Armstrong, MFA

Development of a Novel Marker Set for the 3D Measurement of Upper Limb Kinematics in Violin and Viola Performance
Eduard Wolf, BSc

The Relationship and Direction of Worry in Creativity Among Secondary Dance Students
Alexandra Pooley, MSc
Dangerous Choreography
Daniel Huynh, BFA

A Dancers Process of Healing a Chronic Illness
Loren Sexton, BA

Moving to Connect: An Analysis of Dance/Movement Therapy and Pediatric Autism Spectrum Disorders
Morgan Bates, BA, BS

Friday, July 8, 2016

7:00 AM
Registration Opens

7:55 AM
Announcements - Moderator

8:00 AM
Neuroplasticity of Motor Control: Part 2
Juan Sanchez-Ramos, PhD, MD

8:30 AM
Putting Research into Clinical Practice
Bronwen Ackermann, PhD, MPH, PT, BAppSc(PT)

9:00 AM
How can we prevent death by lifestyle in performers? NOMC: Health of New Orleans Musicians
Bethany Ewald Bultman

9:30 - 10:00 AM
Poster Session - Networking – Break

10:00 - 11:30 AM
PLENARY 1 (concurrent)
Risk and Resilience of New Orleans Musicians and Hurricane Katrina: Identifying Factors of Vulnerability and Protection
James Morris, PhD, MSW

Christina Siomos, BSc, MBChB, MMus, LRAM
<table>
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<tr>
<th>Title</th>
<th>Time</th>
<th>Speaker(s)</th>
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<tbody>
<tr>
<td>LGBTQI Sensitivity in the Healthcare Setting</td>
<td>10:30 AM</td>
<td>Jason Hu, MD</td>
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<tr>
<td>Developing an Interdisciplinary Clinic for Instrumental Musicians’ Occupational Health: Programmatic Implications and Potential Translatable Models</td>
<td>10:45 AM</td>
<td>Serap Bastepe-Gray, MD, MM, MSOT, OTR (with Sarah Hoover, DMA)</td>
</tr>
<tr>
<td>The British Association for Performing Arts Medicine (BAPAM): A National Clinical and Educational Service for Performers</td>
<td>11:00 AM</td>
<td>Deborah Charnock, BSc, PhD, ATCL, MMus</td>
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<tr>
<td>Popular Musician Attitudes Regarding Mental Health Services</td>
<td>11:15 AM</td>
<td>Lloyd Berg, PhD</td>
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<tr>
<td>Plenary 2 (concurrent)</td>
<td>10:00 AM</td>
<td>Andrea Beghi, MD, ENT Specialist</td>
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<td>Muscle Balance and Motion Patterns - Design of a Multicentre EMG Study of Muscle Activity in Instrumentalists</td>
<td>10:15 AM</td>
<td>Dirk Moeller, Prof. PT</td>
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<tr>
<td>Anxiety's Effect on Muscle Activation and Fatigue in Trumpet Players: A Pilot Study</td>
<td>10:30 AM</td>
<td>Hannah Ramsey, BS, BA</td>
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<tr>
<td>Optimizing Body Gestures of Advanced Violinist with Motion Capture</td>
<td>10:45 AM</td>
<td>Emmanuel Bigand, Doctor Psychology</td>
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<td>A Retrospective Analysis of the Pre-Season Screen Used in a Professional Ballet Company with Recommendations for Improvements in the Screen</td>
<td>11:00 AM</td>
<td>Kevin Robinson, PT, DSc</td>
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<td>Are Musicians' Injuries Inevitable?</td>
<td>11:15 AM</td>
<td>Edna Golandsky</td>
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<td>Plenary 3 (concurrent)</td>
<td>10:00 AM</td>
<td>Jochen Blum, MD, PhD</td>
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<td>Physical Trauma and its Consequences for Musicians Careers</td>
<td>10:00 AM</td>
<td>Howard Nelson, PT, BM (with Pamela Frank, BM)</td>
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<td>Determining a Movement System Diagnosis and Treatment for a Career-Threatening Neck Injury to a Professional Violinist</td>
<td>10:15 AM</td>
<td>Nadine Rensing, BSc PT (with Heike Schiemann, MSc PT, BSc PT)</td>
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<tr>
<td>Musculoskeletal Demands in Violin and Viola Playing</td>
<td>10:30 AM</td>
<td>Isabel Artigues-Cano, BSc, MSc</td>
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<td>Hypermobility and Proprioception in the Finger Joints of Flautists</td>
<td>10:45 AM</td>
<td>Kevin Kappens, MSc, PT</td>
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<tr>
<td>Exercise and Stress Induced Hypoalgesia in Musicians with and without Shoulder Pain: A Randomized Controlled Crossover Study</td>
<td>11:00 AM</td>
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</tbody>
</table>
### The Role of the Hand in Healthy Technique
*Doug Johnson, MM, RN (with Dustin Hardwick, Assistant Professor, PT, DPT, PhD)  11:15 AM*

### WORKSHOPS  10:00 - 10:45 AM

**Postural Reintegration**  
*Philip Drube, M.MOMSc, MA, BA*

**A Comparison of the Physical Exercise and Nutrition Behaviors among College Music Majors**  
*Florence Fong, EdD*

**Prepare the Nervous System for Performance**  
*Betsy Polatin, MFA*

### WORKSHOPS  10:45 - 11:30 AM

**Empowering and Enhancing Artistic Development with Yoga for Musicians**  
*Kristen Queen, MM, BM*

**Sustainable Performer Wellness - Stress Reduction Through Music Therapy**  
*Michael Lahue, MT-BC*

**Performance Anxiety: Softening the "Grip"**  
*Jo Ann Staugaard-Jones, MA, BS*

### Lunch and/or PAMA Committee Meetings  

### PLENARY  1:30 - 3:00 PM

**Rockin' Physiology**  
*Tim Lightfoot, PhD, FACSM and Ritt Henn  1:30 - 2:15 PM*

**The Effective Use of Kinesthetic Training for Upper Extremity Pain in Musicians**  
*Kristie Kava, MS, PT, DScPT  2:15 PM*

**Torso and Bowing Arm 3D Joint Kinematics of Experienced Cellists**  
*Suzanne Wijisman, DMA, MMus, MA, BA (hons), BMus (Oberlin) (with Cliffion Chan, PhD, BPhysio(HonsI), GDMusic)  2:30 PM*

**Physiological Demands of Piano Performance: Differences in Repertoire and Levels of Experience**  
*Emma Redding, PhD  2:45 PM*

### WORKSHOPS  1:30 - 2:15 PM

**A Preventive Pedagogy: Body Stabilization for Musicians and Music Teachers**  
*Carina Joly, DMA, CAS*

**Coaching Musicians on Healthy Practice Habits Outside the Studio/Clinic**  
*Deanna McBroom, MM, BME*
## WORKSHOPS 2:15 - 3:00 PM

**Identification and Resolution of Postural Issues with Body Mapping Strategies**

*Lea Pearson, DMA, MA, BA, Licensed Andover Educator, CHC (with Teri Slade, BMus, Licensed Andover Educator; Claire Stefani, BA)*

“Ouch! Why does it hurt when I play?” Promoting Pain Prevention in Young Violinists through Pain Eradication and Education in University Level Violin Students

*Emma Peake, GTCL, LTCL, MA*

**Use of a Sport Video Analysis App in Correcting Faulty Dance Movement**

*Rose Schmieg, DHSc, MSPT*

### 3:00 - 3:30 PM

**Poster Session - Networking – Break**

## PLENARY 3:30 - 5:00 PM

**ALICE G. BRANDFONBRENER YOUNG INVESTIGATOR AWARD**

**Effects of Physical Symptoms on Muscle Activity Levels in Skilled Violinists**

*J. Matt McCrary, BS, BFA 3:30 - 4:00 PM*

**Pain among College Music Students and Faculty**

*Jeremy Stanek, MD, MM 4:00 PM*

**Reducing NIHL Risk in Collegiate Music Ensembles using Ambient Technology**

*Jason Powell, PhD 4:15 PM*

**Physical Characteristics of Instrumentalists as Predictors of Playing-related Musculoskeletal Disorders**

*Amanda Williamson, PT, DPT 4:30 PM*

**Sleep Disturbance amongst Performing Artists**

*Karolin Krell, M.Ost 4:45 PM*

### 5:00 PM

*Athletes and the Arts Showcase - hosted by Randy Dick, MS*

The Broadway Athlete - Join us for a conversation with Leanne Cope, star of An American in Paris currently performing on Broadway

## Evening Program

Cultural Options around New York

**Broadway Shows** - Previous purchase required (pre-purchased tickets can be picked up at the PAMA registration desk)

8:00 pm - An American in Paris - Palace Theatre - 1564 Broadway
8:00 pm - Beautiful - Stephen Sondheim Theatre - 124 W. 43rd St.
Friday Poster Sessions

9:30 - 10:00 AM and 3:00 - 3:30 PM

Arts Medicine for Veterans: Exploring Creative Strategies for Posttraumatic Stress Disorder
Mary Rorro, DO

Instrument Assisted Soft Tissue Mobilization (IASTM) Graston Technique® Treatment of Dance Injuries
Joshua Honrado, MS ATC

The Perception of Trust Between Athletic Trainers and Musical Performing Artists
Jenna Chinburg, BS, ATC

Intermittent Muscle Cooling as an Intervention to Prevent Musician Fatigue and Activity-induced Tremor
Lauren Jensen, BS

Does Music Therapy Help People With Temporal Lobe Epilepsy?
Mohammad-Parsa Hosseini, PhD Candidate

Acceptance and Commitment Therapy for the Treatment of Music Performance Anxiety: Preliminary Results of a Pilot Study Involving Student Vocalists
David Juncos, PsyD

Dietary Intakes of a Cohort of Elite Adult Dancers in New York City
Jennifer Burris, MS, RD, CNSC, CDE, CSG, CSSD

Flexibility and Range of Motion in Dancers: The Effects of Social Media and Competition on Physical and Psychological Health
Lily Ontiveros, BFA

Evaluating the Positive Effects of the Pilates Practice on Collegiate Level Dancers
Cassidy Paskett, BA

Yoga As A Form of Cross Training for Dancers
Amanda Masongsong, BFA, BS

Assessment of Diet Quality among Marching Artists
Colleen McConnell, BSE
# Saturday, July 9, 2016

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<tbody>
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<td>7:30 AM</td>
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<td>8:00 AM</td>
<td>Clinical Research in Professional Dance</td>
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<td>Marijeanne Liederbach, PhD, PT, ATC, CSCS</td>
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<td>8:30 AM</td>
<td>Hearing Loss Education and Prevention</td>
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<td>Marshall Chasin, AuD., reg. CASLPO; Joseph Montano, EdD; Dan Beck</td>
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<td>9:00 AM</td>
<td>Institutional Educational Interventions</td>
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<td></td>
<td>Aaron Williamon, PhD</td>
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<tr>
<td>9:30 - 10:00 AM</td>
<td>Poster Session - Networking – Break</td>
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<tr>
<td>10:00 - 11:30 AM</td>
<td>Plenary 1 (concurrent)</td>
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<tr>
<td></td>
<td>Achieving Successful Online Delivery of Musicians' Performance Health Education</td>
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<td></td>
<td>Bronwen Ackermann, PhD, MPH, PT, B.AppSc(PT) 10:00 AM</td>
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<td></td>
<td>Teaching the Physical Side of Violin Playing: An Instrumental Case Study</td>
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<td></td>
<td>Linnea Thacker, MMus 10:15 AM</td>
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<td></td>
<td>The Immediate Effects of Somatic Approach Workshops on Physical and Musical Aspects of Pianists' Performance</td>
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<td></td>
<td>Grace Wong, MA, G.Dip, BMus(Ed), ARCT 10:30 AM</td>
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<td></td>
<td>A Physiological Analysis of Current Violin Technique and Pedagogy</td>
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<td>Katelyn Richardson, BM, MME 10:45 AM</td>
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<td>Lost in the (Neuronal) Stars; Neurological Dysfunction and its Impact on Performing Musicians</td>
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<td>Heather O'Donnell, MM, BM, BSc 11:00 AM</td>
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<td>Is Stretching Detrimental for Music and Dance Performers? A Scoping Review</td>
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<td></td>
<td>Bonnie Robson, MD, FRCP (with Christine Gaptill, BMus, PhD, OT) 11:15 AM</td>
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<tr>
<td>10:00 - 11:30 AM</td>
<td>Plenary 2 (concurrent)</td>
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<td>Normative Concussion Baseline Values for Groups within the Dancer Population</td>
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<td>Lauren McIntyre, ATC 10:00 AM</td>
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<td>10:15 AM</td>
<td>Reliability and Validity of a Dance Outcomes Instrument. Part I. Comparison of the 16 Question DFOS to Knee, Foot and Ankle Outcomes Tools</td>
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<td>10:30 AM</td>
<td>Reliability and Validity of a Dance Outcomes Instrument. Part II. Comparison of the 14-Question DFOS to the SF-36</td>
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<td>10:45 AM</td>
<td>An Examination of the Relationship between Baseline Screening Scales</td>
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<td>11:00 AM</td>
<td>Updates on the Assessment and Management of Patellar Tendon Injury in the Dancer</td>
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<td>Adult Manifestation of Osgood-Schlatter Disease in Pre-Professional and Professional Dancers</td>
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<td>10:00 - 11:30 AM</td>
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<td>10:00 AM</td>
<td>Hearing Screening in Healthy Teachers of Singing and Voice Students at a State and Regional NATS Competition</td>
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<td>10:15 AM</td>
<td>Perceived Psychological and Laryngeal Health in Undergraduate Performing Arts Students</td>
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<td>10:30 AM</td>
<td>Double the Shows, Double the Fun? An Evaluation of the Effects of Vocal Loading in Professional Musical Theatre Performers Involved in Multiple Performances per Day: An Acoustic, Electroglosttographic Measures and Self-Perception Study</td>
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<td>10:45 AM</td>
<td>“Pulsed, Connected Giggle” - A Treatment Option for Singers with Essential Tremor</td>
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<td>11:00 AM</td>
<td>The Medical Complications of Eating Disorders</td>
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<td>10:00 - 10:45 AM</td>
<td>WORKSHOPS</td>
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<td>10:00 AM</td>
<td>Breathing, Stress, And Tension: How They Can Help And Hurt Performance, And How You Can Control Them</td>
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<td>Heart Rate Variability Biofeedback for Optimizing Performance: A Deeper Look at the Mind/Body Connection</td>
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<td>Respiratory Training for Positional Control, Performance &amp; Recovery</td>
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<td>11:30 - 1:30</td>
<td>Lunch and/or PAMA Committee Meetings</td>
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<td><strong>Special Event</strong> – Demonstration of a New Mobility Device for Differently-Abled Dancers - Merry Morris, MFA, PhD Candidate</td>
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<td>1:30 PM</td>
<td>Quantitative Performance Measurement Technology</td>
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<td>John Chong, MD FRCPC</td>
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<td>2:00 PM</td>
<td>Conditioning for Upper Extremity Use in Dancers</td>
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<td>Donna Krasnow, PhD</td>
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<td>2:15 PM</td>
<td>WORKSHOP</td>
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<td>Part 2 with Kevin Robinson Dancer Demo</td>
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<td>3:00 PM</td>
<td>Poster Session - Networking – Break</td>
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<td>Is Health Promotion among Musicians in Tune with the Evidence? Literature Review and Future Directions ('Better Practice')</td>
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<td>Raluca Matei 3:30 PM</td>
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<td>Vocal Health Protocols at Undergraduate Music Programs</td>
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<td></td>
<td>Allison Aaron, BA (with Emily Martin, DMA) 3:45 PM</td>
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<td>The Health of Instrumental and Vocal Music Teachers</td>
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<td>Naomi Norton, MA (Alice G. Brandfonbrener Young Investigator Award Applicant) 4:00 PM</td>
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<td>The Effect of an Educational and Prevention Course for University Music Students on their Body</td>
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<td>Awareness and Attitude towards Health and Prevention</td>
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<td>Kari Arnason, BSc 4:15 PM</td>
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<td></td>
<td>S.W.A.N.I.—A Novel Approach to Preventing Overuse Musculoskeletal Injuries among Middle School</td>
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<td>Orchestra Students</td>
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<td>Jarron Tilghman, MD (with Barbara O'Connor, OTR and Sherry Wann, BMusEd) 4:30 PM</td>
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<td>Lecture of Music Physiology at the University of Applied Sciences Osnabrueck, Germany</td>
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<td>Dirk Moeller, Prof. PT (with Heike Sehennmann, MSc PT, BSc PT and Christoff Zalpour, Prof. Dr. med.) 4:45 PM</td>
</tr>
</tbody>
</table>
PLENARY 2 (concurrent) 3:30 - 5:00 PM

Injury Rate, Risk, and Affected Body Part among Elite Collegiate vs Professional Dancers
Anna Katkovskaya  3:30 PM

Pre-professional and Professional Dancers' Experiences with Perfectionism in the Dance Environment
Kaleigh Ferdinand Pennock, MSc 3:45 PM

Risk of Depression in Chronic vs. Traumatic Forms of Dance Injury
Ken Peyser, MFA 4:00 PM

Elite Dancers and Cross-training: the Relationship between Self-reported Pre-season Cross-training and both Seasonal Injuries and Perception of Fatigue
John Paul Chan, BS 4:15 PM

Injury Rate among Dancers on Cruise Ships
Yenwen Kuo, MSc, BFA (Alice G. Brandfonbrener Young Investigator Award Applicant) 4:30 PM

Prevalence of Homohysteria in Dance
Joshua Honrado, MS ATC 4:45 PM

PLENARY 3 (concurrent) 3:30 - 5:00 PM

Influence of Task Variables on Execution Variability in Violin Bowing
Peter Stein, DC 3:30 PM

Augmented Reality: Using Motion Sensing Technology to Teach Action in Violin Playing
Marcel Trussell-Cullen, MMUS, MTeach, MA, BMus, GradDip IT 3:45 PM

Evaluation of the Perception of the Subjective Visual Vertical (SVV) and the Comfort in Two Types of Seats for Instrumentalists
Ana Velazquez Colominas, physiotherapist 4:00 PM

Playing Related Musculoskeletal Disorders (PRMD) Exposure Investigating Anthropometrics through Biomechanics
Jacqueline Henderson, PhD 4:15 PM

Hand Span, Upper Extremity Pain and Muscle Activation in Pianists
Jeffrey Russell, PhD, AT, FIALMS 4:30 PM

The Do’s, Don’ts, and Unexpected of a New Athletic Training Program in the Collegiate Dance Setting
Amanda Donahue, MS, ATC  4:45 PM

PLENARY 4 (concurrent) 3:30 - 5:00 PM

Physiology and Psychology of Keyboard Performance: A Course for College Students
Phyllis Lehrer 3:30 PM

All Hands on Keys: Strategies for Teaching Piano Students of Varying Hand Sizes
Jessica Johnson, DMA 3:45 PM

Cenesthetic Relaxation in Piano Technique
Pilar Leyva 4:00 PM

Vocal Fold Pseudocyst: Outcomes of Behavioral and Surgical Treatment
Christine Estes, MM, MA-CCL/SLP 4:15 PM
Physical and Psychological Health Profile of Music Students-a Cohort Study
Nikolaus Ballenberger 4:30 PM

Music Education and Music Therapy: Contact surfaces and Boundaries
Barbara Schnetinger, MMag.  4:45 PM

5:00 PM

Athletes and the Arts Showcase - hosted by Randy Dick, MS
Enter a journey of discovery around gender issues and how they impact performance and resilience - meet Bobbi Lancaster, the first transgender woman to qualify for the LPGA fulfilling her lifelong dream

Evening Program

Cultural Options around New York

Broadway Shows - Previous purchase required (pre-purchased tickets can be picked up at the PAMA registration desk)
8:00 pm - Something Rotten - St. James Theatre - 246 W. 44th
8:00 pm - King and I - Lincoln Center - Vivian Beaumont Theater - 150 West 65th Street

Saturday Poster Sessions

9:30 - 10:00 AM and 3:00 - 3:30 PM

Tension Precursors to Focal Dystonia
Hara Trouli, MD, MSc Performing Arts Medicine

Examination of the Physical Exertion of College Marching Musicians
Nancy Burns, MA

Effects of Bench Height Variation on Muscle Activation in Pianists
Sarah Welch

The Role of Occupational Therapy in performing Arts Medicine
Rebecca Barton, DHS, OTR, FAOTA

Performing Science Research Lab Vienna: EMG, EDA, LIPR, CAM RESP Studies
Matthias A. Bertsch, PhD

Assessing the Relationship between Iliopsoas Tightness and Lumbar Spinal Alignment among Dancers
Elizabeth Eyermann (with Aurianna Lajaunie, BS)

Assessment of Energy Availability among New York City Dancers
Kathleen Woolf, PhD, RD

The Female Athlete Triad and Carotenoderma
Dorothy Fink, MD
Encouraging Dancers to Strengthen the Upper Body Using Non-Weight Bearing Exercises
Nicole Hagen, BFA

Spondylolisthesis: a Dancer’s Perspective of the Effectiveness of Conservative and Surgical Treatment Methods
Kati Simpson

Physical and Psychological Effects of Massage Therapy on Dancers
Carolyn Oliver, BA, BS

How Dancers Deal with Pain
Gina Hesp, BA

Sunday, July 10, 2016

7:00 AM
Registration Opens

7:55 AM
Announcements - Moderator

PLENARY 1 (concurrent)  8:00 - 9:30 AM
Houston Methodist Hospital's Center for Performing Arts Medicine: Current clinical care approaches to injuries and medical conditions of the student and professional artist. Specialists include: Orthopedics, ENT, Ophthalmology, Internal Medicine, Obstetrics/Gynecology.
Todd Frazier, Dr Richard Fish, Dr Kevin Varner, Dr Eric Hanfrect, Dr Robert Jackson, Dr C Richard Stasney 8:00 - 9:30 AM

PLENARY 2 (concurrent)  8:00 - 9:30 AM
A Comparison of how Dancers Generate Angular Impulse to Initiate Pirouette and Pique Turns of Increased Rotational Demands
Antonia Zaferiou, PhD 8:00 AM

Professional and Student Dancers' Interest in Nutritional Counseling
Rachel Fine, MS, RD, CSSD, CDN 8:15 AM

Implications of Popular Dieting Practices in Dancers
Shannon Sterne, MS, MA, RDN 8:30 AM

Injury Prevention Videos Featuring a Teen Dance Company: A Collaborative Effort
Kendall Alway, DPT 8:45 AM
PLENARY 3 (concurrent)  8:00 - 9:30 AM

Injuries in Context: Impact of Touring and Performance Schedules on 1-year Injury Rates in a Modern Dance Company
Lily Wood, BS, BA  8:00 AM

Body and Instrument, Duet or Duel?
Grete Ege, Bachelor in physical therapy 8:15 AM

The Closed Piano Lid: Maximizing The Brain & Muscle Memory
Rose Grace, DMA, MM, BM 8:30 AM

Dancers Perceptions of Anatomy and its Relation to Movement
Jason Hu, MD  8:45 AM

Prevalence of Playing-related Musculoskeletal Pain among College-Level Musicians before and after Informative Lecture  
Caryn Pierce, MSPT 9:00 AM

"Spreading the Word" in Arts Medicine Via the Internet
Janice Plastino, PhD 9:15 AM

9:30 - 10:00 AM

Break - Networking

10:00 - 11:30 AM

Annual General Meeting, Install New PAMA Board of Directors, Wrap-up - Comments/Evaluations

11:30 AM

Adjourn
Invited Faculty

Bronwen Ackermann, PhD, MPH, PT, BAppSc(PT)
University of Sydney
Lidcombe, New South Wales, Australia

Dan Beck
Trustee of The Music Performance Trust Fund
Managing Partner, Big Honcho Media
New York, NY

Bethany Ewald Bultman
Co-Founding Director and Chair
New Orleans Musicians Assistance Foundation
New Orleans, LA

Marshall Chasin, AuD., reg. CASLPO
Doctor of Audiology
Director of Research and Chief Audiologist, Musicians’ Clinics of Canada
Associate Professor, University of Western Ontario
Adjunct Professor in Linguistics, University of Toronto
Queen Elizabeth II Silver Diamond Jubilee Medal
Toronto, Ontario, Canada

Richard J. Lederman Lecturer
Steven J Frucht, MD
Professor of Neurology
Director, Movement Disorders Division
Mount Sinai School of Medicine
New York, NY

Ritt Henn
Bass Player, Song Writer
New York, New York

Bobbi Lancaster, MD
Family Physician
HRC Volunteer
Champion Golfer
Arizona

Marijeanne Liederbach, PhD, PT, ATC, CSCS
Director, Harkness Center for Dance Injuries
NYU Langone Medical Center Hospital for Joint Diseases
New York, NY
Tim Lightfoot, PhD, FACSM
Professor & Director, Huffines Institute
Texas A&M University
College Station, TX

Alice G. Brandfonbrener Young Investigator Award
J. Matt McCrary, BS, BFA
PhD candidate, Discipline of Biomedical Sciences
Sydney Medical School, The University of Sydney
Darlinghurst, New South Wales, Australia

Joseph Montano, EdD
Chief of Audiology and Speech Language Pathology
New York Presbyterian Hospital-Weill Cornell Medical Center
New York, NY

Richard J. Lederman Lecturer
Juan Sanchez-Ramos, PhD, MD
Helen Ellis Professor of Neurology
University of South Florida
Tampa, FL

Michael G. Stewart, MD, MPH
Professor & Chairman, Department of Otolaryngology-Head and Neck Surgery
Vice Dean of the Medical College
E. Darracott Vaughan MD Senior Associate Dean for Clinical Affairs
Weill Cornell Medical College
Otolaryngologist-in-Chief, NewYork-Presbyterian Hospital/Weill Cornell Medical Center
New York, NY

David Weiss, MD
Clinical Associate Professor, NYU School of Medicine
Associate Director, Harkness Center for Dance Injuries
Hospital for Joint Diseases, NYU Langone Medical Center
Department of Orthopaedic Surgery
New York, NY

Jim Whitehead, BA
Executive Vice President/CEO
American College of Sports Medicine/
Exercise is Medicine Global Health Initiative
Indianapolis, IN

Aaron Williamon, PhD
Professor of Performance Science
Royal College of Music, Centre for Performance Science
London, United Kingdom
## Abstract Presenters

<table>
<thead>
<tr>
<th>Presenters</th>
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<tbody>
<tr>
<td>Allison Aaron, BA (with Emily Martin, DMA, BM)</td>
<td>Christine Estes, MM, MA-CCC/SLP</td>
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<tr>
<td>Bronwen Ackermann, PhD, MPH, PT, GDipWHS</td>
<td>Jeanne Even</td>
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<td>Kendall Always, DPT</td>
<td>Elizabeth Eyermann (with Arianna Lajaunie, BS)</td>
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<td>Liliana Araujo, PhD</td>
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<td>Dorothy Fink, MD</td>
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<td>Isabel Artigues-Cano, BSc, MSc</td>
<td>Anncristine Fjellman-Wiklund, PhD, RPT</td>
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<td>Nikolaus Ballenberger</td>
<td>Florence Fong, EdD</td>
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<td>Rebecca Barton, DHS, OTR, FAOTA</td>
<td>Todd Frazier</td>
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<td>Serap Bastepe-Gray, MD, MM, MsOT, OTR (with Sarah Hoover, DMA)</td>
<td>Patrick Gannon, PhD</td>
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<td>Morgan Bates, BA, BS</td>
<td>Edna Golandsky</td>
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<td>Andrea Beghi, MD</td>
<td>Rose Grace, DMA, MM, BM</td>
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<td>Lloyd Berg, PhD</td>
<td>Gayanne Grossman, PT, EdM, BFA</td>
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<td>Ovidio Bermudez, MD, FAAP, FSAHM, FAED, Faiacdp, CEDS</td>
<td>Christine Guptill, BMus, PhD, OT (with Bonnie Robson, MD)</td>
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<td>Matthias Bertsch, PhD</td>
<td>Nicole Hagen, BFA</td>
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<td>Emmanuel Bigand, Doctor psychology</td>
<td>Lucinda Halstead, MD</td>
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<td>Jochen Blum, MD, PhD</td>
<td>Sebastien Hamel</td>
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<td>Kathleen Bower, DPT</td>
<td>Lindsay Harmon-Matthews, PT, DPT, OCS, MPH</td>
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<td>Shaw Bronner, PhD, PT, OCS</td>
<td>Melissa Hatheway, BME (with Alyssa McPherson, MS, LAT, ATC, OTC, CSCS)</td>
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<td>Véronique Brouillette, BS</td>
<td>Kate F. Hays, PhD (with Jim Whitehead, BA, Linda H. Hamilton, PhD, David Murray, MM)</td>
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<td>Mary Burns, PhD, PMA Certified</td>
<td>Jacqueline Henderson, PhD</td>
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<td>Nancy Burns, MA</td>
<td>Gina Hesp, BA</td>
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<td>Jennifer Burris, MS, RD, CNSC, CDE, CSG, CSSD</td>
<td>Joshua Honrado, MS</td>
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<td>Regina Campbell, PT</td>
<td>Mohammad-Parsa Hosseini, PhD Candidate</td>
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<td>Cliffton Chan, PhD, BPhysio(HonsI), GDMusic</td>
<td>Jason Hu, MD</td>
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<td>John Paul Chan, BS</td>
<td>Daniel Huynh, BFA</td>
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<td>Deborah Charnock BSc PhD ATCL, MMus</td>
<td>Peter Ilitis, PhD</td>
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<td>Jenna Chinburg, BS, ATC</td>
<td>Mitchell Isaac, BS</td>
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<td>John Chong, MD, FRCP</td>
<td>Lauren Jensen, BS</td>
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<td>Esther Chou, MEd, AT, CSCS</td>
<td>Doug Johnson, MM, RN (with Dustin Hardwick, Assistant Professor, PT, DPT, PhD)</td>
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<td>Kathline Colvin, PhD</td>
<td>Jessica Johnson, DMA</td>
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<td>Sheri Cook-Cunningham, PhD (presented by Natalie Benafield, AuD CCC-A)</td>
<td>Carina Joly, DMA, CAS</td>
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<td>William Dawson, MD</td>
<td>David Juncos, PsyD</td>
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<td>Kathleen Delaney, MA</td>
<td>Benj Kanters, MM</td>
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<td>Amanda Donahue, MS, ATC</td>
<td>Brooke Kapple, BSc</td>
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<td>Sally Donaubauer, PT, DPT, OCS</td>
<td>Steven Karageanes, DO, FAOASM</td>
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<td>Jayme Dowdall, MD</td>
<td>Anna Katkovskaya</td>
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<td>Philip Drube, M.MOMSc, MA, BA</td>
<td>Kristie Kava, MS, PT, DScPT</td>
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<td>Evan Edwards, BM</td>
<td>Elliana Kirsh, BM, BS</td>
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<td>Grete Ege, Bachelor in physical therapy</td>
<td>Donna Krasnow, PhD</td>
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Yenwen Kuo, MSc, BFA
Kevin Kuppens, MSc, PT
Michael Lahue, MT-BC
André Lee, MD
Sang-Hiee Lee
Paul Lehrer, PhD
Phyllis Lehrer
Pilar Leyva
Amanda Masongsong, BFA, BS
Raluca Matei
Deanna McBroom, MM, BME
Colleen McConnell, BSE
Lauren McIntyre, ATC
Dirk Moeller, Prof. PT
James Morris, PhD, MSW
Merry Morris, MFA, PhD Candidate
Michael Mullin, ATC, PTA, PRC
Howard Nelson, PT, BS (with Pamela Frank, BM)
Heather O'Donnell, MM, BM, BSc
Sheyi Ojofeitimi, PT, DPT, OCS, CFMT
Carolyn Oliver, BA, BS
Lily Ontiveros, BFA
Cassidy Paskett, BA
Emma Peake, GTCL LTCL MA
Lea Pearson, DMA, Licensed Andover Educator, CHC (with Teri Slade, BMus, Licensed Andover Educator, and Claire Stefani, BA)
Judith Peterson, MD
Ken Peyser, MFA
Caryn Pierce, MSPT
Janice Plastino, PhD
Betsy Polatin, MFA
Alexandra Pooley, MSc
Kristen Queen, MM, BM
Susan Raeburn, PhD
Emma Redding, PhD
Igor Eduardo Reis Urbano
Nadine Rensing, BSc PT
Jonathan Reynolds, PT, PhD
Katelyn Richardson, BM, MMSE
Kevin Robinson, PT, DSc
Katie Rodrick, MS, ATC, PTA, CSCS
Katherine Rohrer, MM, BME
Mary Rorro, DO
Lillie Rosenthal, DO
Hannah Rumsey, BS, BA

Jeffrey Russell, PhD, AT, FIADMS
Leigh Schanfein, MS
Heike Schmieg, MSc PT, BSc PT
Rose Schmieg, DHSc, MSPT
Barbara Schnetzinger, MMag.
Loren Sexton, BA
Selina Shah, MD FACP
Kati Simpson
Christina Siomos, BSc, MBChB, MMus, LRAM
Jo Ann Staugaard-Jones, MA, BS
Peter Stein, DC
Anke Steinmetz, MD
David Sternbach, MM, MSW
Shannon Sterne, MS, MA, RDN
Michelle Strong, BS, MFA
Lucian Sulica, MD
Linnea Thacker, MMus
Jarron Tilghman, MD (with Barbara O'Connor, OTR and Sherry Wanne, BMusEd)
Hara Trouli, MD, MSc
Marcel Trussell-Cullen, MMUS MTeach MA, BMus GradDip IT
Ana Velazquez Colomina, Physiotherapist
Sarah Welch
Suzanne Wijsman, DMA, MMus, MA, BA (hons), BMus (Oberlin)
Elaine Winslow-Redmond, MS, ATC, EMT-B, ART
Eduard Wolf, BSc
Grace Wong, MA, G.Dip, BMus(Ed), ARCT
Lily Wood, BS, BA
Kathleen Woolf, PhD, RD
Luís Xarez, PhD
Moegi Yamaguchi, AT
Janice Ying, PT, DPT, OCS (with Erin Hayden, PT, DP OCS)
Antonia Zaferiou, PhD
Christoff Zalpour, Prof. Dr. med.
Notes
As researchers continue to explore the many facets of performing arts medicine (PAMed), several different research methods can be employed to better understand our multi-disciplinary field. Survey research is one descriptive research method that can be used to understand participants' thoughts, feelings, practices, and behavior about a variety of issues. Survey research can also help researchers understand PAMed demographics, epidemiology, and etiology such as the status of a health condition or a situation specific to performing artists and PAMed practitioners. In addition to qualitative (e.g., non-numerical) responses, researchers can also quantify participant responses through statistical coding and provide meaningful data (e.g., frequencies, correlations, regression analyses) to help researchers make inferences or predictions about artists' and PAMed practitioners' feelings, practices, and reported behavior. While survey research may initially seem like an easy process that can be performed by simply asking questions, this is a common misconception. Conducting good survey research requires appropriate skills to develop, orchestrate, and conduct rigorous research to draw meaningful conclusions. The aims of this presentation are to discuss key considerations when conducting survey research including: (1) formulating clear research questions, (2) choosing appropriate sampling parameters, (3) developing a vetting committee, (4) deciding correct data collection strategies, (5) constructing well-defined items and questionnaires, (6) implementing proper vetting and approval processes, (7) piloting the survey, and (8) conducting the survey research project. Understanding key steps in conducting a strong survey research study can decrease the risk of ethical problems, or inappropriate data analyses and interpretation. Survey research methods cannot examine all research questions, and are dependent on participant self-reports. Still, well designed survey research questionnaires, data collection, and analyses can result in meaningful qualitative and quantitative information that can help performing artists. At the end of the presentation, we expect that attendees will understand the survey research processes and recognize how to use survey research to improve performing artists' health and well-being.

Useful References:


"It Hurts When I play": A Systematic Review of Incidence and Prevalence of Instrumental Musicians' Playing-related Musculoskeletal Injuries Across the Lifespan

Christine Guptill, BMus, BSc, MSOT, PhD, University of Alberta, Edmonton, Alberta, Canada
Bronwen Ackermann, PhD, PT, University of Sydney, Australia
John Chong, ARCT, MD, FRCSC, Musicians' Clinics of Canada, Hamilton, Ontario, Canada

Background: Playing-related health problems in instrumental musicians are poorly recognized by healthcare practitioners, and ill-defined in the clinical literature. However, studies have found a range of prevalence rates, from 37 to 87%. A single systematic review of incidence and prevalence was conducted in the field of performing arts health in 1998. Since this time, research in musicians' health has increased; however no review has been conducted to that includes this wealth of research from childhood through retirement.

Purpose(s)/Aim(s): The purpose/aim of this study was to report the prevalence, incidence and risk factors of instrumental musicians' playing-related musculoskeletal injuries across the lifespan, particularly since 1998.

Methods: A team of researchers, including an expert in systematic reviews; an expert in musicians' health research; and a science librarian, are conducting the review. A member of this team previously conducted a scoping review in order to capture the breadth of the available literature. Databases searched include Medline, EMBASE, CINAHL, Web of Science, and SCOPUS. In addition, the bibliographies of relevant papers were searched, and the journal Medical Problems of Performing Artists online archive was hand searched in order to extract all relevant papers. The librarian was verified the search strategy.

Results: The study is currently in progress.

Conclusions and Practical Relevance: A current understanding of the prevalence and, where possible, incidence, of these problems is essential to designing effective prevention and treatment practices. This understanding is also essential for organizations that employ musicians, funding agencies, and unions.
The Prevalence of Generalized Joint Hypermobility and Joint Hypermobility Syndrome in a Cohort of Elite Australian Dancers

Cliffton Chan, PhD, BPhysio(HonsI), University of Sydney, New South Wales, Australia
Feili Zhang, BAppSci(Physio), University of Sydney, New South Wales, Australia
Luke Hopper, PhD, BSci(Hons), Edith Cowan University, Western Australia, Australia
Verity Pacey, PhD, BAppSci(Physio), Macquarie University, New South Wales, Australia
Leslie Nicholson, PhD, BAppSci(Physio), University of Sydney, New South Wales, Australia

Background: Joint hypermobility in select joints is often considered advantageous for dancers. However, Generalized Joint Hypermobility (GJH) and Joint Hypermobility Syndrome/Ehlers Danlos Syndrome-Hypermobility Type (JHS/EDS-HT) may negatively impact a dancer’s career. The prevalence of these conditions among dancers varies across different experiential cohorts and has not been extensively researched to date using stringent measures.

Purpose(s)/Aim(s): The purpose/aim of this study was to determine the prevalence of GJH and JHS/EDS-HT among elite dancers using a range of established outcome measures.

Methods: Eighty-five pre-professional and professional dancers were tested using four physical measures: GJH was determined using the Beighton score (cut-point ≥5/9) and the Lower Limb Assessment Scale (LLAS) (cut-point ≥6/12), while the presence of JHS/EDS-HT was assessed using the Brighton and Villefranche criteria. The prevalence of GJH and JHS/EDS-HT was calculated using the four outcome measures. Paired sample t-tests were performed to determine any differences between the two GJH and the two JHS/EDS-HT outcomes. Secondary analysis was conducted comparing GJH and JHS prevalence between pre-professional and professional dancers, as well as for any gender differences.

Results: 72% of dancers met the Beighton score for GJH, 41% for the LLAS left, and 49% for the LLAS right. A significant difference was found between the Beighton and the LLAS left and right outcomes (both p<0.05). 29% of dancers met the Brighton criteria for JHS/EDS-HT and 84% met the Villefranche criteria (p<0.001). Secondary analysis revealed a higher prevalence of GJH in professional than pre-professional dancers for the LLAS left and right outcomes (both p<0.001). Gender differences were found for age, mean Beighton score, the Beighton criteria (cut-point ≥5/9), left LLAS mean score and the Brighton Criteria (p<0.05).

Conclusions and Practical Relevance: A high prevalence of GJH and JHS/EDS-HT existed among elite dancers regardless of criteria used. The LLAS is a more specific measure of lower limb hypermobility than the Beighton score, while the Brighton criteria may more accurately measure the prevalence of JHS/EDS-HT than the Villefranche. Professional dancers demonstrated a higher prevalence of lower limb hypermobility than pre-professional dancers. We recommend using a higher Beighton and LLAS cut-off score than what is traditionally used for the general population when identifying GJH or JHS/EDS-HT in elite dancers.

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Acquired Sound Doses and Hearing Health of Music Student Interns

Sheri Cook-Cunningham, Ph.D., University of Central Arkansas, Conway, Arkansas, USA
Natalie Benafield, Au.D, University of Central Arkansas, Conway, Arkansas, USA

**Background:** Recent research has documented an increase of noise induced hearing loss (NIHL) over the past 25 years, particularly among musicians. NIHL usually presents as an audiometric notch in the 3 to 6 kHz range. It is gradual and cumulative, often going unnoticed until after the damage has already occurred. For musicians, hearing loss in the upper frequencies can result in an inability to correctly match pitch or correctly respond to dynamic changes, resulting in over-singing or overplaying.

**Purpose(s)/Aim(s):** The purpose/aim of this presentation was to document hearing doses among student musicians (N = 70) during a typical week of student teaching, study, playing, and performing through the use of personal noise dosimeters. Results from this study will assist music students in making informed hearing health decisions.

**Approach of Presentation:** Participants (N = 70) of this study were college music students at a southern mid-size university. All participants received two complete audiological examinations, one prior to the study and the second exam took place the week after the wearing of the noise dosimeter. Study participants wore a Cirrus CR:110A doseBadge (CR dBAdge) personal noise dosimeter for four consecutive days during their normal teaching and playing activities. The dosimeters measured continuous sound pressure levels during the eight-hour time frame. The dosimeters were calibrated to NIOSH standards with a 100% daily dose equaling an eight-hour exposure to a continuous 85 dB(A) noise with a 3 dB exchange rate.

**Content of Presentation:** Results indicated that 67% of the participants obtained high sound doses on at least two of the four days studied. A sub-set of participants, Music Student Interns (n = 7) was further examined. The results from the post-audiological exams indicated that two of the seven music student interns exhibited clinically significant threshold changes after their student teaching. One intern was tested post-placement only and showed a possible noise notch. Student teachers in instrumental classrooms received the highest doses during the measurement period.

**Conclusions and Practical Relevance:** The Music Department and Communication Sciences and Disorders Department are using the results of this study to further develop the hearing awareness and conservation program. Noise exposure guidelines and hearing conservation measures are being fully integrated into the music curriculum.

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Musculoskeletal Injury and Pain in Drum Corps Participants

Melissa Hatheway, BME, Lone Star High School, Band Director, Lewisville, Texas, USA
Alyssa McPherson, MS, LAT, ATC, OTC, CSCS, Indiana University, Bloomington, Indiana, USA

Background: Previous research has demonstrated the intense physical demands of marching band, as well as the associated high rates of musculoskeletal health concerns. Drum corps activity, however, includes even greater rates of physical and mental demands than traditional marching band. This creates the possibility of increased musculoskeletal injury. Drum corps members also participate in lengthy performance tours around the country, which may also affect their injury rates and ability to access appropriate healthcare. Unfortunately, no study to-date has examined the specific musculoskeletal health concerns of drum corps participants.

Purpose(s)/Aim(s): The purpose/aim of this study was to explore the musculoskeletal health issues experienced by marching artists participating in the 2015 Drum Corps International (DCI) season.

Methods: Nine-hundred and thirty-six drum corps participants (age=18.56±1.39 yrs; sex=522 male, 403 female [7 prefer not to answer]; drum corps experience:=1.96±2.11 yrs) volunteered and gave informed consent to participate in this study. Subjects were invited to participate if they were active in the 2015 Drum Corps International season. Each participant completed an online epidemiological questionnaire via the Qualtrics survey platform. This questionnaire included questions regarding general demographics, rehearsal habits, healthcare access, injury information, and experiences of pain during the season.

Results: Statistical analysis is on-going. However, preliminary analysis has revealed that 478 participants (52%) experienced musculoskeletal injury during the course of the season, with 83% of those experiencing at least one single-incident injury, and 61% experiencing at least one overuse injury. Only 57% of drum corps participants had consistent access to a healthcare provider while on-tour, and 58% experienced musculoskeletal pain (outside of that associated with a specific injury.) Further analysis will focus primarily on exploring the types of musculoskeletal injuries that were encountered by participants, as well as the factors surrounding those injury occurrences.

Conclusions and Practical Relevance: Drum corps participants experience a high rate of musculoskeletal injury and pain, but have low access to consistent, qualified healthcare while on tour. Any further correlations and relevant findings revealed in the data will be transformed into recommendations for further resources for drum corps participants.

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Noise Exposure of Healthcare Personnel Working with Marching Band

Jeffrey A. Russell, PhD, AT, FIADMS; Ohio University, Athens, Ohio USA
Moegi Yamaguchi, MS, AT; Ohio University, Athens, Ohio USA

Background: Undoubtedly loud music levels can impair hearing. Marching band has received comparatively little attention; yet, its heavy percussion and brass orientation presumably contribute to hearing loss. Thus, healthcare personnel who work with marching band, in addition to marching musicians themselves, may be subjected to high noise levels when working at marching band rehearsals and performances.

Purpose(s)/Aim(s): The purpose/aim of this study was to determine the noise levels to which healthcare practitioners working with marching band are exposed.

Methods: Athletic trainers (ATs) working with a well-known American university marching band volunteered. During the marching band season, the ATs wore Etymotic ER-200D dosimeters whenever working with the band. For comparison, a dosimeter was worn by an AT working in the university’s performing arts medicine clinic. Participants did not alter their typical duties during any data collection sessions. Noise data were collected with the dosimeters set at the NIOSH standards of 85dBA threshold and 3dBA exchange rate; the NIOSH 100% daily dose is an exposure to 85dBA over 8 hours. Dose data for each session were standardized for comparison by dividing the dose percentage by the duration of the exposure and setting the NIOSH standard as a factor of 1.0.

Results: We collected data from 65 rehearsals (R), 38 performances (P), and 13 clinic sessions (C). Mean doses were significantly different from one another (p<0.0005): R, 17±19%; P, 203±158%; and C, 2±1%. The largest doses occurred during performances, with a range of 2% to 557% of the NIOSH recommended dose occurring in 6.5 hours or less; the highest levels were at football game performances. Mean standardized dose factors compared to the 1.0 NIOSH factor were: R, 1.24 times NIOSH; P, 5.24 times NIOSH; and C, 0.04 times NIOSH.

Conclusions and Practical Relevance: Our results suggest that healthcare providers working with marching bands are exposed to dangerous levels of noise during performances. This is especially true at venues such as football stadiums, where crowd noise and public address systems add to the dosage levels. Hearing protection should be required for all healthcare staff who work with marching bands. Moreover, our results should inform hearing protection practices for marching musicians and directors.

Key References:

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Noninvasive Pelvic Floor Evaluation and Treatment in Performers

Steven Karageanes, DO, St Mary Mercy Hospital, Plymouth, Michigan USA

Purpose(s)/Aim(s): The purpose/aim of this presentation is to teach attendees that treating pelvic floor dysfunction with noninvasive techniques can help improve various painful and recurrent musculoskeletal conditions in dancers and performers.

Approach of Presentation: Hands-on workshop

Content of Presentation:
1. Clinical relevance of pelvic floor dysfunction
2. Anatomy: specific structures of the pelvic floor, including sacrotuberous ligament
3. Correlation: how pelvic floor structures interact with lumbosacropelvic structures and exacerbate painful conditions like lumbar disc disease, snapping hip syndromes, sacroiliitis and ankle impingement
4. Problem: pelvic floor is rarely evaluated during physical exam, poorly understood in relation to its surrounding structures, and rarely treated because conventional physical therapy involves invasive techniques that few clinicians can or want to perform on a patient who may not even have pain in that location
5. Treatment: showing each attendee noninvasive techniques on how to manually treat pelvic floor dysfunctions

Conclusions and Practical Relevance:
1. Pelvic floor dysfunction is much more common in performers than currently understood
2. Pelvic floor dysfunction often exists without pelvic floor pain, urinary, sexual, or gynecological symptoms
3. Pelvic floor dysfunction is a factor in many common conditions that are difficult to eliminate, such as low back pain, sacroiliitis, and snapping hip syndromes
4. The pelvic floor should be included in any physical exam involving problems in the lower half of the body
5. Clinicians can use noninvasive manual techniques without disrobing the patient to treat pelvic floor dysfunction alone or in conjunction with various other conditions
The Performance Anxiety Toolbox: Techniques, Tools and Treatments For All Performers to Start Using NOW!

Patrick Gannon, PhD Peak Performance Systems, San Francisco, California, USA

**Background:** Clinical experience treating MPA and other anxiety disorders/trauma/attachment disorders. Knowledge of the latest clinical and neuroscience research on MPA. Knowledge of new technologies and treatments for anxiety disorders.

**Purpose(s)/Aim(s):** The purpose/aim of this presentation to provide performers with the latest knowledge about the tools, techniques and treatments for performance anxiety

**Approach of Presentation:** Lecture, video presentation and Q & A.

**Content of Presentation:** This workshop will begin with a reconceptualization of MPA that builds on Kenny's (2011) work that expands on Barlow's emotionally-based triple vulnerability model. In this conceptualization, there are five sources of anxiety that generate the MPA symptoms across all five categories of symptoms. Underlying sources of anxiety that overwhelm the performer's psychological defenses and conscious coping strategies as the performance approaches is what results in MPA symptoms. The diversity and intensity of these symptoms determines the severity of the MPA in general, whether the performance is ultimately affected or not. MPA is not just a state anxiety. MPA needs to be seen as a full-blown anxiety disorder that persists over time and is reinforced by performance experiences. Treatment needs to be multi-modal and performers need to take an active role in managing MPA over time until their confidence levels are either established or restored. This information will be applied to the self-assessment inventories for MPA that attendees can download and fill out on the spot or later on. Using this self-assessment, attendees will identify their own symptom profile which will become the basis for their own personal treatment plan. Tools, techniques and treatments of MPA will then be described in depth with special emphasis on how to apply them those before, during and after performances. The use of beta-blocker medication will be reviewed.

**Conclusions and Practical Relevance:** This workshop will offer an overview of the best practices for addressing performance anxiety that can be employed to support optimal performance.


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A Turnout Measurement System and Its Functional Application for Assessment and Treatment of Dance Injuries for Clinicians

Gayanne Grossman, PT, EdM, BFA, Muhlenberg College and Lehigh Valley Health Network, Allentown, Pennsylvania, USA

Background: Dance injury rates can be 60%-80% per year in dancers over 16 years of age and higher in professional dancers. Children as young as 8 y/o can have injury rates greater than 10%-20%. The etiology of many of injuries is poor use of turnout. Dancers and their dance teachers rarely know in degrees how much turnout to employ in dance training. Unfortunately, this can also be true with health care providers. Over turning out and under turning out can have injurious consequences to the spine, pelvis, and lower extremities. Rehabilitation is less effective or ineffective when this is not corrected.

Purpose(s)/Aim(s): The purpose of this presentation is to train clinicians to measure whole leg passive, active, functional turnout and compare the differences. The clinicians will learn manual and cueing techniques to correct the differences between active and passive turnout.

Approach of Presentation: A physical therapist with 27 years of experience caring for dancers from professionals to beginners will first instruct the participants in the theory of a systematic approach for measuring active and passive whole leg turnout. The physical therapist will then demonstrate these turnout measurement techniques and review hip measurements for ROM and restriction of motion that are specific to compensatory motor control patterns in dancers who are not turning out well. The participants will practice the measurement techniques. These measurements and a corrective program will also be demonstrated on volunteer dancers.

Content of Presentation: A turnout measurement system validated by MRI, retroreflective marker and goniometry. Assessment techniques for other soft tissues affecting hip and pelvic alignment that are valid and reliable. Application of these measurements and techniques to the dancing body.

Conclusions and Practical Relevance: Much attention has been played to turnout world-wide and it is thought that proper use can improve a career and prevent injuries. Yet, thorough whole leg assessment techniques that compare active and passive turnout and a corrective approach that corrects soft tissue restriction and motor control deficits are frequently overlooked. There is little in the current literature that instructs clinicians on measurement techniques and how to employ them in the clinic. This workshop is specifically targeting those in clinical practice who treat or wish to treat dancers.

Key References:

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Physiotherapy Treatment of Upper String Players with Thoracic Outlet Syndrome

Regina Campbell, PT, Performing Arts Physical Therapy, PC, Boston, Massachusetts, USA

Instrumental musicians require highly developed neuromuscular control of the hands and upper extremities. Rapid, complex and coordinated movements are required to play stringed instruments. Musicians who play stringed instruments are in particularly awkward postures for prolonged periods of time. These awkward postures can lead to compression of the brachial plexus at the thoracic inlet and result in what we know as Symptomatic Thoracic Outlet Syndrome. This diagnosis is fairly rare amongst the general population, but quite common in musicians. The condition can result in impaired sensation, coordination and motor control of the hands, and hence, impair playing technique. The purpose of this workshop is to review physiotherapy treatment strategies for upper string players with Thoracic Outlet Syndrome.

In this workshop, I will briefly review common evaluation findings of Thoracic Outlet Syndrome. Progression of the rehabilitation treatment program will be described and demonstrated in detail including myofascial release, thoracic spinal mobilization, stretching exercises, neurodynamic stretches, sensory integration techniques, core strengthening and scapular strengthening. Postural assessment with the instrument and its effect on the brachial plexus will be reviewed. Special considerations of the instrumental set up will also be examined including shoulder rests and chin rests. An incremental return to playing strategy to avoid stress on the brachial plexus will also be outlined.

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Thursday, July 7, 2016 – 10:45 – 11:30 AM – Concurrent Workshop

**Brief Treatment for Performance Anxiety**

David Sternbach, MM, MSW, George Mason University, North Bethesda, Maryland, USA

**Background:** A licensed, board certified clinician for over 30 years with a specialty practice treating musicians, dancers and others with performance issues. Since 1986, a writer, speaker, and educator on musicians’ psychological and physical health issues with presentations made in workshops and speeches to musicians, teachers and music students throughout the United States and Europe. Have given seminars to health professionals and researchers at regional, national, and international conferences, including OSHA’s International Occupational Safety and Health Symposia. Authored over 100 articles on musicians’ issues in medical journals, educational association journals, and musicians’ publications. From 2001 to 2009, founder and director of the Center for Arts and Wellness at George Mason University, a program established to disseminate information on musicians’ health issues. Created the class and wrote the textbook for GMU’s required course, “Wellness Practices for Musicians.” Thirty years’ experience as a performer in symphony and opera orchestras in the United States and Europe, in chamber music programs, as a recitalist, and as a conservatory and university teacher.

**Purpose:** Present and teach a technique for rapid treatment of performance anxiety.

**Approach:** Didactic and experiential.

**Content:** Review past and current approaches for treating stage fright and introduce the conceptual basis for this treatment approach, utilizing principles from Cognitive Therapy, Neuro-Linguistic Programming and meditation. Case studies will be presented, the technique demonstrated, and an experiential exercise utilizing this approach will be taught, with time for Q&A and discussion.

**Conclusions and Practical Relevance:** Many performers, regardless of how well they perform, suffer from severe state fright. Looming anticipation can appear days, weeks, even months before critical performances. Further, a slip onstage can be traumatic, generating painful flashbacks that resemble PTSD. Stage fright can result in students leaving music programs and can cost professionals their careers. Most performers and students have limited time and financial resources to invest in treatment programs. This technique offers clinicians an alternative approach that is brief, cost-saving and effective. I have successfully used this approach in my professional practice for clients ranging from conservatory students to internationally known performers.
Motor Control Training for the Hip: A Movement Session

Sally Donaubauer, PT, DPT, OCS, Cleveland Clinic, Cleveland, Ohio, USA

Background: Hip injuries including anterior hip impingement syndrome and acetabular labral tears are common in dancers. These injuries are commonly due to overuse/repetitive trauma which suggests that muscle imbalances, improper technique, and poor mechanics may be contributing factors. Exercises geared towards rehabilitation and prevention of these injuries need to include details for fine-tune control, as dancers are masters of producing the movements that are asked of them, but may not use the most optimal movement strategies to achieve them.

Purpose(s)/Aim(s): The purpose/aim of this presentation is to educate attendees about the importance of motor control of the lumbo-pelvic-femoral region in addition to gluteus medius and maximus strengthening for preventing and rehabilitating hip injuries in the dancer.

Approach of Presentation: During this workshop/movement session, participants will learn and perform a series of Pilates-based mat exercises in various positions with a focus on lumbo-pelvic stability, hip disassociation, and glute recruitment. Concepts learned and applied in the mat exercises will then be applied in standing functional and dance specific exercises with a focus on dynamic hip stabilization. The session will utilize props such as small balls and yoga blocks. Participants should wear clothes they can move in.

Content of Presentation: Participants will learn lumbo-pelvic-femoral motor control exercises as mentioned above. Participants will also learn common dancer compensation patterns as well as verbal and tactile cues to facilitate proper execution. Examples of modifications and progressions of each exercise will be given. At the conclusion of the session participants should have many tools they can use to improve mechanics and control at the hip for their dancer clients and patients.

Conclusions and Practical Relevance: Anterior hip impingement and acetabular labral tears are common in dancers. Decreased lumbo-pelvic-femoral motor control may contribute to these injuries. Other contributing factors may include poor hip mechanics including excessive anterior translation of the femoral head in the acetabulum, poor kinesthetic awareness of gluteal muscles, and decreased gluteus medius and maximus strength. Often the glute strength component is addressed, however this does not always translate into improved motor control and function.

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Notes
The Use of Real-Time Magnetic Resonance Imaging in Performing Arts Research: Application to Brass Performance and Movement Disorders

Peter Iltis, Ph.D., Gordon College, Wenham, Massachusetts, USA
Rachel Burke, Candidate for B.S., Gordon College, Wenham, Massachusetts, USA

**Background:** Being able to image motor activity within the oral cavity and throat of brass players has been virtually impossible until now. Recent developments in high-speed, real-time magnetic resonance imaging have for the first time allowed descriptive and quantitative dynamic analyses of these movements. Elite horn players have been studied and compared to horn players with various motor deficiencies (embouchure dystonia and "reverse swallow" syndrome) in a series of studies conducted at the Max Planck Institute for Biophysical Chemistry. Several publications have resulted in the last 2 years that provide ground-breaking insights into brass pedagogy and to both of these movement disorders.

**Purpose(s)/Aim(s):** The purpose/aim of this study was to establish benchmark motor behaviors in elite performers, and to compare these to the motor behavior of affected horn players. There are three studies to report on: comparison to embouchure dystonia players, comparison to "reverse swallow" patients, and elucidation of vocal fold involvement in horn playing.

**Methods:** 12 elite horn players, 5 dystonic horn players, and 3 reverse swallow horn players were examined while performing a standardized series of performance exercises emphasizing various techniques involved in horn playing. All subjects performed on an MRI-compatible horn, and were filmed using real-time magnetic resonance imaging technology capable of obtaining frame rates of as high as 100 frames per second. Customized MATLAB software was developed and used to conduct dynamic, quantitative analyses of motor behavior of the tongue in all subjects.

**Results:** 1. Horn players with embouchure dystonia demonstrate markedly different and less efficient motor strategies from elite horn players on many of the exercises. 2. Horn players with reverse swallow syndrome show inefficient motor strategies as well which may be redeemable with therapy, and 3. traditional pedagogy encouraging an "open throat" during brass performance may be based upon faulty assumptions.

**Conclusions and Practical Relevance:** The RT-MRI technology is lending vital empirical data that is clarifying the nature of embouchure dystonia, providing a new technology for studying the efficacy of myofacial therapy in treating "reverse swallow" syndrome, and elucidating the true nature of involvement of the glottis in horn playing. Further extensions of this technology seem inevitable.

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Quantification of Instability of Tone Production in Embouchure Dystonia

André Lee, MD, Technische Universitaet Muenchen, München, Germany
Shinichi Furuya, PhD, University of Music, Drama and Media Hannover, Institute for Music Physiology and Musicians’ Medicine, Hannover, Germany
Eckart Altenmüller, MD, MA, University of Music, Drama and Media Hannover, Institute for Music Physiology and Musicians’ Medicine, Hannover, Germany

Background: In contrast to pianists’ dystonia, which can be objectively assessed based on movement kinematics and muscular activities, no objective quantitative measure has been established for embouchure dystonia.

Purpose(s)/Aim(s): The purpose/aim of this study was to provide an objective and reliable measure of embouchure dystonia by assessing the fluctuation of the time-varying fundamental frequency of a note.

Methods (how you conducted the study): We included 7 professional musicians with ED who reported impaired playing ability when eliciting sustained notes and 10 healthy controls. One patient played the horn, four the trombone, one the tuba and one the trumpet. The healthy controls were professional musicians, of which four played the horn, five the trombone and one the tuba. Since one parameter of interest was pitch fluctuation, each participant was asked to play 6 notes in mezzoforte (medium loudness) for 5 seconds with maintaining loudness or pitch as precisely as possible, and without vibrato. To identify a feature that represents dystonic symptom, we first extracted time-varying information of fundamental frequency (F0) from the recorded acoustic signal. Then we computed the standard deviation of the F0 signal during each of a short moving time-window that consists of 60 milliseconds over the 2.5 seconds within a trial (i.e. from 0.5 to 3 seconds), and computed the median value across all windows. The average value between two tones at each of the three pitch registers was defined as a variable that represents fluctuation of time-varying F0 signal.

Results (what data or findings you obtained): A comparison between patients with embouchure dystonia and healthy controls found a significantly higher variability of the fundamental frequency for the patients.

Conclusions and Practical Relevance: The present findings propose a new quantification and objectivation method for embouchure dystonia. The advantages of this method are firstly that it can be applied in addition to the less reliable subjective rating; secondly assessment occurs at the instrument, an important prerequisite in a task specific disorder.

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TataTataTakaTaka - Tonguing Performance on Wind Instruments - Visualization and Benchmarks

Matthias Bertsch, PhD, Music University Vienna, Austria

Background: A tongue motion initiates each note that is played on wind instruments. Visualizations of the complex motion by previous x-ray or MRI studies have been restricted to 4-20 images per second, and do not show a high spatial resolution. Moreover, there are no empirical data, how fast musicians can or should be able to perform 'single tonguing' (TataTata) or 'double tonguing' (TakaTaka).

Purpose was to document the tongue motion with a high-resolution trajectory in slow motion and to reveal benchmarks on maximum tonguing tempi that can be played by musicians of various experience-levels.

Methods: Movement data (250fps) were acquired by means of electromagnetic articulography ('EMA' by Carstens AG501). Cartesian xyz coordinates are gathered of several head and tongue-sensors (transmitter coils), which allow calculating their motions during playing on a trumpet or a clarinet. Another quantitative study (n=206) has been done to evaluate the maximum tempi that can be played on brass instruments. Continuous sixteenth note with 'single tonguing' and 'double tonguing' were recorded to find the absolute maximum tempo for two seconds and the fatigue strength reduction factor over 30 seconds.

Results: Data of the electromagnetic articulography have been visualized and can be seen at 'www.tinyurl.com/Performancevideos'. They show a complex but symmetric 2D trajectory. The range of motion is much smaller for faster notes. The tongue rises with increasing pitch.

The average tempi (median) in BPM (Metronome values) for four 1/16 notes in the first two seconds have been for 'single tonguing' 109 for amateur, 120 for students and 123 BPM for professional players (167 for the fastest player, i.e. 11 notes per second). For 'double tonguing' the averages are 149 for amateurs, 170 for students and 172 BPM for professional players (238 for the fastest player, i.e. 16 notes per second).

Conclusions: The EMA method allowed for the first time a more detailed motion analysis of the tongue. The provided benchmarks values (like BPM 120 for playing 'single tonguing') deliver useful informations for musicians dealing with articulation dysfunction and they can be of potential value for assessing this factor in health clinics.

Key References: Brass Instruments, Tonguing, Tempi, Motion Analysis

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PAMA 2016 International Symposium ~ Medical Problems of Performing Artists

Thursday, July 7, 2016 – 1:30 – 2:15 PM – Concurrent Workshop

Self-Management of Myofascial Pain Syndrome

Jonathan Reynolds, PT, PhD, Eagan, Minnesota, USA

Background: I have been treating musicians and dancers at all levels with myofascial pain syndrome for 27 years. In many cases, these patients derive much benefit from such treatment, but the effects are better when they are able to self-administer similar techniques between sessions of physical therapy. Furthermore, when these dancers and musicians are on tour or do not have access to physical therapists in preparation for a show/performance, they are often dependent on pain relieving deep soft tissue mobilization and self-administered joint mobilization.

Purpose(s)/Aim(s): Attendees will: 1. Gain a basic understanding of skeletal muscle anatomy and physiology. 2. Gain an up-to-date understanding of myofascial pain syndrome (MPS) and its potential causes. 3. Learn about perpetuating factors associated with MPS. 4. Learn to self-administer deep pressure techniques using the TolaPoint (www.tolapoint.com).

Approach of Presentation: The presentation will be a combination of PowerPoint and practicum using Tola Point apparatus.


Conclusions and Practical Relevance: In my experience, musicians and dancers are frustrated when the progress they make in physical/massage therapy sessions doesn’t last. This educational session will provide performing artists with a basic understanding of myofascial pain syndrome and self-help techniques to use at home and on tour that have been proven to be effective. TolaPoint enables the self-application of pressure to soft tissue, including myofascial trigger points, to relieve pain and inhibit muscle activation that facilitates more effective stretching. These techniques are not intended to replace the role of their therapist but rather enable the artist to be more independent in taking care of themselves.
A Physiotherapeutical Approach to Functional Voice Disorders in Singers

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**Background:** Singers belong to the group of professional voice users with the highest demands regarding voice quality and vocal load. Thus, they also have a high risk of developing a voice disorder, which in return has major impact on their ability to work. Besides voice disorders caused by organic changes, there are functional voice disorders caused by, e.g., a hypertonia of the larynx, shoulder and neck muscles or insufficient breathing patterns. In these cases, physiotherapy can be one component of a multidisciplinary approach to treatment.

**Purpose(s)/Aim(s):** The purpose/aim of this presentation is, based on anatomical considerations and current evidence, to inform about and demonstrate physiotherapy techniques for treating singers with functional voice disorders.

**Approach of Presentation:** A case from a special physiotherapy outpatient clinic for vocalists will be described. Based on this example, information on the evidence of physiotherapy approaches for functional voice disorders will be provided. Afterwards, some practical hands-on techniques will be demonstrated for participants to try.

**Content of Presentation:** This workshop will focus on the physiotherapy treatment for a vocalist with functional voice disorders. The vocalist experienced changed pitch and hypertonia in both the muscles of the shoulder-neck region and the extrinsic laryngeal muscles. Paralaryngeal manual techniques, in addition to posture and breathing exercises, will be demonstrated with the purpose of mobilizing the larynx and relaxing the hypertonic muscles.

**Conclusions and Practical Relevance:** This workshop highlights the special potential of physical therapy in the treatment of functional voice disorders in singers.

**Key References:**

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Principles of Strength and Conditioning in Performing Arts

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Background: Decreased strength, control, endurance, and power are all associated with increased risk of injury in dance. Fatigue is associated with increased risk of injury, and performing artists' fitness routines often lack adequate cardiovascular conditioning. Training for teachers, fitness instructors, and healthcare professionals may not include formal education on the scientific principles behind designing a safe and effective strength and conditioning program.

Purpose(s)/Aim(s): to educate participants on the basic principles of strength and conditioning as taught by the National Strength and Conditioning Association, and teach components of a properly designed training or rehabilitation program that focuses on specificity for performing artists while emphasizing proper alignment and execution. It is also the purpose of this session to introduce attendees to ballet barre fitness workouts which include a blend of Pilates, ballet, and calisthenics, designed to build up strength, tone, and endurance while emphasizing form and posture. At the conclusion of the session, participants should have an understanding of how to develop well-rounded, effective, and safe training programs based on scientific principles.

Approach of Presentation: This will be an interactive workshop that begins with components of designing a resistance training program followed by instruction on proper lifting techniques on common athletic exercises, and those specific to performing artists. Attendees will participate in a sample ballet barre fitness class. Props may include yoga mats, ballet barre, dowel rods, and light dumbbells.

Content of Presentation: Participants will be introduced to proper selection of exercises based on movement patterns and targeted muscle groups, selection of reps/sets/frequency/duration of exercises based on training goals of power/endurance/hypertrophy/strength, and program design addressing cardiovascular, strength, and flexibility needs specific to performing artists. The history and components of a ballet barre fitness classes will also be covered.

Conclusions and Practical Relevance: Strength and conditioning programs are necessary for improving performance and overall health. Participation decreases injury rates, stress, and time lost from injuries. Ballet barre fitness classes address strength, flexibility, and cardiovascular fitness, and place emphasis on ankle and hip strengthening specific to the needs of performing artists, especially dancers.


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Mindfulness Practices: Healthy Approaches for Treating Bipolar Disorder and Sensory-Processing Sensitivity in Performing Artists

Kathline Colvin, Ph.D., Healthy Artists – Pacifica Psychological Services, Newport Beach, California, USA

Background: The task of making great art requires the integration and development of both the mind and the body working together, so performers can truly recognize their potential. Mindfulness Practices can be adapted so artists can apply effective approaches to train their minds, automate body movement, and deepen connections with their repertoire.

Purpose(s)/Aim(s): This presentation will increase awareness of the core elements of Mindfulness Practices and how they can be utilized to reduce performance anxiety and stress, informed by current research and treatment practices for Bipolar Disorder and Sensory-Processing Sensitivity. Specific ways that Mindfulness Practices can be tailored to the needs of performing artists will be discussed with case examples and individualized plans to maintain “creative wellness”.

Approach of Presentation: Retrospective case studies of two adolescent female musical theater artists will illustrate adapted Mindfulness Practices used in psychotherapy, along with comparing and contrasting their performance issues during the musical production of “Into the Woods”. Musical theater clips enhance these case presentations.

Content of Presentation: The constraints of performance anxiety and artistic sensitivity are examined through two case studies of adolescent female musical artists. The research in Mindfulness-Based Stress Reduction (Jon Kabat-Zinn, Ph.D.) and Sensory-Processing Sensitivity (Elaine Aron, Ph.D.) guides our efforts in training healthy performing artists, gifting them with the tools for successful physical and psychological preparation for outstanding performances. Helping young artists to develop robust psychological tools compels them to stave off the many stressors of preparation and performance. This presentation offers strategies for performers in maintaining a healthy body, managing anxiety, understanding the neurobiology of the highly sensitive person, and utilizing Mindfulness Practices to enhance creative expression. Music and Mindfulness Meditation, along with other wellness strategies are explored, and participants have an opportunity to experience these tools during the presentation.

Conclusions and Practical Relevance: Mindfulness-Based psychotherapy has become one of the most popular new treatment approaches over the last decade, because it holds great promise for personal development, and offers powerful tools to augment treatment for performing artists. Understanding the components of Mindfulness Practices and how they work to alleviate psychological distress allows performers to creatively adapt these practices to promote optimal practice sessions and peak performances.

Key References:
Andreasen, N. The Relationship between Creativity and Mood Disorders. *Dialogues in Clinical Neuroscience*. 2008; 10; 251-255


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Team Approach to Integrated Performing Arts Medicine: Case Studies

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Martha Neagu, MD, PhD, Brigham and Women's Hospital, Harvard Medical School
Leah McKinnon-Howe, NP, New England Conservatory

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Background: One of the many challenges performing artists face while navigating the healthcare system is communication between the providers that are caring for different aspects of the patient's health. As a performing arts healthcare team, we will share our insight on how we work through the needs of vocalists and instrumental musicians with diagnoses that cross specialties and practice settings.

Purpose(s)/Aim(s): The purpose/aim of this presentation is to raise awareness of health assessment, treatment, and communication strategies when a performer is facing difficulty with a condition that spans specialty expertise. We will provide information on how to navigate care amongst different providers and ideas for which types of health providers would compose an ideal team. We will share perspectives from our multidisciplinary team from nursing, neurology, laryngology, physical therapy, practice assistant, pulmonology and voice therapy. We will also provide specific cases of how patients traverse health care settings including college health, specialty practices and outpatient physical and voice therapy to facilitate integrated care.

Approach of Presentation: The group will present cases and take questions from the attendees.

Content of Presentation: In addition to case presentations, we will also demonstrate our physical examination and voice assessment tools for instrumentalists and vocalists and share our strategies for navigating care.

Conclusions and Practical Relevance: A multidisciplinary team is ideal for performer’s health needs. A glimpse into the inner workings of such a team will provide helpful insights for teachers, performers and healthcare professionals with a goal of providing more integrated care.

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A Holistic Approach to Warming Up the Dancer

Michelle Strong, BS, MFA, Texas A&M University, College Station, Texas, USA
Alexandra Pooley, BA, MSc, Texas A&M University, College Station, Texas, USA

**Background:** We know through general research endeavors that the physical body is affected by mental and emotional wellbeing. In dance science specifically, there have been many strides in teaching effective warm-up techniques. However, when looking at available dance science research on holistic warm-up methodologies, nothing exists. We are interested in preparing the physical, mental and emotional aspects of the dancer to be successful in class, rehearsal and performance.

**Purpose(s)/Aim(s):** Present participants with information to guide their performers with regard to appropriate, efficient, and effective holistic warm-ups. Discuss strategies for physical, mental and emotional preparation for an all-encompassing warm-up design.

**Approach of Presentation:** An introduction to our interest in a Holistic warm-up design and a brief overview of the current research will begin the session.

We will then explore examples of warm up ideas that incorporate focusing the mind as well as warming up the body. Participants will be encouraged to engage in discussion and share ideas regarding holistic warm-up techniques to close the presentation.

**Content of Presentation:** The presentation will begin with a short research analysis reviewing performing arts warm-up techniques to date, with particular attention to strategies being used in dance. We will discuss the current research which reflects mainly physical preparation and the lack of research on mental and emotional preparation in dance. The workshop aspect of the session will include meditative/somatic, breathing and visualizations/imagery exercises to mentally prepare the dancer. We will also experiment with emotional inventory and how to "dance through" wherever the emotional self is that day. We will look at traditional aspects of the physical warm up and incorporate these techniques into the overall design as well.

**Conclusions and Practical Relevance:** To date, research has largely focused on physical aspects of warm-up. While this is undoubtedly important, conversations and research in the dance community need to shift to include the whole dancer, not just the physical body. We know that dance, and performing arts in general, take a toll on the mind and constitute a significant emotional investment. Teaching students and young professionals how to prepare for this is in the best interest of the artists and their respective artistic communities.

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Notes
Background: Playing related musculoskeletal problems (PRMP) amongst instrumentalists, singers and dancers are a very common and demanding problem that seeks its solution not only in prevention and proper diagnosing but ongoing therapy as well. In the physio-clinic at the INAP/O Osnabrueck (first 200 cases were presented at PAMA in 2011) a team of physical therapists for musicians offers a specialised service for students and professionals as well. Meanwhile 356 patients were seen.

Purpose(s)/Aim(s): The purpose/aim of this study was to show the broad perspective of careseekers (singers, instrumentalists, dancers) from all genres (classical, jazz, pop, rock) and display how those were categorized according to specific complaints in body regions and treated with means of physical therapy. It also aims to convince people that a specific physical therapy for musicians is both, necessary and possible, but has to be developed thoroughly by relevant experts.

Methods (how you conducted the study): epidemiologic data of 356 consecutive patients were analysed descriptively by, first and second instrument (including voice) and also physical therapy treatment details. Subgroup-analysis allows to a specific complaint-panorama of different instrumental/musical types: e.g. strings, wind, singers, keyboards, dance.

Results (what data or findings you obtained): Almost all popular instruments (n=21) were seeking help; the top 5 were (displayed by occurrence): singers, percussionists, guitarists, keyboarder, violonists. Main discomforts included areas (displayed by occurrence): as thoracic, cervical, lumbar (spine), hand, shoulder, forearm, head. Complaints differed between subgroups: e.g. string-players suffered most on elbow-forearm- and hand problems, while wind instrumentalists complaint most about thoracic/cervical spine and keyboarders most about thoracic and lumbar spine. Dancer in contrast had their problems on the lower extremity.

Physical therapy used manual therapy, soft tissue techniques, exercises, physical agents, neuromobilisation, proper advice (e.g. for healthy practice), posture control, specific exercises and special treatment and osteopathy.

Conclusions and Practical Relevance: This study shows that high performers as musicians with a very special and specific demand on fine-motor control are in desperate need for special physical therapy treatment involving precise diagnosis, specific therapy and ongoing advice and prevention.

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Concussion Knowledge of Theater Personnel

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**Background:** Concussion is a neurometabolic brain injury that is well publicized in sports. Performing artists are at risk for concussion, but do not always have access to specialized healthcare to manage this injury. Many on-stage and backstage activities, obstacles, and hazards place actors and production workers at risk of concussion.

**Purpose(s)/Aim(s):** The purpose/aim of this study was to determine the knowledge and attitudes of theater personnel regarding concussion and concussion risks, and whether they have previously experienced concussion.

**Methods:** An online survey was sent to members of university theater departments and professional theater companies. Respondents were asked to identify concussion symptoms from a list of correct and incorrect symptoms and to share their attitudes regarding concussion by completing sentences about sustaining and reporting this injury. Participants then selected mechanisms of sustaining a concussion from a list of correct and incorrect choices. Finally, respondents indicating they had suffered one or more concussions during theater activity answered questions regarding mechanism of injury, symptoms experienced, whether they reported the injury, and, if so, to whom.

**Results:** Theater personnel have a general understanding of concussion mechanisms and symptoms and perceive the injury as serious and worthy of medical attention. Sixty-seven percent of true concussion symptoms were identified by participants, and only 21% of false concussion symptoms were incorrectly identified. However, 72% of participants indicated they hit their head, experienced concussion symptoms, yet did not report the incident. Eighty-two percent of participants who hit their head in the theater were participating in an activity related to scene construction or technical elements. Twenty-eight percent of the participants who were seen by a healthcare provider and diagnosed with a concussion were not given any activity restrictions.

**Conclusions and Practical Relevance:** Theater personnel work in environments that present risk for concussion. Safety in performing arts environments cannot be accomplished unless risks are identified and personnel are properly educated. This study provides insight into the extent to which theater personnel understand concussion and its risks, as well as the nature of healthcare delivered to concussed theater personnel. Concussions are prevalent in theater; however, better care for this injury is needed.

**Key References:**

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Outsmart Your Genes: The Epigenetic Approach to Peak Performance

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Background: DNA is not our destiny. Contrary to popular belief, 80% of all illness and injury are due to lifestyles choices. These are crucial concepts to be considered in caring for the health and success of the artist and athlete. The daily choices of food, exercise, sleep and stress management informs and modifies our DNA at a biological level. The emerging science of epigenetics describes the direct relationship between environment and gene expression. It is critical for the artist and athlete to make lifestyle choices that support and optimize their well being to achieve peak performance.

Purpose(s)/Aim(s): The purpose/aim of this presentation is to educate and inspire action in directing lifestyle choices that have a positive impact on the performance and well being of the artist/athlete.

Approach of Presentation: The speaker will share 25 years of clinical experience in the specialized care of the athlete and the performing artist. A discussion of epigenetics and the impact of lifestyle choices on peak performance will be highlighted with case studies.

Content of Presentation: The success of the artist/athlete demands superior functioning of mind and body. This optimal health model must include a discussion of lifestyle choices and their impact on performance. Behaviors and habits (food, activity level, sleep and stress patterns) directly impacts gene expression. We can nudge our biology towards good health or towards illness and injury, depending on our daily choices. The science of epigenetics supports that we can nurture our nature in powerful ways. The performing artist and athlete can learn to outsmart their genes to enhance performance. This peak performance model should include a 5 point actionable plan that supports the concept that "selfcare is healthcare".

Conclusions and Practical Relevance: Lifestyle choices inform our DNA and has a vital impact on the health, well being and performance abilities of the artist/athlete. It is critical to assess, educate and prescribe a plan to optimize health for peak performance.
Performing Arts and Sports: Practitioners', Performers', and Administrators' Perspectives on Commonalities and Differences

Kate Hays, Ph.D., Toronto, Canada
Jim Whitehead, B.A., American College of Sports Medicine, Indianapolis, Indiana, USA
Linda Hamilton, Ph.D., New York City Ballet, New York, USA

Background: Recognition of the connections between sports and the arts is a fairly recent phenomenon. This presentation addresses both the similarities and differences related to the performance process—mental and physical preparation, performance, and evaluation—from the perspective of administrators, performing artists, and performance psychologists.

Purpose(s)/Aim(s): The purpose/aim of this presentation is to identify those aspects and strategies that enhance performance as well as those that can assist in recovery from performance challenges. The combined expertise of performers, performance psychologists, and administrators allows a complete and nuanced discussion.

Approach of Presentation: The four presenters will each discuss the issues from their own perspective, followed by integrative discussion.

Content of Presentation: A sports administrator reviews and describes initiatives related to athletes and artists, both in relation to past accomplishments and potential future initiatives. A growing multi-disciplinary national movement will be highlighted that focuses on the intersection of athletes and artists in regard to performance and health, and the important opportunities that exist for individual practitioners as well their professional societies. Following this, a practitioner sport/performance psychologist offers a continuum model regarding psychological skills and techniques, from performance enhancement to remedial therapy. This presentation focuses in particular on the similarities and contrasts between sports and the performing arts in regard to pressure, competition, emotional expression, audience, and injury among athletes and performing artists. In turn, a practitioner performing arts psychologist—a former dancer in a major professional company—addresses the historical, sociocultural, and psychological issues involved in optimal dance performance. With choreography’s increased focus on multiple dance techniques and gymnastics, in addition to psychological preparation, performers require greater preparation to excel and avoid physical risks, such as concussions, as well. Finally, a professional musician/college professor shares perspectives on the mental and physical challenges of preparation for performance. This presentation will include a brief live demonstration of the athleticism involved in musical performance.

Conclusions and Practical Relevance: These four perspectives address the range of issues and opportunities that create a synthesis of best practices, whether in sports or the arts.
Doing Research: A Practical Workshop to Assist PAMA Researchers with Implementing their Research

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The members of the Performing Arts Medicine Association have expressed a need for better training on conducting rigorous research. Members of the research committee and the general membership have expressed a desire for more small group discussion and research mentorship. At the discretion of the symposium planning committee, we would like to reserve the possibility of changing the content of the workshop based on feedback from the 2015 workshop. The purpose of this workshop is to assist PAMA members to implement rigorous research. PAMA members will bring research ideas at any stage of implementation. Participants will be divided into small groups with a mentor, made up of the presenters and members of the research committee, as available. These mentors have varying skills and areas of expertise to support the eclectic array of research interests within our membership. The goal is to help members troubleshoot problems in their projects, receive suggestions in their research design and methods, understand or interpret statistical analyses, and/or find direction and support in their research interests (e.g. engaging partners, applying for funding, seeking research ethics approval, submitting an abstract to a scientific meeting, writing a manuscript for publication, etc.). Research is critical to moving performing arts medicine practice and arts education forward. Many PAM researchers do not have the resources or support, locally, to carry out research projects. Small group mentorship with experienced researchers is a powerful way of contributing to the development of research in the field.

Panel Members:
- Esther A. Chou, MEd, AT, CSCS
- Christine Guptill, BMus, BSc, MS(OT), PhD
- Bronwen Ackermann, PhD, MPH, BAppSc(PT), GDip(WHS)
- Patrick Gannon, PhD
- Donna Krasnow, PhD
- Jeff Russell, PhD, AT
- Peter Visentin, MMus, BMus
- Ginny Wilmerding, PhD
Strategies to Address Hearing Awareness and Preservation for the Student and Professional Musician

S Benjamin Kanters, MM, Columbia College, Chicago, Illinois, USA

With the increasing incidence of hearing disorders, particularly for those in the entertainment media that include both live and recorded music, it is critical that musicians and music educators begin to address hearing awareness, to ensure long, successful careers.

Working from material developed for the Hearing Conservation Workshop, this workshop will address practical hearing-health issues facing the performing musician:

- The lack of understanding or appreciation of the hearing mechanism
- Noise and music-induced hearing disorders, including loss, pitch and dynamic distortions, tinnitus, and hyper-sensitivity
- Current protection and performance-assist technologies (high fidelity earplugs and in-ear monitor systems)
- Simple, non-technical conservation strategies
- How to assess and address the efficacy of any conservation strategy in the pursuit of good performance technique and aesthetic

The presentation and discussions will all be in the musician’s “language” of music and sound. This provides an easy context to understand these otherwise very technical and detailed topics.

The success of The Hearing Conservation Workshop has proven that, once taught how hearing works (and breaks), musicians develop a sense of “ownership” of their ears, and become concerned about their own hearing health. This directly impacts their futures as professional musicians.

Not only does this effort benefit musicians, they, in turn, are in a unique position to be role models of hearing awareness to the much broader and more diverse music-listening public.

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Notes
**Pep Band Member Noise Dosage and Noise-Induced Hearing Loss Prevention**

Evan Edwards, BM, Vocal/Choral Pedagogy Research Group, University of Kansas, Lawrence, Kansas, USA

**Background:** Noise-induced hearing loss (NIHL) may negatively affect the careers of current pre-service music educators (Callahan et al., 2011; Cutietta, 1994). Previous research on NIHL explored the marching band setting, but no study to date has measured the noise dosage experienced by members of an indoor pep band.

**Purpose(s)/Aim(s):** The purpose of this study was to (a) assess the status of noise dosages acquired via Etymotic personal noise dosimeters (model ER-200D) from 2 pep band members (an alto saxophonist who sat in front of trumpets and near the drum set and a trombonist who sat behind trumpets) as they performed at 3 NCAA Division I men’s basketball games, (b) assess perceived effectiveness of musician earplugs (Etymotic ER-20XS) on the 2 primary participants, and (c) assess the status of all band members’ ($N = 72$) knowledge of hearing loss and hearing loss prevention (adapted questionnaire; Lass et al., 1990).

**Results:** Noise dosages accrued from primary participants greatly exceeded the National Institute for Occupational Safety and Health’s (NIOSH) recommendation regarding safe daily noise exposure time. Barring one exception, participants reported that the earplugs provided sufficient protection from noise. Survey responses demonstrated a gap in a large percentage of band members’ hearing loss knowledge.

**Conclusions and Practical Relevance:** Conditions present at these pep band performances put members at great risk of injury. The percentage of students who neglect to wear hearing protection at pep band events reflects a lack of knowledge or importance of hearing loss prevention.

**Key References:** Pep Band, Noise Dosage, Noise-Induced Hearing Loss

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The Perceptions of Injured Dancers by Uninjured Dancers in a University Setting

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Background: Personal well-being is important for success in artistic performance. There are six primary dimensions required for optimal wellness, including social and emotional dimensions. Previous studies acknowledge the importance of social support to manage life stress, illness, and injuries. Injured dancers need to receive sufficient social support from family, friends, fellow dancers, and healthcare providers to recover successfully. Support from uninjured dancers may be valuable, but no studies could be located in the literature about how uninjured dancers view injured dancers. Negative views of injured dancers by uninjured dancers may compromise the social dimension of wellness and recovery from injury, especially as it relates to the physical and emotional dimensions. Further insight into this aspect of dancers' social support environment is needed.

Purpose(s)/Aim(s): To determine how uninjured university dance students perceive dance students who are injured.

Methods: Semi-structured individual interviews with seven uninjured dancers (age=20.3±1.03 years, years of dance experience=16.1±2.03 years) were conducted. The interview questions focused on uninjured dancers’ perceptions of injured dancers, as well as uninjured dancers’ attitudes toward seeking medical attention and their definitions of mental weakness and toughness. A qualitative analysis was conducted to develop categories and themes describing the uninjured dancers’ perceptions of injured dancers.

Results: The results revealed that three participants felt empathy for injured dancers while some participants expressed a negative attitude toward injured dancers. In general, most of the participants felt worse for top-skilled injured dancers than lower-skilled ones. Also, all of the participants had experience dancing in pain, and they usually waited at least a couple of days before seeking medical attention. Moreover, many of the participants referred to perseverance when they described mental toughness, whereas they described mental weakness as giving up, caving in to negative feelings, not be able to handle the pressure, being lazy, having weak work ethic, and “being [a] baby.”

Conclusions and Practical Relevance: Knowing the perceptions of injured dancers may help dance teachers and dance medicine healthcare providers understand dancers’ injury context and help the people around injured dancers to improve the emotional and social support systems that dancers require.

Key References: dance, wellness, social support, mental toughness, mental weakness

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Effectiveness of Plyometric Training on Collegiate Level Dancers' Vertical Jump Height and Horizontal Jump Distance

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Background: The height of the dancer’s jump allows for more time in the air which allows the dancer to achieve multiple “beats” or batterie in ballet or suspension in modern dance. Plyometric training is a popular cross training method used by athletes and dancers to achieve greater power in their movements.

Purpose(s)/Aim(s): The purpose/aim of this study was to examine the effectiveness of Plyometric training on vertical and horizontal jump in university dancers.

Method: A randomized control trial study was conducted in university dancers over a five week period. Seventeen female and two male dance majors (Age: 20.1±0.91; Height: 164.7±5.6 in; Weight: 61±7 kg) completed the study. All participants were enrolled in a dance class that met three times a week. The plyometric group participated in training sessions three times a week using specific plyometric exercises. The control group maintained their regular technique classes with no additional jump training. Both groups were tested pre and post study for vertical jump using the Vertec Vertical Jump test, and for horizontal jump utilizing the triple hop test assessment.

Results: No significant R LE/L LE vertical jump differences (R P=0.74) (L P=0.96) were shown between the groups but a significant difference (R P=0.005) (L P=0.011) was revealed from pre intervention (R 32.5”) (L 34.8”) to post intervention (R 36”) (L 38.5”) regardless of group. A significance difference (P=0.016) was found for bilateral LE vertical jump from pre intervention (34.5”) to post intervention (37”) but no differences (P=0.56) were shown between the groups. No significance difference for bilateral vertical jump (P=0.56) was shown between the plyometric group and control groups. No R triple leg hop distance differences (P=0.057) were found from pre intervention (156.2”) to post intervention (164.5”) regardless of group. No significance L triple leg hop distance difference (P=0.051) was shown between the plyometric group and control groups. No L triple leg hop distance differences (P=0.152) were found from pre intervention (154.1”) to post intervention (159.3”) regardless of group.

Conclusions and Practical Relevance: While plyometric specific dance training did not improve vertical jump, dance training over a 5 week period does appear to improve vertical jump ability that is necessary for functional dance movements. Dance training nor plyometric specific dance training appear to increase horizontal jump ability.

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Development of a Novel Marker Set for the 3D Measurement of Upper Limb Kinematics in Violin and Viola Performance

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Christoff Zalpour, Prof. Dr. med., University of Applied Sciences, Osnabrueck, Germany

Background: Only a few studies analysed the upper limb kinematics of performing violinists and violists by the means of an optoelectronic three-dimensional (3D) motion capture system. None of them describes shoulder motions with respect to the recommendation of the International Society of Biomechanics (ISB). The ISB proposes definitions of joint coordinate systems for the shoulder complex including the clavicle, scapula and humerus. In addition, the placement of skin-based markers is not permitted on some of the proposed anatomical landmarks during violin or viola playing. The markers might be occluded by the bowing arm in motion or they disturb the placement of the instrument on the shoulder.

Purpose(s)/Aim(s): The purpose/aim of this study was to find the most appropriate methods for the marker-based 3D measurement of upper limb kinematics during violin and viola playing and thus to develop a novel marker set avoiding marker occlusions and limitations in instrument placement.

Methods: Different marker sets were attached successive to a 27-year-old female violinist playing different bowing patterns in multiple motion trails. For the measurement of scapular motions, we created customized rigid acromion marker clusters (AMC) varying in shape and size and compared them in terms of trajectory quality and accuracy. Additionally, rigid marker clusters for compensating marker occlusions were developed and tested for an accurate and simple use. Furthermore, two established regression techniques and one functional method for joint localization were compared concerning the differences in estimating the glenohumeral joint rotation centre (GHRC).

Results: In preference to the ISB recommended methods we found that an AMC promises more accurate and reliable measurements of scapular kinematics. Additional rigid marker clusters on the third thoracic vertebra and the bowing arm are an approved choice for avoiding marker occlusions on the sternum and the right wrist. Clavicle markers were excluded because they disturb the instrument placement and the clavicular joints have a negligible impact on the shoulder kinematics anyway. Finally, we propose to use a functional approach for an objective, precise and subject-specific GHRC estimation with an reduced number of required markers.

Conclusions and Practical Relevance: The novel marker set offers accurate, reliable and detailed analyses of upper limb kinematics for further biomechanical studies of violin and viola performance.

Key References:


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The Relationship and Direction of Worry in Creativity Among Secondary Dance Students

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Background: Previous research in dance and creativity has been mainly qualitative, and focused on professionals, primary school students and teachers. There has been limited research into creativity and very limited when researched alongside performance anxiety. The study was additionally a part of a longitudinal study and pilot for the Dancer’s Perception of Creativity Questionnaire (DPCQ).

Purpose(s)/Aim(s): The purpose of this study was to explore the relationship between performance anxiety and creativity as reported by dance students in secondary education. Secondly, to investigate the direction of performance anxiety too self-perceived creativity, and thirdly to provide descriptive data on anxiety direction among dance students in an educational setting.

Methods: Ninety-seven dance students from schools and sixth forms from all over England participated in this study aged between 16-18 (mean: 17.03 years SD = 0.61). The dance students were asked to complete a two part questionnaire assessing their own creativity and anxiety in dance classes in Secondary school. The new DPCQ was used to measure the creativity Sport Anxiety Scale - 2 (SAS-2) was used to measure the anxiety intensity. Added to the SAS-2 was the previously established anxiety direction scale, usually used with the Competitive State Inventory – 2.

Results (what data or findings you obtained): Participants noted a negative relationship between anxiety and creativity (rho = -.22*, p<0.05.) A moderate positive correlation between somatic direction and creativity (rho=.28, p<0.05). Worry Intensity was the only variable that had significance. The only significant direction of a variable was worry this was deemed to be facilitative. (rho=-.32, p,0.01.)

Conclusions and Practical Relevance: The results reported added support for the use of the DPCQ, as all of the subscales had acceptable internal consistency. Correlations portrayed that the students perceived themselves to suffer from anxiety during dance class towards their creativity. However it was reported that they found all three of the subscales (Worry, Somatic and Concentration Disruption) to be facilitative towards their creativity in class. The results highlight the importance of investigating the direction of the anxiety and not just the anxiety itself.

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Dangerous Choreography and Injuries in Studios and Companies

Daniel Huynh, BFA Dance Performance, Chapman University, Orange, California, USA

Background: Choreography has evolved to include more movements, tricks, and stunts which potentially places dancers at a higher risk for injuries. As the demands of the concert and commercial dance environment change dancers feel pressured to demonstrate an increased hypermobility, master multiple genres of dance and push the boundaries of their physical ability. The increasing influence of social media driving the trends in choreography without providing proper instruction for tricks may have an impact on injuries.

Purpose(s)/Aim(s): The purpose/aim of this presentation is to educate dancers and medical professionals on the current trends appearing in choreography and the potential risks dancers face.

Approach of Presentation: An extensive analysis of social media sites, competition dance events, current commercial and concert dance performances will illustrate the frequency of specific risky choreographic devices.

Content of Presentation: An analysis of current trends in choreography requiring hypermobility, asymmetry, impact, and proper turn out demonstrates the frequency of these movements and mechanisms for injury. A brief discussion of the most frequently used choreographic devises (tilts, heels, needle, knee drop etc.) and proper training requirements for each skill will be presented in the poster.

Conclusions and Practical Relevance: Dancers, instructors, and choreographers must be made more aware of the safety concerns regarding certain choreographic devices. There is a risk in copying a movement performed by another dancer if there is no formal training established. Choreographers create art and frequently disregard the anatomical limits or the current physical conditioning of the dancers they have to work with. Medical professionals with limited knowledge of current dance trends are unaware of the extreme demands placed on dancer's today. There is a need to approach dance in an anatomical fashion, now more than ever, to keep dancers healthy and ensure future performing careers.
A Dancers Process of Healing a Chronic Illness

Loren Sexton, Chapman University, Orange, California, USA

Background: With a 101% increase in the reported cases of chronic illnesses just within the United States, it is important to research the process of healing the mind and the body. Dancers are unique in their perception of pain tolerance along with idea of “normality”. Through healing a chronic illness, non-dancers and many physicians describe a healed body as one without the infection in it. However dancers idea of normality is being back to physical activity. That process is faced with challenges both physical and psychological.

Purpose(s)/Aim(s): The purpose and aim of this presentation is to increase awareness of chronic illnesses as well as the healing process after a trauma on the body. Similar to rehabilitation of an injury, healing the body after a chronic illness involves more than just the physical work.

Methods: Research includes interviews of dancers who have been diagnosed with Lyme disease, Chronic Fatigue Syndrome and/or Fibromyalgia Syndrome. Questions were based on finding information on how the disease affected the dancer and what steps have been taken to return to dance. Along with the interviews I will conduct a case study on myself illustrating a timeline of the symptoms though diagnosis and treatment to find what helps the development the healing process.

Results: Both interviewees as well as the personal case study participants waited over a year to receive their diagnosis, psychological issues were able to set in along with their chronic illness. The research results directly related to the idea that healing a dancer is beyond the physical aspects. Instead it has a lot to deal with the psychological issues that surround the chronic illness and the steps to recovering the body.

Conclusions and Practical Relevance: The timeline of development back to a healthy body will include mental and physical growth. Each process is very different depending on their pain perception based on their dance training, the severity of their chronic illness, as well as the length between the beginning of symptoms and the correct diagnosis.
Moving to Connect: An Analysis of Dance/Movement Therapy and Pediatric Autism Spectrum Disorders

Morgan Bates, Chapman University, Orange, California, USA

Background: Dance/movement therapy (DMT) is a relatively new field used by trained specialists to help disabled individuals improve motor skills, social abilities, and mind-body connection through integrative and individualized movement practices. This form of therapy has been used on various forms of disability since it first came into use, including depression, Parkinson’s disease, and various forms of psychosis, but one area of literature that has shown particular promise is the use of DMT as early intervention for childhood autism spectrum disorders (ASDs). Due to the complex and varying nature of ASDs in young children, DMT has shown signs of being an ideal form of treatment because of its ability to adapt to and fit the needs of each individual child.

Purpose(s)/Aim(s): The purpose/aim of this presentation is to design and theoretically implement a unique and specialized movement/dance therapy program to be used in pediatric autism treatment and care centers.

Methods: The first part of this study consisted of an extensive literature review of the current research into dance/movement therapy, autism, and the relationship between the two. The second part of the study was based on a series of interviews with professionals in both areas of interest (autism spectrum disorders and dance/movement therapy). The information gained from these interviews was then synthesized to describe possible ways dance/movement therapy can be used for pediatric autism.

Results: Based on current literature and interviews individually designed dance/movement therapy programs may provide a valuable piece in working with pediatric autism disorders. Developing movements specified based on the symptoms present in the child and the developmental stage of the child supports individual growth.

Conclusions and Practical Relevance: Dance/movement therapy remains an under represented field in the published literature. Based on the current research and the interviews conducted in this study, it seems promising dance/movement therapy can be a useful tool for treating symptoms of autism spectrum disorders, specifically in the areas of motor and communicative deficiencies.

Key References (optional):

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How can we prevent death by lifestyle in performers?

Bethany Ewald Bultman
Co-Founding Director, The New Orleans Musicians Clinic

After creating the USA’s only federally designated Patient Centered Medical Home (PCMH) for performers, the New Orleans Musicians Clinic (NOMC, established in 1998), there is one thing we have learned: addressing the short-term occupational needs of performers is the easiest part.

Whether our patient is a ballerina, a classical pianist or a jazz trumpeter, the reality is that they often fall into what has been dubbed the health care “sacrifice zone”: a sector of low-income patients in high-risk professions who experience barriers of care within conventional medical systems. In our experience, those few performers who benefit from employer-based health insurance are often the last to inform health providers of chronic conditions or injuries for fear of losing coveted gigs. To support their “calling” to be performers, many of our patients are working two to three jobs in the service industry while experiencing high levels of health disparity. According to the 2015 Louisiana Health Report Card, Louisiana ranks 46 of 50 in cardiovascular disease, 47th in number of deaths due to cancer, and 45th in both diabetes and obesity.

Often, we are told that health insurance and coverage is the key to overcoming health inequalities. The dire health outcomes those in the southern region of the USA face are exacerbated by a system of care for the poor which is unresponsive and difficult to access. How, then, do we improve outcomes in a group not accustomed to receiving preventive and primary health services? How do we effectively treat individuals who wait until the advanced stages of illness, when they can no longer tolerate their symptoms, and who do not want to be publicly “branded” with their illness or injury? What we at PAMA and Athletes in the Arts must advocate for are systems where the well being of the performer takes precedence over their short term performance.

As health care providers, we must understand what goes on behind the curtain: sometimes a performer’s “calling” can be a barrier to seeking preventive health and practicing self-care. Behind the many performance-related conditions, there may be lurking deeply-rooted occupational perils. Many NOMC patients perform in unhealthy environments with long and late night hours resulting in disrupted sleep patterns while they earn low, often cash-based, pay. Noisy rehearsal spaces contribute to hearing disorders. Separations from families while on the road contribute to performance anxieties and/or self-medication, drug and alcohol dependence. Frequent practice on a wind instrument can lead to dental disease.

Mission and Need
Seeking to mitigate poor health outcomes for performers, our NOMC founders crafted a responsive mission: to sustain New Orleans’ performers in mind, body, and spirit. Through a longstanding collaboration with our colleagues at PAMA, we offer vital occupational medical care to keep the
music alive in our city. Our oldest patient was performing a weekly gig as a vocalist, a trumpet player and a band leader up until three months before he died at the age of 103. That is the gold standard of Performance Arts Medicine which we aspire to for all of our 2500+ patients. Engaging patients in their own well being is the only way our clinic can succeed in truly keeping sustaining the long-term well-being of performers.

It took several years after our founding to fully grasp that to fulfill this promise to our patients, the NOMC medical team needed to embrace public health, sociology, cultural anthropology and even civil rights advocacy to achieve our mission. We must strive to produce innovative, robust preventive and wellness programming, encouraging effective health literacy and culturally sensitive self-care regimes. To succeed, we must remain a trusted, responsive resource by ensuring that access to health care is non-burdensome for the performers we care for, regardless of a patient’s insurance coverage status.

**New Orleans Musicians: Changing the Health Seeking Patterns of the Working Poor**

While many of our NOMC patients spend their summers wowing crowds in Europe; back home they are vulnerable to health disparity. According to the 2009 report from the American Human Development Project entitled “A Portrait of Louisiana,” life expectancy for African Americans in New Orleans was 69.3 years, ten years shorter than anywhere else in the USA; putting them on a par with citizens of North Korea, Colombia, Venezuela and Uzbekistan (Sharps, et. al., 2009).

*In Louisiana, the number one industry is tourism, and the backbone of that industry is music. However, musicians themselves often do not(rarely?) benefit from industry expansion.*

In 2015 New Orleans’ tourism recorded $7.05 billion in spending from 9.78 million visitors. The industry itself employs 86,000 individuals, many in seasonal, minimum wage jobs. At home famed jazz musicians often work for cash or tips. Although there have been several programs which promise to invest in the livelihood of independent performers in New Orleans, the resources captured through taxes in this industry are often used for infrastructure development rather than providing resources to cultural workers. These performers in turn experience high levels of poverty and income inequality.

At the same time, performers in New Orleans often embody the well-established social disparity of their region: New Orleans has the 3rd highest rate of HIV infection in the nation, and is 1st in number of those diagnosed with syphilis, gonorrhea and chlamydia. 35% of our population is considered medically obese and Type 2 diabetes is prevalent. The city’s murder rate is one of the highest in the nation and has the same literacy rate as Rwanda.

**Sustaining the NOMC Mission**

Medicaid expansion arrived in Louisiana on July 1, 2016. It is indeed a miracle, but as health care providers we must engage our patients to a new model of active self-care, assisting them in
understanding and using the coverage included in their health plan. Our model of accessibility encourages NOMC patients to visit us for primary health care needs, instead of frequenting the emergency room where they receive expensive, sub-standard care.

To truly overcome health disparity, we must create nimble methods of providing preventive health care to populations which fall below the radar as we engage our patients as cultural thought leaders to advocate wellness to thousands of local community members each year through health outreach events (cancer screenings, blood drives, immunization campaigns and health literacy events), wellness advocacy, Emergency Management, and social services. Within the past year, under our leadership, NOMC patients were strong voices in the health advocacy landscape of New Orleans - including outspokenness on a ban on smoking in bars and restaurants (i.e. their workplaces) and on the medicaid expansion program and the addition of dental and PT benefits to Medicaid.

Our comprehensive medical clinic is supported by the LSU Healthcare Network (which donates the space for the NOMC), family foundations, and donors who invest in the concept that the most affordable way to provide medical care is through prevention, early detection and patient engagement.

Since the founding of the NOMC, stakeholders are continuously asked: How can you afford to provide such a wide range of medical services to 2500+ performers?

Our answer is simple: **How can we afford not to?**
Risk and Resilience of New Orleans Musicians and Hurricane Katrina: Identifying Factors of Vulnerability and Protection

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Background: Hurricane Katrina stormed through New Orleans on August 29, 2005, leaving 80% of the city under water. Musicians are among the most disadvantaged, exposed, and vulnerable of populations. Many were not able to return, and those who did faced rebuilding their homes, lack of work, loss of community support, lack of healthcare infrastructure, and mental health issues related to the catastrophe. Faced with these challenges, many have thrived to become something newer and better. The stories of resilient musicians were researched in order to address their strengths, vulnerabilities, and ability to overcome disasters.

Purpose(s)/Aim(s): The purpose/aim of this study was to better inform musicians and helping professionals about factors of risk and resilience that professional musicians face in a way that will remediate vulnerabilities, while also building upon strengths.

Methods: Semi-structured ethnographic interviews were conducted with 10 resilient New Orleans musicians. The content of these videotaped interviews were coded using the Variable-Generating Activity (VGA), resulting in the identification of 5 themes of musician resilience. The specific content of these 5 themes will be presented in meaningful ways to better plan for positive future outcomes.

Results: This study explored the resilience of musicians in New Orleans. The primary research question was: What are the factors that have enabled resilient musicians in New Orleans the ability to cope with the disaster that was Hurricane Katrina? 10 research sub-questions were developed that are consistent with the research literature. Findings indicated a significant overlap in the content of the items generated by the VGA process, allowing for the consolidation of 10 research questions to 5 themes of musician resilience. These 5 themes of musician resilience are: Risk Factors, Stress, and Mental Health; Protective Factors and Thriving; Social Support; The Role of Consuming or Performing Music; Connection to Community and Mentoring. Each of these 5 emergent themes will be discussed individually, along with specifics germane to each theme.

Conclusions and Practical Relevance: 5 themes of musician resilience were developed from 10 interviews with resilient New Orleans musicians. These themes include 127 specific items that represent the lived experiences of those interviewed. The content of these themes generally, and items specifically, may assist both musicians and those in the helping professions better plan for future outcomes.

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Experience, Attitudes towards and Knowledge of Playing-Related Injuries in Symphony Orchestra String Players: A Questionnaire Survey of London Symphony Orchestras

Christina Siomos, BSc, MBChB, MMus, LRAM, Trinity Laban Conservatoire of Music and Dance, London, United Kingdom

Background: A 1988 survey of 2,212 orchestral musicians in the U.S.A. revealed that 82% suffered a playing-related medical problem, with 76% experiencing at least one severely affecting their performance. The highest prevalence was in string players.

Purpose(s)/Aim(s): The purpose/aim of this study was to assess changes in the prevalence of playing-related morbidity amongst orchestral string players since publication of this milestone survey and investigate their experiences, attitudes and knowledge of playing-related injuries.

Methods: A questionnaire comprising three parts (‘Experience’, ‘Attitudes towards’ and ‘Knowledge of’ playing-related injuries and their prevention) was distributed to 292 string players (violins I and II, viola, ‘cello, double bass) from five London-based orchestras (LSO, BBC Symphony Orchestra, RPO, LPO, Philharmonia Orchestra), with 137 players (65 violinists, 30 violists, 23 ‘cellists, 15 double bassists, 4 unstated) returning it.

Results: Prevalence of pain and discomfort when playing was 88.2%, with 39.8% experiencing it daily, 23.5% weekly and 36.7% monthly. ‘Cellists and violists (95.5% and 93.3% respectively) were the most affected and prevalence was higher in females. 62.8% had suffered a playing-related injury, with 46.3% suffering an injury severely affecting their performance and 39.7% having to stop playing as a result (50% for less than one month, 37.5% for 1 to 3 months, 8.3% for 3 to 6 months). Injury was more common in females and occurrence was higher in ‘cellists (84.2% affected). 66.2% considered a degree of pain and discomfort when playing to be inevitable, a view held more by those who experience such symptoms or have suffered a playing-related injury. 90.5% felt that playing-related injuries were not taken seriously enough at music college. Respectively, 75.6% and 67.9% did not receive information and advice on these injuries at music college or as an orchestral musician. 68.1% were able to name a specific injury, 43.8% three ways in which to minimise injury risk whilst practising and 98.3% a method of injury prevention, with 73.7% actively undertaking injury prevention.

Conclusions and Practical Relevance: This study gained unprecedented access to London’s leading symphony orchestras and revealed no improvement in the prevalence of pain and injury amongst orchestral string players, highlighting the ongoing importance of research and education into the causes and prevention of playing-related injuries.

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LGBTQI Sensitivity in the Healthcare Setting

Jason Hu, MD, NewYork-Presbyterian/Queens, Weill Cornell Medical College, New York, New York, USA

Background: Both the LGBTQI community and the healthcare system have been evolving at a rapid pace. As a healthcare professional, I hear of concerns that my colleagues do not feel well-trained to be comfortable initiating the topic of sexual orientation, or gender identity, in a clinical setting. As a member of the LGBTQI community, I hear complaints from friends who feel they are not treated with sensitivity when they visit some of their medical providers.

Purpose(s)/Aim(s): The purpose of this presentation is to bring awareness to LGBTQI healthcare discrepancy, and teach sensitivity towards the LGBTQI community in the healthcare setting.

Approach of Presentation: 15 minute oral presentation with slide show and video

Content of Presentation:
- Define terminology and describe concepts related to LGBTQI population
- Discuss health disparities experienced by LGBTQI patients
- Discuss LGBTQI health topics
- Share cases/stories
- Provide a set of tools to work with LGBTQI patients

Conclusions and Practical Relevance: This presentation will teach the basics of LGBTQI sensitivity in a healthcare setting, and provide resources for continued education for providers and their staff.

Key References:
- Association of American Medical Colleges (AAMC)
- Diversity Inc.
- Gay and Lesbian Medical Association (GLMA)
- Human Rights Campaign (HRC)
- Weill Cornell Medical College LGBT Steering Committee
- 2016 LGBT Health Workforce Conference: New Frontiers & Interprofessional Collaboration in LGBT Health
  - Weill Cornell Medicine/ NewYork-Presbyterian Hospital/ CUNY Hunter College

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Developing an Interdisciplinary Clinic for Instrumental Musicians’ Occupational Health: Programmatic Implications and Potential Translatable Models

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Background: A large and growing body of research confirms that engagement in music-based activities is essential for well-being over our life span. In the U.S., more than 62 million people are reported to play a musical instrument, however, about a third of them are experiencing pain and discomfort in their necks, arms and hands. This indicates the necessity for a paradigm shift in approaches to musicians’ playing related musculoskeletal and neurological disorders from a “boutique model” towards a global public health perspective. Despite the heightened interest in musicians’ playing related health within the last three decades, no decrease in the incidence and prevalence rates of playing related disorders has been observed. The consensus among clinicians, pedagogues and musicians emphasize the need for creating multidisciplinary alliances to increase a cohesive knowledge base and to enhance the capacities of stakeholders in developing preventive and rehabilitative programs for musicians. However, institutional entities that are willing to embrace this responsibility are often left with limited financial resources and an insufficient interest from the medical community.

Purpose(s)/Aim(s): The purpose/aim of this presentation is to clarify relevant constituencies and the essential components of an interdisciplinary musicians’ health and wellness clinic that is applicable to the medical sector with parallels to already established models in other fields.

Approach of Presentation: Interviews conducted with stakeholders and an evaluation of translatable models will be used to illustrate the elements of a framework necessary to guide the establishment of a sustainable interdisciplinary clinic for musicians.

Content of Presentation: A qualitative analysis of the interviews with key informants for constituencies including instrumental instructors, performers, singing-voice specialists, physicians, therapists, somatic education specialists, administration and third party re-imbursers indicate significant differences in perspectives in the need, scope, key partners, organizational structure and mechanism of oversight of a musicians’ interdisciplinary clinic, creating challenges for programmatic development. Sports medicine, geriatrics and singing-voice team approaches have the potential to provide viable translatable models.

Conclusions and Practical Relevance: Establishment of interdisciplinary clinics to effectively serve instrumental musicians' preventive and rehabilitative needs has implications for musicians' health and wellness, and will benefit from identification of common grounds and alignment of stakeholder perspectives.

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The British Association for Performing Arts Medicine (BAPAM): A National Clinical and Educational Service for Performers

Deborah Charnock, BSc, PhD, ATCL, MMus, BAPAM, London, United Kingdom

Background: Performing artists commonly experience physical and psychological problems in the course of their training and work. Lack of awareness of performer health issues amongst both performing artists and healthcare professionals means that many performers can struggle to find timely and appropriate advice and support. For over 30 years, BAPAM has been providing support to a diverse range of performing artists in the UK through free assessment clinics, referral to specialist practitioners and educational programmes for both performers and healthcare professionals.

Purpose(s)/Aim(s): The purpose/aim of this presentation is to outline the work of a unique, national non-profit organisation providing health advice, support and education in performer healthcare.

Approach of Presentation: The lecture will provide an overview of BAPAM's work with detailed reference to clinical caseload (over 1,000 performers annually), referral network (the BAPAM Directory), education and training activity, and strategic plans.

Content of Presentation: Descriptions of performers and their problems and the ways in which BAPAM helps them will be outlined. Our activities as the UK's national knowledge hub for performing arts medicine knowledge and practice will also be outlined, including our research and training activities and involvement in the development of the Master's (MSc) in Performing Arts Medicine at University College London (UCL). Demand for BAPAM's clinical services is growing and, as many of the problems we see are preventable and amenable to practical advice and short term interventions, we have recently developed an education programme for performers (including teachers and students) providing both generic talks and bespoke workshops relevant to the performers' specific practice. The importance of health promotion and education initiatives with key partners, particularly the Musicians' Union (MU), will be outlined.

Conclusions and Practical Relevance: BAPAM's experience as a national centre co-ordinating research, education and clinical practice provides unique opportunities and insights for the future development of Performing Arts Medicine.

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Popular Musician Attitudes Regarding Mental Health Services

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Background: Musicians, particularly popular genre performers, have been shown to be at elevated risk of psychiatric illness (Raeburn et al., 2003) and suicide (Kenney & Asher, 2016). A recent study found musicians three times more likely to utilize psychotherapy and 50% more likely to use psychotropic medication compared to the general workforce (Vaag et al., 2016). Little is known, however, about how beneficial or efficacious mental health services are perceived by musicians.

Purpose(s)/Aim(s): The purpose/aim of this study was to investigate musicians' satisfaction with, and perceived benefit from, counseling, psychiatric medication management and/or addiction recovery services.

Methods: An online client satisfaction survey was sent to all musicians and their family members actively enrolled in mental health services through a nonprofit mental health organization between June, 2014 and June, 2015 (n=628).

Results: 262 individuals (41.4%) responded to the survey. 94% of respondents were musicians (n=244), 5% were family members, and less than 1% had other music industry roles. A majority of musician respondents were male (60%) and white (79%). 87% were receiving counseling, 32% psychiatric medication management and 8% addiction recovery services. 89% percent of musicians (196/220) rated their counselor as "very good" or "excellent"; 79% (71/90) rated their psychiatric providers and 90% (26/29) rated their addiction recovery specialists in this range (non-significant between all categories, p > 0.05). 86% of musicians receiving counseling, 75% receiving psychiatric medication management, and 52% receiving addiction recovery services either agreed or strongly agreed their symptoms and overall functioning improved as a result of treatment (p < 0.05 for differences between all categories). 99% of musicians said they would refer a friend to this mental health organization.

Conclusions and Practical Relevance: The results of this study show popular musicians express strong satisfaction with a variety of mental health interventions. Rationales for differences in perceived symptom reduction and functioning improvement between treatment modalities are discussed and warrant further investigation. Dissemination of these findings may encourage others in this high risk, underserved population to seek mental health treatment.

Key References:

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Notes
Strategies of Postural Control in Musicians: The Role of Vestibular Input

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Background: Postural dysfunctions are among the causes of many musicians disorders, mainly related to overuse. Recent neurophysiological acquisitions affirm the key role of vestibular input as intrinsic reference in the regulation of postural control in order to achieve maximum efficiency with minimum effort, in static and even more in dynamic.

Purpose(s)/Aim(s): To check the possible role of vestibular dysfunction as one of the causes of overuse syndrome in instrumental musicians.

Methods: Seventeen advanced courses musicians of Conservatoire “F. Venezze” (Rovigo, Italy) affected by overuse syndrome and without vestibular symptoms underwent a static and dynamic posturography to assess their balance and the role of different inputs (visual, proprioceptive, vestibular) on their postural strategy.

Results: 14/17 subjects (82%) showed one or more posturographic alterations, 8/17 (47%) in those conditions more challenging for the vestibular system (eyes closed on foam and/or eyes closed on mobile platform); 2/17 (11.7%) showed a clear vestibular impairment at the Sensory Organisation Test.

Conclusions and Practical Relevance: all the subjects suffered from “overuse syndrome” and a noticeable percentage of them showed posturographic patterns possibly related to vestibular dysfunction or altered central integration of even correct vestibular inputs. In our opinion, coming from neurophysiological assumptions and these preliminary data, there is a need of further exploration of the role of the vestibular system in the pathophysiology of performance related musculoskeletal disorders for prevention, treatment and performance improvement issues.

Key References:
Goodworth AD et al, J Neurophysiol 2010; 103:1978-87
Norris RN., The Musician’s Survival Manual; ICSOM, 1993

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Muscle Balance and Motion Patterns - Design of a Multicentre EMG Study of Muscle Activity in Instrumentalists

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Background: Instrumentalists are exposed to many risk factors that may lead them to develop playing-related musculoskeletal disorders (PRMDs). The dynamic and static load while playing most of the instruments may result in muscular overuse problems, particularly prevalent in the upper limbs and back. The fast and repetitive movements of a musician may over time result of in inappropriate physical strain and consequent alterations in muscle balance and motion patterns. This abstract presents a cross-sectional design to concurrently investigate muscle activity and motion.

Purpose(s)/Aim(s): The purpose/aim of this study is to analyse whether there are different muscle balance and motion patterns in musicians with and without PRMDs and how these patterns correlate with other influencing factors such as duration, pain, anxiety or performance capacity.

Methods: The subject group will include music students and professional musicians, who are divided via questionnaires and physical tests to a PRMD and a no PRMD group. In the first phase, a pilot study, a delphi survey and a literature review identifies the muscles that are mostly used in surface electromyography (SEMG) applications in instrumentalists and which instrument is the most evaluated. The second phase uses SEMG and kinematic analysis systems to examine muscle activities and motion patterns of both groups while playing defined musical excerpts varying in speed and intensity of playing. Primary outcomes are the muscle activity characteristics and motion patterns. Correlations will be drawn between these and playing duration, pain, anxiety and performance capacity.

Results: This is the presentation of a study design, as data capture will not yet be completed. The hypothesis is that there will be differences between musicians with and without PRMDs in the results of the SEMG and the motion capturing analysis. These results may further correlate with the secondary outcomes.

Conclusions and Practical Relevance: Significant differences in muscle balance and motion patterns between musicians with and without PRMDs may provide valuable information concerning the impact of PRMDs on performance. It may be possible to identify compensatory or less effective motor strategies used to maintain performance. Recognising aberrant motion patterns, and if such motions are correlated with less efficient muscle activation patterns, may help in developing targeted PRMD prevention and management strategies.

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Anxiety’s Effect on Muscle Activation and Fatigue in Trumpet Players: A Pilot Study

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Jeeyun Park; B.S. in Biology, B.S. in Biomedical Engineering
Peter Pidcoe; Ph.D. in Bioengineering

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Background: Physical stressors are extremely common in musicians; one study showed that up to 64% of instrumentalists suffer from musculoskeletal disorders. Psychological factors, such as anxiety, can contribute to musicians' muscle overexertion and improper playing technique. Monitoring pressure—resulting from being watched or evaluated—can be detrimental to sensorimotor skills. This is because of the performer's increase in explicit motor control rather than focusing externally on the goal. Thus, the interaction of anxiety, muscle fatigue, and performance effectiveness could be interpreted as follows: the more the player experiences anxiety, the more he/she increases explicit motor control, over-exerts the muscles, and then experiences fatigue. Due to the increase of muscle fatigue, the quality of performance decreases. The more the quality of performance decreases, the more the player's anxiety continues to increase, resulting in a cyclical performance decline.

Purpose(s)/Aim(s): The purpose of this study was to analyze the possible relationship between anxiety, muscle activation, and muscle fatigue in undergraduate trumpet players.

Methods: Twenty-seven undergraduate trumpet players were involved in the study. Surface electromyography (sEMG) data of the right masseter, upper trapezius, and sternocleidomastoid muscles were taken during six 30-second playing trials. The State Trait Anxiety Inventory was used to measure trait anxiety, and a Visual Analogue Scale was used to measure perceived anxiety during the playing trials. Half of the subjects were informed that their performance was being evaluated for accuracy (anxiety-induction group), while the other half was told not to worry about mistakes (control group).

Results: The anxiety-induction group was shown to have higher masseter activation (M=95.0), than the control (M=54.4); the anxiety-induction group also displayed a slightly higher fatigue rate in all three muscles versus the control. Subjects with high perceived-anxiety (as measured by the VAS) displayed higher masseter activation (M=104.5), than non-anxious participants (M=62.9). Subjects with high perceived anxiety also had higher fatigue rates in the upper trapezius and sternocleidomastoid than non-anxious participants.

Conclusions and Practical Relevance: Despite these notable trends, there was no statistical significance for any of the muscle groups for muscle activation or fatigue. However, this pilot study suggests the potential for future research to explore both an improved protocol and increased sample size.
Key References:


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Optimizing Body Gestures of Advanced Violinist with Motion Capture

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Background: Strategies and techniques to enhance musical performance have scientific, didactic and artistic implications. Current research mostly dealt with cognitive issues (memory) or reducing anxiety and stress before public performances (Williamon Oxford University Press, 2004). In the present study we focus on how changes in body postures and gestures by kinesthetic interventions could have a positive effect on kinetic features of bow movements and sound qualities of advanced violinist students.

Purpose(s)/Aim(s): The purpose/aim of this study was to assess the impact of specific changes in postures of violinists that are supposed to provide a better muscular equilibrium and dynamism according to Meziere’s kinesthetic model (Mathieu, 2004)

Methods: 20 violinists participated in the study, half being advanced students from the musical conservatoire of Dijon, the other half being professional violinists. Each of them was requested to play 4 musical pieces before and after the intervention of the kinesytherapeute. The intervention spend 20 minutes, and consisted in modifying the body posture of the violonist. Motion capture was used each time with 12 optitrack cameras and the musical performance was recorded with the high quality device. The musical performances were rated for several features (including sound qualities, loudness and aesthetic value) by a set of 5 professors of violin who were not informed about the purpose of the experiment.

Results: The data analysis compared the overall body posture (centra gravity center, hands, arms, shoulders, hips and feets) before and after the kinesthetic intervention, and linked changes in posture and gestures with changes in sound qualities. The findings suggest that the kinesthetic intervention actually modified the velocity of the bow and these changes were associated with changes in sound qualities: changes in bow velocity provoked changes in sound attacks, timbre richness, and loudness. Finally performances after the kinesthetic intervention were significantly rated differently, with more aesthetic values.

Conclusions and Practical Relevance: The present study provides some evidence that a slight changed in posture achieved by a short kinesthetic intervention can modulated the gestures of advanced and professional violinists, leading to changes in sound qualities and esthetic value.

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A Retrospective Analysis of the Pre-Season Screen Used in a Professional Ballet Company with Recommendations for Improvements in the Screen

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Background: Professional ballet dancers are at a high risk for lower extremity injuries. Dance USA developed a pre-season health screen intended to identify medical or musculoskeletal conditions that may limit a dancer's ability to participate. This study examined 7 years of screening data to determine the screens ability to detect at risk dancers.

Purpose(s)/Aim(s): The purpose/aim of this study was to determine the ability of the current pre-season screen to detect professional dancers' risk for injury and examine how the addition of hand dynamometry and 3D analysis could improve the screen.

Methods: Past screen history from the 2007-2014 seasons was obtained from 285 medical records. The ability of the established pre-season screen to predict injury among the injured dancers was determined by noting side-to-side differences specifically in the manual muscle test and functional movement analysis portions of the screen. Additionally for the 2015 season, 17 professional dancers from the Nashville Ballet (11 female and 6 male) were screened. Manual muscle testing was performed using hand dynamometry on the gluteus maximus and gluteus medius muscles of each subject. 3D motion analysis (MyoMotion) recorded dancers performing demi-plies on the right and left sides in parallel and in turnout.

Results: Of the injuries reported during the 2007-2014 seasons, 92% were in the lower extremity. This data showed that manual muscle testing identified side-to-side gluteus medius differences in 26.92% (n=26) and gluteus maximus side-to-side differences in 80% (n=5) of injured dancers. Visual assessment of alignment while performing a plie in parallel and in turnout identified side-to-side differences in 23.08% and 26.92% respectively of the injured dancers. Strength testing with the hand dynamometer, showed a significance between right and left gluteus maximus strength in percent body weight (p = 0.000) and right and left gluteus medius strength in percent body weight (p = 0.025). When assessing alignment using MyoMotion Kinematic Analysis, right and left hip external rotation in turnout was found to be significant (p = 0.004).

Conclusions and Practical Relevance: The pre-season screen used by professional ballet companies only identifies 25.64% of side-to-side differences. Using hand dynamometer and 3D motion analysis is recommended to improve the pre-season screen ability to identify at risk dancers.

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Are Musician’s Injuries Inevitable?

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**Background:** The Taubman Approach is an analysis of the minute motions that function underneath a virtuoso technique. The resulting knowledge makes it possible to assist pianists and other instrumentalists to overcome technical limitations, as well as prevent and treat playing-related injuries. It is also the way that tone production and other components of expressive playing can be understood and taught. The Taubman Approach was developed to provide solutions to the common technical problems and injuries experienced by many performing musicians.

**Purpose(s)/Aim(s):** This presentation will examine and demonstrate some of the specific in-coordinate hand/forearm positions and movements that commonly result in playing-related injuries and explain the basic principles that underlie a healthy technique.

**Approach of Presentation:** The presentation will draw on both the theoretical and the practical application of the Taubman Approach to instrumental playing. The practical demonstrations at the piano will be underpinned by detailed explanations of the bio-mechanics underneath a co-ordinate, healthy technique, explaining how the Taubman work may assist musicians in overcoming playing-related injuries.

**Content of Presentation:** The presentation will address various passages from the piano repertoire, demonstrating how very specific co-ordinate movements can assist in overcoming common technical and musical difficulties encountered by pianists, leading to fatigue, injury and pain. The presentation will also draw on specific cases to demonstrate the efficacy of this approach in successfully re-training injured pianists to return to playing professionally.

**Conclusions and Practical Relevance:** This presentation aims to offer a new and often unfamiliar perspective on long-existing problems amongst the musical community. Through deeper understanding of the physicality behind a healthy, co-ordinate technique, musicians can avoid playing-related injuries. Injured musicians can access long-term solutions, rather than merely address symptoms, so that they can again have the opportunity to practice their craft and engage in quality musical experiences.

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Notes
Physical Trauma and its Consequences for Musicians Careers

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Background: Physical trauma creates severe consequences for or destroys the professional career of instrumentalists. Of specific interest are the performing arts medicine related therapeutic procedures in the treatment of instrumentalist's injuries, as well as the outcome related to their professional career.

Purpose(s)/Aim(s): The purpose/aim of this study was to analyze individual therapeutic steps and efficiency in the treatment of traumatic injuries in instrumentalists related to the specific needs of musicians including posture, playing techniques and ergonomics. Furthermore we would like to learn, which steps could be helpful in preserving a professional career for instrumentalists, and which ones could not prevent ending professional playing.

Methods: From 130 instrumentalists 92 were male, as 38 were female, ranging from 18 to 64 (average 42) years. Only 22 (16.9%) suffered from a trauma directly related to their professional surroundings. All the others (83.1%) suffered from home (31.5%), sports (29.6%) or traffic (17.6%) accidents or others (4.4%) - including severe trauma as f.e. the fall from a mountain during climbing in the swiss alps, where co-climbers died. In all cases the upper limbs where involved, here in 79.2% as single injury, in 20.8% as injury combinations. Operative fracture treatment (ORIF) was necessary in 27 cases (20.7%). 6 instrumentalists (4.6%) did not return back to a professional level of playing. For the other 124 instrumentalists it took unto 6 weeks (48.5%), 3 months (36.9%) or 6 month (10.0%) to return to their original working place in orchestras, ensembles or soloist work.

Results: From 130 instrumentalists 92 were male, as 38 were female, ranging from 18 to 64 (average 42) years. Only 22 (16.9%) suffered from a trauma directly related to their professional surroundings. All the others (83.1%) suffered from home (31.5%), sports (29.6%) or traffic (17.6%) accidents or others (4.4%) - including severe trauma as f.e. the fall from a mountain during climbing in the swiss alps, where co-climbers died. In all cases the upper limbs where involved, here in 79.2% as single injury, in 20.8% as injury combinations. Operative fracture treatment (ORIF) was necessary in 27 cases (20.7%). 6 instrumentalists (4.6%) did not return back to a professional level of playing. For the other 124 instrumentalists it took unto 6 weeks (48.5%), 3 months (36.9%) or 6 month (10.0%) to return to their original working place in orchestras, ensembles or soloist work.

Conclusions and Practical Relevance: The treatment of instrumentalists has always to be designed very individual and needs basic knowledge of the professional requirements, after physical trauma even more. Creativity is essential to adapt ergonomic details as musician's instruments, accessories, seats ecc. to the individual patient. We like to present typical cases of patients on their way back to play in professional surroundings, and the individual concepts to enhance this process.

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Determining a Movement System Diagnosis and Treatment for a Career-Threatening Neck Injury to a Professional Violinist

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Background: The Movement System Impairment theory, developed by Sahrmann and Associates, states that sub-optimal movement patterns can cause musculoskeletal pain and injury. A major premise of the theory is that painful and degenerative conditions are precipitated by subtle, repetitive deviations from ‘normal’ alignment and movement. For example, if a violinist uses a scapular depression strategy to stabilize her instrument, it can be shown how this strategy may be a contributing factor to her neck injury. Improving the scapulae position while playing can reduce stressful forces on the neck. The theory states it is possible to train ourselves to change painful ingrained patterns into more beneficial ones.

Purpose: The purpose of this presentation is to inform musicians, healthcare practitioners, and teachers that it is possible to identify and categorize movement-related causes for musculoskeletal pain. The movement diagnosis that identifies the faulty pattern also guides the treatment by specifying which motions are causing symptoms.

Approach of Presentation: I will present a case study of a 45 year-old professional violinist with neck and arm pain. I will illustrate the contributing factors and treatments to correct her impairments and faulty movement patterns.

Content of Presentation: A 45 year-old female professional violinist with the diagnosis "cervical disc osteophyte complex with foraminal narrowing" was referred for physical therapy. Initially, she could not move her head or hold her violin. A movement system diagnosis of scapula depression and cervical extension-rotation was determined using a movement examination to analyze her alignment and movements. The exam, daily life and violin playing all mirrored the same faults found in the exam. By re-training her way of aligning and moving, and the way she played violin, she was able to progress to playing without symptoms.

Conclusions and Practical Relevance: A predominant belief among physicians and the public is that most wear and tear injuries "just happen". The Movement System Impairment theory postulates that it is possible to find a biomechanical cause for many injuries by using a systematic movement exam and an analysis of movements in daily and professional life. This analysis applies to any activity - artistic, athletic, or daily life. Our personal and national healthcare costs could diminish if it can become widely accepted that how we move our bodies is medically relevant.

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Musculoskeletal Demands in Violin and Viola Playing

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Christoff Zalpour, Prof Dr., University of Applied Sciences, Osnabrück, Germany

Background: Performance-related musculoskeletal disorders (PRMDS) are known as a common problem amongst orchestral musicians. They can cause high costs for the musicians and orchestras and can lead to serious consequences for their performances and finally their career. Recent research in music medicine has reported incidence rates of musculoskeletal disorders of approximately 70% in instrumental musicians. String players had the highest risk of performance-related musculoskeletal disorders with incident rates ranging from 65% to 88%. Neck, jaw, shoulder, hands and back are the most affected body regions. Playing the violin or viola requires complex musculoskeletal skills. The high frequency of repetitive movement patterns, dynamic and static muscle load, awkward postures, poor technique and increasing practice time are factors that can cause musculoskeletal strain. In ergonomic literature these disorders can be categorized based on extrinsic and intrinsic loads. The intrinsic loads, like muscle utilization and joint motion in violin playing, are necessary to identify factors of musculoskeletal disorders.

Purpose(s)/Aim(s): The identification of intrinsic loads in violin playing may facilitate the development of prevention strategies, clinical examination and interventions in performing arts medicine. And it could also inform further research.

This study gives an overview about what kind of musculoskeletal demands can be found in research about motion and posture in violin and viola playing. The aim of this study was to present a survey about musculoskeletal demands in violin and viola playing.

Methods: A literature search was conducted using the following electronic databases: PubMed, COCHRANE and CINAHL from 1999 to 2015. A manual search of a key performing arts journal, Medical Problems of Performing Artists, was also conducted. Additional references were identified by searching the citations and reference lists of all identified relevant studies.

Results: The results (using the results of the shoulder) suggest that an asymmetric playing posture, the associated muscle activity and joint mobility may contribute to musculoskeletal problems in violinists. It indicates an increasing load of intrinsic factors in violin performance.

Conclusions and Practical Relevance: The identification of musculoskeletal demands in high string players could provide strategies how PRMDs should be prevented and treated. The results could be relevant for clinicians, therapists and researchers.
Hypermobility and Proprioception in the Finger Joints of Flautists

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Howard Bird MD MA FRCP, University College, London, London, United Kingdom

Background: Ergonomically, the flute is especially complex among wind instruments, and flautists may therefore be at particular risk of performance-related musculoskeletal disorders. Yet little is known about injury prevalence among flute players, and even less in those flautists who are also hypermobile. Recent research has found hand and wrist pain to be common complaints among flautists. Understanding of the predictors of injury and pain is therefore crucial as the presence of pain decreases performance quality and causes unnecessary time loss. There is a strong relationship between hypermobility and impaired proprioception, although many musicians may acquire greater proprioception than the average population.

Purpose(s)/Aims(s): The aim of this study was to compare flexibility and proprioception of the hand in a study of flautists.

Methods: Twenty flautists took part in the study. General hypermobility, the passive range of motion of the 3 specific joints most involved in flute playing, and proprioception acuity were all measured accurately for the first time in this awkward instrument that needs high levels of dexterity.

Results: Flautists’ finger joints have a greater range of movement than in the general population. This group of flute players had especially large ranges of movement in the finger joints, which take the weight of the instrument. Although flautists have hypermobile finger joints, they are not generally hypermobile elsewhere as measured by the Beighton Scale. Flautists, even with very mobile finger joints, have very accurate proprioception, which may be acquired through training.

Conclusions: The study of instrumentalists may provide an ideal model for study of the interaction between localized joint flexibility and joint proprioception, both inherited and acquired.

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Exercise and Stress Induced Hypoalgesia in Musicians with and without Shoulder Pain: A Randomized Controlled Crossover Study

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6) StatUa Center for Statistics, University of Antwerp, Antwerp, Belgium 
7) Ghent University Hospital (6K3) (REVAKI), Faculty of Medicine, Ghent University, Belgium

Background: Professional and pre-professional musicians are characterized by physical and psychological demands inherent to their musical activity, and therefore at risk for developing performance related musculoskeletal pain. Physical and psychological demands are known to influence human pain modulation.

Purpose(s)/Aim(s): The purpose/aim of this study was to compare the influence of a physical and emotional stress task on pain thresholds in musicians with and without shoulder pain.

Methods: A single-blinded randomized and controlled crossover study design was used to compare the effects of a physical versus emotional testing procedure on pressure pain thresholds (PPTs) in musicians with and without shoulder pain. During the physical testing procedure, the subjects performed an isometric exercise of the glenohumeral external rotators. The emotional task comprised watching “unpleasant” images selected from the International Affective Picture System. The outcome was the assessment of change in PPTs before and after the physical and emotional task.

Results: Our results indicate similar effects of both protocols in either group i.e. musicians with and without shoulder pain (p>0,05). All musicians showed elevated PPTs at local and remote areas after isometric exercise (p<0,05). The emotional stress task increased PPTs at remote areas only (p<0,05).

Conclusions and Practical Relevance: In musicians with and without regional shoulder pain, no significant differences were found with respect to pain modulation during a physical and an emotional stress task. Both interventions adequately activated central and widespread pain inhibitory mechanisms in both groups.

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The Role of the Hand in Healthy Technique

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Dustin Hardwick, PT, DPT, PhD, University of South Florida School of Physical Therapy, Tampa, Florida, USA

Background: Performance Related Musculoskeletal Disorders (PRMD's) are a significant health problem amongst musicians. The most prevalent location of PRMD's in musicians is the upper extremity. The hand is the primary interface between the instrumentalist and the instrument. Observations in the teaching studio demonstrate patterns of motion in the upper extremities and hands that correspond to both a high level of function and artistry and also to dysfunction and injury. Therefore the goal of this line of research is to identify these elements of both healthy technique and dysfunctional instrumental technique.

Purpose(s)/Aim(s): The purpose of this study is to explore the role of finger/hand use in organizing and integrating function of the upper extremity and the system as a whole.

Methods: For the first phase of this line of research we are studying a cohort of healthy individuals. We are using a handheld dynamometer to measure the effects of varying hand positions on proximal shoulder strength. We are also utilizing electromyography and video to explore movement patterns and activation patterns of the proximal upper extremity during tasks with varying hand use and positions.

Results: Preliminary data suggests clear differences between and open and active hand compared to a dropped passive hand. An open and active hand results in greater strength of the muscles of the shoulder as measured by dynamometry and manual muscle testing techniques. An open and active hand results in a greater sense of stability during a variety of tasks and an observable increases in stability during a full body stability test.

Conclusions and Practical Relevance: Preliminary data suggests that an open and active hand results in greater strength and improved organization and stability of the shoulder and the entire system. Conversely, a dropped hand caused a marked decrease in strength and stability. A dropped hand may be an element of dysfunctional technique that may contribute to PRMDs. There is an observable and reported change in organization/mechanics of the motions, specifically the motions become more disorganized and less integrated. This data has immediate clinical relevance to technique and rehabilitation.
Postural Reintegration – A Delicate Balance

Philip Drube, M.OMSc, MA, BA, The Spinal Joint Classical Osteopathy, Toronto, Ontario, Canada

**Background:** My background as a professional dancer, and student of movement awareness disciplines, put me in a place to investigate and challenge limits, mentally, physically and artistically. The transition into becoming an osteopathic practitioner continues the challenge and follows in the footsteps of A.T. Still and many other significant osteopaths. Osteopathy has led me back and forth on a more scientific route. Both careers represent a study in anatomy and a cognitive awareness and understanding of the body. I sometimes describe it as outside-in vs inside-out. An osteopath must have a 3D concept of how to illicit change from restriction and provide the opportunity for motion.

**Purpose(s)/Aim(s):** The purpose/aim of this presentation is to give the participants a greater dynamic understanding of the relationships involved in their ever changing posture. We are constantly in motion and therefore our nature of adaptability leads to compensatory patterns. Alterations of motion mechanics can have an adverse impact on the individual. I hope to influence people by giving them tools to increase their own abilities of postural awareness or learn how to learn.

**Approach of Presentation:** Lecture and interactive movement demonstration, discussing relevant anatomy, fascial patterns, postural dynamics and breathing. PPT as well, if possible.

**Content of Presentation:** I will cover relevant anatomy, postural dynamics, breathing, injury prevention and healing. I will discuss osteopathic philosophy and the governing laws and principles that apply to various concepts of treatment. The demonstration will guide people how to recognize imbalances, investigate psycho/physical/physiological relationships and ways to create change and reintegration.

**Conclusions and Practical Relevance:** By providing a key to changing habitual patterns, the artist will have the practical ability to increase their potential in class, on stage and in life.

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A Comparison of the Physical Exercise and Nutrition Behaviors among College Music Majors

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Background: As a college music major, I experienced arm, neck, and back pain. The pain continued as I began my career in teaching and performing music. I was diagnosed with carpal tunnel and mild scoliosis, affecting my violin and piano performance. Through years of treatment with an anti-inflammatory diet and strengthening exercises, including swimming and indoor rock climbing, I have been able to manage pain and build strength and endurance to sustain a career in musical performance.

Purpose(s)/Aim(s): The purpose/aim of this presentation is to investigate and compare the physical exercise and nutrition behaviors of college music majors from two private colleges and one private university.

Approach of Presentation: Lecture with Powerpoint followed by questioning will illustrate comparisons of reported physical exercise and nutrition instrument positions, repetitive motions, and exercises that can strengthen affected areas.

Content of Presentation: One hundred eighty-seven college music majors from one southeastern private university, one southeastern private college, and one midwestern private college responded to a researcher-designed Musicians’ Wellness Questionnaire. Participants reported weekly amounts of intentional physical exercise and nutrition intake. Comparisons were based on gender, instrumentation, academic classification, and school. Male participants reported engaging in more amounts of intentional physical exercise and consuming more red meats. Female participants reported consuming more vegetables and fast foods. Brass performers reported engaging in more moderate-intensity cardiovascular exercises. School A reported consuming more caffeinated coffee or tea, School B reported engaging in more low-intensity cardiovascular exercises, and School C reported consuming more vegetables, lean protein, red meats, and salty snack foods.

Conclusions and Practical Relevance: Further research is needed to investigate lifestyle habits including physical exercise and nutrition behaviors among college music majors. Understanding the possible behavior trends would help music organizations know the types of information that need to be disseminated to musicians, music educators, and college music majors. College and university music departments and music schools could implement health education courses and educate music majors on the need, guidelines, and means for maintaining healthy behaviors as they pursue careers in music ing.

Key References:

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**Prepare the Nervous System for Performance**

Betsy Polatin, MFA, Boston University College of Fine Arts, Boston, Massachusetts, USA

**Background:** I have been working in the Arts for more than 40 years, studying and/or teaching actors, dancers and musicians. My work combines The Alexander Technique with Carl Stough’s Breathing Coordination principles and Peter Levine’s Somatic Experiencing theory of trauma. I am interested in helping performers create a healthy body-mind self.

**Purpose(s)/Aim(s):** The purpose of this presentation is to teach performers new ways to prepare for performance. This will include understanding how three main systems in the body work. 1. Musculoskeletal system - how we are designed to function. 2. Respiratory system - the coordination of the diaphragm. 3. Nervous system – how to regulate activation and deactivation. This will provide easy to use reliable techniques.

**Approach of Presentation:** To prepare for performance, and minimize performance anxiety artists want to understand how to use support. I will present different approaches to finding the support from the ground that can provide a kind of solidity that allows freedom from habit. I will also present explorations to discover the suspension and expansion that allows a performer to fill the stage with themself and their art form. We will look at how this combination of support and suspension can allow unrestricted breathing for full physical, musical, and vocal expression.

**Content of Presentation:** The workshop will address specific performance issues. The class will have demonstrations and also the participants in the class will have an opportunity to explore the ideas and principles presented. The work is also beneficial for injury prevention, and rehab for musicians. Much of the material presented will be from my book, *The Actor’s Secret*, Techniques for Transforming Habitual Patterns To Improve Performance.

**Conclusions and Practical Relevance:** I will be incorporating prevention, and wellness education. And presenting information about the potential physical/psychological risks of performance, particularly those risks related to preparation. I will be addressing performance anxiety, and postural and breathing habits.

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Empowering and Enhancing Artistic Development with Yoga for Musicians

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**Background:** Within the past decade, the advantages of practicing yoga have become abundantly clear to performing artists. In addition to its well-documented physical and mental benefits, yoga provides a therapeutic option for those suffering from many forms of anxiety, especially performance anxiety. Several recent studies in scholarly research journals illustrate a marked improvement in anxiety, stress, depression, and anger when musicians participate in yoga at least once per week. Offering a yoga experience in the college music curriculum helps alleviate problems that arise when students unknowingly use their breath, body, and mind in an automatic, disconnected manner. Such a course can consequently dramatically affect students’ success in the practice room, on stage, and beyond, thus making it critical for creative development and long-term resiliency.

**Purpose(s)/Aim(s):** The purpose of this workshop is for participants to not only take part in a brief “Yoga for Musicians” class, but also to receive an array of information to utilize either in their own practice, pedagogy, or performance in order to improve both psychological and physiological well-being.

**Approach of Presentation:** Using the model I have developed at my university, this workshop will provide an interactive glimpse into a typical class using various asana (or poses), and offer some practical ways the physical and psychological elements of yoga can be integrated into music classrooms, ensemble rehearsals, and applied lessons. It will incorporate both work on mats, as well as, an engaging multimedia presentation.

**Content of Presentation:** This workshop will address benefits for a variety of instruments, disciplines, and physical ability levels, incorporating desires for increased flexibility, decreased muscle tension, relaxed flow of breathing, and reduced anxiety and stress. By providing empowering instruction that avoids criticism and judgment, “Yoga for Musicians” focuses on developing awareness and intentionality in both physical activity and stasis, enabling musicians to learn and play with greater relaxation and enjoyment. It will utilize both unique asana tailored to musicians and incorporate recent scholarly information beneficial to a variety of musicians.

**Conclusions and Practical Relevance:** No prior experience or knowledge of yoga is required and the workshop will be presented in a practical and approachable manner. Overall, the workshop offers a creative insight to the physical and psychological yogic elements related to the developing performing artist.

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Sustainable Performer Wellness: Stress Reduction Through Music Therapy

Michael Anthony Lahue, MT-BC, Performance Wellness, Inc., New York, New York, USA

Background: My work is informed by music therapy training in the USA and Brazil and by the ground breaking Montello Method for Performance Wellness, developed by my late mentor, Louise Montello, PhD, which integrates music therapy, neuropsychology, yoga and research. Dr. Montello's book, Essential Musical Intelligence, identified specific techniques to support the use of music for wellness in a holistic framework. These techniques, stemming from Dr. Montello's research, were incorporated into the Performance Wellness Training workshop to help artists relieve stress, reduce performance anxiety, prevent overuse injuries, and inspire creativity.

Purpose(s)/Aim(s): This workshop will demonstrate specific skills in an experiential format, that can be delivered and utilized by performing artists.

Approach of Presentation: The workshop will incorporate three interactive music and wellness exercises, hand outs to participants, and learning a Brazilian chant.

Content of Presentation: Based upon the growing need for performers to develop self-care practices and tools for stress-reduction in both psychological and physical domains, this presentation highlights practical techniques that are evidence-based. Drawing from the fields of music therapy, neuropsychology and yoga, this workshop shows participants how to reduce stress-related emotional challenges and incident of injury common among performers.

Conclusions and Practical Relevance: Having a self-care routine, building specific skills for anxiety management, and participating in group music-based programs has a definite impact upon stress reduction and injury. These practices can be performed alone or in a group and can be sustainably woven into the busy lives of performers.

Key References:

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Performance Anxiety: Softening the “Grip”

Jo Ann Staugaard-Jones, MA, BS, County College of Morris, New Jersey, USA

Background: Certified Advanced Pilates and E-RYT500 Yoga Teacher Trainer; MA in Dance, NYU. Author of *The Vital Psoas Muscle, The Anatomy of Exercise and Movement for the Study of Dance, Pilates, Sports, and Yoga, and the newly released Concise Book of Yoga Anatomy.* “As artists we spend countless hours practicing and performing, and tend to rely on our bodies' nervous and muscular systems to recuperate on their own. Our "fight or flight" mode is taxed, and the need to re-balance is paramount to a successful career. Calming the central nervous system and releasing the grip of muscles like the psoas major can be key to a healthy body, creative mind, and an enjoyable performance and lifestyle.”

Purpose(s)/Aim(s): The purpose/aim of this presentation is to inform artists and teachers of the capacity of our bodies to relax, heal, and release with simple techniques that can be helpful on a daily basis.

Approach of Presentation: Presentation of documented material as it relates to anxiety will lead to experiential practice of relaxation techniques including breath work and muscle release that are comfortable and self-initiated.

Content of Presentation: Impulses from the central nervous system can be called emotional responses, or “feelings.” These may create muscle tension through nerve innervation. Therefore, when muscles are relaxed, emotions such as fear, anxiety, and other disturbances housed deep in the body can surface. Once they appear and are able to be let go, the entire area can begin to work in harmony, allowing organisms to respond in a healthy way. The complex human nervous system controls the functions of all the different systems of the body, so when there is physical, emotional, and mental release there is connective flow and balance. Modalities to achieve this will be simple yogic techniques of breathwork (pranyamas), as well as Constructive Rest and Systematic Relaxation.

Conclusions and Practical Relevance: The above are excellent methods to calm the body's nervous system and bring integrity to the body’s pathways. This information and practice will be useful to any person who desires a more balanced life.

References: *The Vital Psoas Muscle: Connecting Physical, Emotional, and Spiritual Well-Being*

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The Effective Use of Kinesthetic Training for Upper Extremity Pain in a Musician

Kristie Kava, PT, MS, DScPT, Oakland Physical Therapy, Novi, Michigan, USA

Background: Arm, neck and shoulder pain are recognized problems for musicians. Research demonstrates poor correlation between physical structure and playing-related symptoms. There is little research considering functional movement patterns and playing-related problems. Scapular dyskinesis has been found in the majority of patients with shoulder pain. Research demonstrates improvement in shoulder pain symptoms with a comprehensive exercise program. An effective exercise program, including kinesthetic training, should be a component of treatment and wellness education for musicians.

Purpose(s)/Aim(s): The purpose of this presentation is to demonstrate the importance of evaluation and movement education in the treatment of performance-related injuries.

Approach of Presentation: A retrospective case study of a professional violinist with playing-related shoulder pain will illustrate the evaluation based design and implementation of a graduated therapeutic exercise program.

Content of Presentation: This presentation will include the evaluation and treatment of a violinist with playing related shoulder pain. The evaluation based treatment program will emphasize kinesthetic muscular endurance training for trunk and scapular stabilization.

Conclusions and Practical Relevance: A violinist was successfully treated for complaints of playing-related shoulder pain with muscular re-education and kinesthetic movement training. An effective intervention is needed for the treatment of playing-related injuries and kinesthetic muscle re-education and movement training has demonstrated positive results. This type of training would be well placed in a musician’s training and wellness education.

Key References:

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Torso and Bowing Arm 3D Joint Kinematics of Elite Cellists

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Luke Hopper, PhD, Western Australian Academy of Performing Arts, Edith Cowan University, Perth, Australia; Clifton Chan, PhD, Discipline of Biomedical Science, Sydney Medical School, University of Sydney, Sydney, New South Wales, Australia; Timothy Ackland, PhD, School of Sport Science, Exercise and Health, University of Western Australia, Perth, Australia; Jacqueline Alderson, PhD, School of Sport Science, Exercise and Health, University of Western Australia, Perth, Australia; Peter Visentin, MMus, Department of Music, University of Lethbridge, Lethbridge, Alberta, Canada

Background: Several large cohort studies of musicians have consistently reported a high prevalence of performance-related musculoskeletal disorders (PRMDs) amongst cellists. Highly repetitive movements and sustained positions of shoulder abduction and flexion in cello bowing can cause excessive physical loading of not only the muscles and tendons, but also to the bursae, ligaments and joints of the shoulder and the musculature employed to control the cervical and thoracic regions; this ultimately can lead to cumulative micro-trauma and/or inflammation. There is a need to examine and quantify normative movements during cello playing to gain insight into potential causal factors for PRMDs in cellists.

Purpose(s)/Aim(s): The purpose/aim of this study was to quantify torso kinematics and right shoulder internal rotation in a group of highly skilled cellists during controlled real-time performance of a set piece under contrasting sound volume conditions using 3D motion capture analysis.

Methods: Thirty-one professional and advanced student cellists performed a C major scale three times at two different volume levels in randomized order, with tempo regulated by a metronome. Torso and arm retroreflective markers and virtual marker trajectories representing the elbow and wrist processes were used to generate 3D computer models of three anatomical body segments. Two-way ANOVA were performed for each of the eight joint degrees of freedom, with playing on each of the four strings (C, G, D, A) and the two contrasting volume conditions as factors.

Results: Significant effects were observed for both the string and/or volume conditions across all torso, shoulder and elbow kinematic degrees of freedom (p<0.05). The torso was consistently positioned by all participants in left rotation from the beginning of the scale, increasing at its apogee. During the loud playing condition, mean flexion, internal rotation and abduction ranges of the shoulder increased when playing at the tip of the bow on the A string (p<0.001), and a combination of torso flexion, lateral flexion and left rotation was also observed.

Conclusions and Practical Relevance: Cellists use highly consistent movement patterns to cross strings and regulate volume levels during fundamental bowing actions. There are clinical and pedagogical implications for the consistently static left rotated torso postures and high degree of combined shoulder flexion and internal rotation observed in this group of cellists.

Key References:


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Physiological Demands of Piano Performance: Differences in Repertoire

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Background: The physiological demands of music playing are largely unknown. While a few studies exist that have measured muscle activation during specific movements among certain instrumentalist groups, little is known regarding musicians’ energy expenditure while playing different pieces of repertoire. Such information is useful for those who are responsible for training and wish to better prepare musicians’ for the physical demands of performance. This current study sought to enhance and extend previous investigations into pianists' energy expenditure and measure different pieces of repertoire. A secondary aim was to explore whether there was a greater difference between the energy demands of different pieces of repertoire among pianists with varying levels of skill.

Purpose(s)/Aim(s): The purpose/aim of this study was first, to examine pianists’ energy expenditure while playing two different pieces of classical repertoire and secondly, to determine explore differences between pianists with varying levels of experience and skill.

Methods: Four conservatoire-trained participants volunteered for this study. Following a maximal oxygen uptake (VO2) treadmill test to determine individual VO2 max values, participants played two pieces of classical repertoire (Chopin Prelude No. 13 F# and Chopin Op10, No. 12 Revolutionary), which were familiar to them while wearing a portable gas analyser. Energy expenditure was determined for each piece by calculating the participants’ percentage of their VO2 max scores. Analysis was conducted to determine differences between pieces, individuals and in relation to level of experience.

Results: The two Chopin pieces differed in terms of their demand as calculated relative to participants’ maximal capacities. The Chopin Prelude No. 13 F# and Chopin Op10, No.12 Revolutionary were played on average at 12.7% and 21.8% of participants’ maximum capacities. The physical fitness of the participants appeared to have an impact.

Conclusions and Practical Relevance: Piano playing is an intermittent and transitory activity with regard to intensity and classical repertoire varies in demand. These findings can assist musicians and their tutors to prepare more effectively for the varying physiological demands of piano performance.

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A Preventive Pedagogy: Body Stabilization for Musicians and Music Teachers

Carina Joly, DMA, CAS, Zurich, Switzerland

Background: Two thirds of musicians suffer from playing-related injuries. However, besides the improvement of the accessibility to information on preventive measures through the increasing number of conferences and recently founded organization committees dedicated to the topic, the curricula of music pedagogy programs lack systematic instruction on prevention. Health and music professionals who are actively dedicated to this cause agree that a promising future solution to the current scenario would be to provide more specialized information on how to prevent the most common health problems to the teachers and musicians of the future.

Purpose(s)/Aim(s): The purpose/aim of this study was to contribute to musicians' and music teachers' accessibility to basic instruction on prevention of injuries through a special focus on body stabilization and postural alignment. The principles to be presented in this workshop are applicable to both individual practice routines and studio instruction.

Approach of Presentation: The audience members will be invited to try physical exercises (stimulating higher awareness and muscle tonus) in standing and seated positions with a special focus on the transference of the principles of body stabilization towards their own playing/singing/conducting.

Content of Presentation: The targeted audience of musicians and music educators will be introduced to principles of postural alignment and will experience physical/mental exercises designed by health practitioners (medical doctors and physiotherapists) and body therapists (e.g. Alexander Technique, Yoga, Feldenkrais, Spiraldynamic, and Dispokinesis) to help to improve body stabilization, alignment and awareness in musicians. A list of publications and other relevant sources of related information will be shared.

Conclusions and Practical Relevance: It is hoped that participants will leave the workshop with tools that may help to minimize minor playing-related physical discomfort caused by imbalanced postural behavior. Moreover, it is hoped that after systematically applying the principles presented in the workshop towards their own practice routine, music teachers will be able to better guide their students towards a more aligned and stabilized posture. To finalize the discussion, the establishment of a connection between body alignment and the improvement in the overall musical performance, observed in several cases by peers and instructors (videos will be shown to exemplify), may serve as a strong motivator.
Coaching Musicians on Healthy Practice Habits Outside the Studio/Clinic

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**Background:** Serving in the role of a “coach”, vocal and instrumental music teachers as well as health clinicians treating singers and instrumentalists are tasked with assisting and indirectly training/supervising students/patients in the many hours of practice, rehearsal, and non-musical use of both the healthy and the injured body. By assigning appropriate repertoire and technical exercises and recommending reinforcement of skills and technique in lessons/sessions and rehearsals, music and health professionals request or require regimens for regular daily practice workouts and management of rehearsal and performance schedules.

**Purpose(s)/Aim(s):** The purpose of this presentation is to offer practical pedagogical suggestions and useful Practice Log tools to aid teachers and clinicians in the coaching of healthy practicing and rehearsal/performance techniques.

**Approach of Presentation:** Following a brief discussion of the underlying philosophy of practicing, the workshop will focus on developing supportive coaching skills for teachers and clinicians. An interactive approach will encourage participants to share ideas from their expertise as well.

**Content of Presentation:** The purpose of practicing will be addressed as: positive reinforcement, musculo/skeletal development, applying one’s musicianship, and artistic formation.

Topics to improve teachers’ and clinicians’ coaching skills for practice will include: fostering positivity and building confidence, promoting healthy practicing choices, suggesting efficient and effective methods in practice, encouraging better time management, and choosing optimal dosing of physical activity.

Creating a welcoming atmosphere for brief, regular, and open coaching discussions with students/patients will be stressed.

Tools to be used for Practice Logs, Goal Setting Guides, and Healthy Dosing Plans will be distributed.

**Conclusions and Practical Relevance:** Developing a teacher’s or clinician’s skills as a coach for meaningful, purposeful, effective, and healthy practicing and rehearsing is a lifelong process. The sharing of these ideas and tools among co-professionals brings an opportunity to learn new methods and skills that can directly benefit our students and patients, minimize health risks, and foster health and wellness for artists.

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A Pilates-based Exercise Regime for Pre-pointe Preparation.

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Background: Ongoing research/analysis of proper dance training & anatomically correct preparation and cueing of dancers for a decreased rate of injury in professional performers of dance & applicable musical theatre productions.

Purpose(s)/Aim(s): To offer dance teachers specific exercises for dancers who have studied at least three years and are preparing for pointe work in the next year of study; as a compliment to their ongoing technique classes; based on former studies of what is the best criteria for determining readiness for pointe work.

Approach of Presentation: A workshop for all attendees to experience in their bodies, or for observation, and then a discussion following the exercises with handouts for future use, & justify the reasons behind each of the exercises employed.

Content of Presentation: The purpose of this presentation is to demonstrate implementation of a dance-specific Pilates-based program for pre-pointe preparation. Medical professionals have properly clarified the means by which a dancer can be deemed ready for pointe work: physical development, core stability, proprioceptive skills, strength & ROM of the feet & ankles, and the duration & frequency of the student's dance training. Certain tests can determine the above, such as the Topple & Airplane tests. This program of Pilates-based exercises will also include options from other somatic approaches, and will help further educate teachers of pre-professional ballet students. Emphasis will be placed on proper alignment and correct muscular execution of motion. Examples of progressions using props will be shown and practiced. The program will offer the means by which those outside the anatomical realm will still truly comprehend how to safely and effectively teach, implement, monitor and progress a dancer through an anatomically correct pre-pointe preparation for career progression onto pointe.

Conclusions and Practical Relevance: Pilates-based exercises should play an important role for the proper preparation & training of pre-pointe dancers because it promotes many of the exact requirements suggested by previous studies on what determines readiness for pointe work. This presentation will hopefully inspire our top research colleagues to collect verifiable data for rates of success of the program in pre-professional dance schools. It can also be incorporated in dance teacher programs at all levels for better teacher preparation from the start!

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Identification and Resolution of Postural Issues with Body Mapping Strategies

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Background: Poor posture is a major cause of playing-induced pain. In the PAMA/NASM Advisory, Basic Information on Neuromusculoskeletal and Vocal Health, Information and Recommendations for Faculty and Staff in Schools of Music, modifiable risk factors include:
“a) … Poor body alignment, sometimes referred to as “bad posture,” which can increase the risk of injury…
b) …. It is important that musicians work to maintain high levels of body awareness in order to avoid bound, stiff, or limited movements that can lead to injury.” (p. II-11, #2a&b)
Music faculty and some health care professionals are often unsure how to effectively teach “good posture.” Some teaching methods actually create rigidity, increasing musicians’ risk of injury. Standard equipment such as violin chin- and shoulder rests can also have negative postural effects. Body Mapping, a somatic approach, provides the effective training in postural balance and support that musicians need.

Purpose(s)/Aim(s): The purpose/aim of this presentation is…to provide studio teachers, university faculty and health care professionals information to help musicians resolve underlying postural issues.

Approach of Presentation: Based in the anatomical and structural foundations of Body Mapping, this workshop offers strategies for teaching good posture, including individual coaching for up to 3 musicians, and postural solutions for violinists with ill-fitted chinrests and shoulder rests.

Content of Presentation: Postural foundation and reflexes; the main places of balance; structural support of the spine; the relationship of arm structure to neck muscles; and strategies for addressing these issues with students.

Conclusions and Practical Relevance: Participants will know the basic anatomy that provides balance and support to the human body. They will understand how accurate mapping of these structures is a foundation for the body awareness that musicians need, and will increase their understanding of how to identify and resolve ill-fitted customized chinrest/shoulder rest set-ups. They will be able to observe students for quality of movement, identify underlying mismappings causing poor posture, and coach students on how to resolve these mismappings.
“Ouch! Why does it hurt when I play?” Promoting Pain Prevention in Young Violinists through Pain Eradication and Education in University Level Violin Students

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Background: “Why does it hurt when I play?” is a tough question that a young ‘pained’ beginner may ask his teacher. It is not one that any music teacher wants to hear, but one on which all pedagogues simply must be able to advise. However, in order to do so, a teacher must have knowledge and awareness as to the most significant causes of performance related pain when playing their instrument(s). But even in this new climate of ‘Wellness Awareness’ are teachers as equipped as our art from would like and need them to be?

Purpose(s)/Aim(s): The purpose of this presentation is to educate teachers as to how to facilitate pain prevention/ eradication work with their University level (violin) students whilst simultaneously demonstrating how such skills can be adapted to any of their student’s future young beginners, thus promoting pain prevention. It also intends to address violin players.

Approach of Presentation: A power point presentation will be shown which will include demonstrations of potential hazards and case studies will be discussed. Live violinistic diagrams will also be delivered.

Content of Presentation: The content will show how University level students can successfully learn pedagogical techniques to implement with any future young beginner students whilst raising their own awareness of any areas of their own playing and performance and performance knowledge that may need attention and rectification. Focus will be on Posture, Ergonomics and Tension but examples of varying aspects of performance that can be the causation of excess tension and therefore pain (warm up/ down, performance anxiety, memorization etc.) will be incorporated, time permitting.

A discussion of specific string techniques highlighting typical technical and physiological problem areas will follow.

Conclusions and Practical Relevance: Standards in violin pedagogy and performance can be markedly elevated in the arena of pain prevention and eradication by addressing the next generation of string teachers-the students in our Universities. And by educating them in ‘Wellness (Self) Awareness’ we can create resilience in our future players as well as resilience in our players’ futures.

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Use of a Sport Video Analysis App in Correcting Faulty Dance Movement

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Background: Dancers and athletes are similar in that if the vigorous core, upper quarter, and lower quarter motions that they are required to execute are performed with poor technique, injury may ensue. Coaches and sports medicine professionals are currently taking advantage of the use of affordable video analysis apps for use as a powerful tool for improving an athlete's performance technique. These apps allow for the athlete's performance video to be: 1) uploaded onto a smartphone or IPAD, 2) played back with slow frame-by-frame advancement, 3) analysed using drawing tools, text, and voice captions, and 4) displayed with side-by-side video of their technique being perfectly executed by a different subject. These apps have value for performance enhancement and clinical rehabilitation in the dancing population.

Purpose(s)/Aim(s): The purpose of this workshop is to demonstrate the use of the sport video analysis app, HUDL, in assessing quality of specific dance movements and how the feedback tools in this app may augment a corrective exercise program to improve performance. Movements such as plie, jump landing, and arabesque will be covered.

Approach of Presentation: A video demonstration of how the HUDL app can display faulty dance motion and the use of the HUDL feedback tools will be shown to the audience followed by audience participation of dance motion assessment using HUDL. In advance of the workshop we would like to have as many participants as possible download the HUDL app onto their own smartphone or IPAD.

Content of Presentation: The initial video demonstration will show a dancer with poor execution of plie, jump landing and arabesque. The audience will see how the app's tools can show the faulty movement to the dancer as a teaching tool. The demonstration will also show the corrective exercises for the faulty motion. The audience will then have an opportunity to participate in/create a dance movement video in HUDL and work through using the app to show aberrant motion along with how to approach the corrective movement intervention.

Conclusions and Practical Relevance: The use of sport video analysis apps is being used successfully for the athletic population to either improve technique or as a corrective exercise tool in rehabilitation. Dancers may have the same benefit by taking advantage of these apps in their respective performance setting or in managing an injury. HUDL is an affordable and easy to use app that is readily available for dance faculty and rehab professionals.

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Notes
ALICE G. BRANDFONBRENER YOUNG INVESTIGATOR AWARD

Effects of Physical Symptoms on Muscle Activity Levels in Skilled Violinists

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Halaki, Mark, PhD, MSc, BSc\textsuperscript{2}
Ackermann, Bronwen J., PhD, MPH, PT\textsuperscript{1}

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\textsuperscript{2}Discipline of Exercise and Sport Science, The University of Sydney, Sydney, NSW, 2006

ABSTRACT

BACKGROUND: Physical symptoms present in a large percentage of instrumental musicians at all levels of expertise, yet the impact of these symptoms on patterns of muscle use and perceived exertion during performance is still unclear. PURPOSE: Quantify the effects of physical symptoms on muscle activity and perceived exertion in skilled violinists during a range of bowing actions.

METHODS: Fifty-five professional or university (undergraduate or postgraduate) violinists performed 5 randomly ordered 45-second musical excerpts designed to elicit a range of right arm bowing techniques. Surface electromyography data were obtained from 16 muscles of the trunk, shoulder and right arm during each excerpt performance. Sites of current participant physical symptoms were reported using a pre-test questionnaire. Average rating of perceived exertion (RPE) for the excerpt performances was obtained immediately following the final excerpt performance.

RESULTS: Right upper trapezius muscle activity levels were significantly reduced in participants reporting right shoulder physical symptoms ($p<.05$). Violinists with right wrist symptoms displayed global increases in average muscle activity across all investigated muscles ($p<.03$). RPE did not differ significantly between any groups of symptomatic and asymptomatic participants. CONCLUSION: Differential muscle activity patterns appear between right shoulder symptomatic, right wrist symptomatic, and asymptomatic violinists, presenting the possibility of altered biomechanical responses to physical symptoms that vary with symptom location.

INTRODUCTION

The high prevalence of pain and other physical symptoms in instrumental musicians ranging from students to professionals is increasingly well documented in the literature.\textsuperscript{1,2} Violinists and violists ("upper strings") in particular report a higher incidence of physical symptoms than orchestral averages, with the back/neck and right and left shoulders the most affected sites.\textsuperscript{3,4} However, the impact of these physical symptoms on factors such as muscle activity patterns, exertion during performance and the players' technique is less clear. In the general population, the most common pain-induced changes in muscle activity include delayed activation of affected muscles, redistribution of activity within affected muscles and redistribution of muscle load to synergist muscles.\textsuperscript{5} In limited literature to date in musicians, research into the impact of physical symptoms on muscle activity reported a decrease in upper trapezius activity levels during performance in violinists and violists with neck-shoulder pain.\textsuperscript{6} These authors suggested that the load was redistributed to distal synergistic muscles, yet no data has been gathered to confirm or refute this hypothesis. Investigations of muscle responses to psychological stress in general and musician populations found global increases in muscle activity in response to
stressful stimuli. However, it is thought that muscle responses to more localized physical symptoms follow different mechanisms, although this effect during instrumental performances has yet to be investigated. In other literature, core support by trunk muscles during rapid arm movements has been suggested to better support the upper limb action, although whether this occurs in violinists is unclear.

Data from Shan, Visentin, and Schultz has indicated that right (bowing) arm movements have the largest amplitudes during violin performance. Accordingly, it was predicted that any significant load redistribution patterns in response to physical symptoms were most likely to be seen in the bowing arm. As such, this study was conducted to quantify the effects of physical symptoms on muscle activity levels, focusing on the right arm, to elucidate any changes in muscle activation patterns occurring with presentation of physical symptoms. Additionally, ratings of perceived exertion (RPE) were measured to evaluate whether any detected alteration in muscular strategies corresponded to any variation in RPE scores in violinists.

METHODS
Participants
Inclusion criteria were full-time professional or university (either undergraduate or postgraduate) violinists. Participants (n=55; age = 28.2±12.3 years; 15 male/40 female; 17 professional, 3 postgraduate and 35 undergraduate) were recruited from professional orchestras and university music schools in eight cities across Australia and New Zealand. The protocol was approved by the University of Sydney Human Ethics Committee prior to study commencement (HREC # 2013/869) and all participants gave written informed consent prior to participation in this study.

Overview of Testing Protocol
All eligible participants were scheduled for a single two-hour research appointment. Participants were instructed to refrain from playing their instrument or exercising for the 12 hours preceding their appointment so that muscles were in a similar rested state prior to measurements. At the beginning of the testing period, participants completed a pre-test questionnaire regarding the locations of current physical symptoms based on a model by Ackermann, Driscoll, and Kenny. Surface electrodes and wireless transmitters were applied to 16 muscle sites. Participants performed five short, randomly-ordered musical excerpts and surface electromyography (sEMG) data were recorded. Following the excerpt performances, participants recorded their perceived exertion (Borg scale, 6-20) and completed a maximum voluntary contraction protocol for all investigated muscles.

Pre-Test Questionnaire
Participants were given a questionnaire prior to study commencement asking whether they were ‘currently experiencing any physical symptoms, such as aches, pain, weakness, lack of control, numbness or tingling?’ If participants responded affirmatively, they were asked to indicate the locations of their current symptoms and report their type and severity (on a scale of 0-10).

Surface Electromyography
Selection of Muscles for sEMG Analysis
For the bowing action, the following muscles of the right arm were selected for analysis: biceps brachii, triceps brachii (lateral head), pectoralis major, anterior deltoid, posterior deltoid, upper trapezius, lower trapezius, forearm flexors and forearm extensors. Six muscles of the core musculature—right and left upper abdominals, right and left lower abdominals, right and left erector
spinae (L4 level)—were also analyzed. The left upper trapezius, a common site of tension and injury in violinists, was also included.\textsuperscript{13, 14}

**Preparation of Skin and Placement of Electrodes**

Prior to placement of electrodes, the skin was prepared through vigorous rubbing with alcohol and abrasive gel (NuPrep, Aurora, CO, USA) to reduce impedance. Electrodes were placed according to the methodology of SENIAM\textsuperscript{15} (right and left upper trapezius; right lower trapezius; right anterior deltoid; right posterior deltoid; right and left erector spinae (L4); right biceps brachii; right triceps brachii, lateral head), or that of Criswell\textsuperscript{16} for muscles for which SENIAM did not make placement recommendations (right forearm flexors; right forearm extensors; right pectoralis major; right and left upper abdominals; right and left lower abdominals). Two Ag/AgCl surface electrodes (Red Dot, 2258, 3M, Sydney, NSW, Australia) were placed 2 cm apart in parallel with the muscle fibers of each selected muscle/muscle group. Fixomull hypoallergenic adhesive tape (Smith & Nephew, North Ryde, NSW, Australia) was applied as necessary to prevent movement of electrodes during trials. Electrodes were connected to wireless EMG sensors (Noraxon, TELEmyo DTS EMG sensors, Scottsdale, AZ, USA – ~14 grams, 3.4×2.4×1.4 cm) and amplified with a 1\textsuperscript{st}-order band-pass filter, bandwidth of 10 - 500 Hz, gain of 500, input impedance > 100 M\textOmega, and common mode rejection > 100 dB. The amplified signals were transmitted to a 16-bit resolution receiver (Noraxon TELEmyo DTS belt receiver, Scottsdale, AZ, USA) and saved to a computer at a rate of 1500 Hz using MR3 software (Version 3.6.20, Noraxon, Scottsdale, AZ, USA).

**Violin Excerpts**

A series of five 45-second musical excerpts previously shown to elicit performance of significantly different right arm bowing movements were used.\textsuperscript{17} A metronome (Tempo, iPhone app, Frozen Ape Pte. Ltd.) was used to standardize tempos during each excerpt performance. The order of excerpts was randomized for each participant. Selected excerpts required the following movements:

1. Forceful right elbow flexion/extension over full range of motion [Fritz Kreisler, *Praeludium and Allegro*, bars 1-22, crotchet = 108 beats per minute (bpm)].
2. Fast, alternating right shoulder abduction/adduction over full range of motion [Rodolphe Kreutzer, *Prelude #7 for Solo Violin*, bars 9-26, crotchet = 108 bpm].
4. Sustained, rapid alternating right elbow flexion/extension and right wrist radial/ulnar deviation over very small range of motion [Joseph-Maurice Ravel, *Sonata for Violin and Piano*, 1\textsuperscript{st}mt, rehearsal markings 9-11, quaver = 160 bpm].
5. Slow, controlled right elbow flexion/extension over full range of motion [Johann Sebastian Bach/Charles Gounod, *Ave Maria*, bars 5-15, crotchet = 60 bpm].

**Maximum Voluntary Contractions (MVCs)**

In all tests, participants were instructed to contract isometrically with maximum effort for 3 seconds against resistance provided by a consistently appointed researcher. Each MVC was repeated 3 times, separated by a 1-minute rest period. The following 13 MVCs were performed:

- Elbow flexion and extension at 90° elbow flexion.\textsuperscript{18, 19}
- Wrist flexion and extension at 90° elbow flexion with forearm supported by table.\textsuperscript{20}
- Standardized set of 5 shoulder exercises:\textsuperscript{21} shoulder internal rotation at 90° elbow flexion; abduction at 90° abduction; shoulder flexion at 125° flexion; and shoulder extension at 30° abduction.
Supine abdominal crunch, supine crossover crunch and prone back extension.

**Signal Processing**

Signal processing was performed in Matlab (Version 2014b, The Math Works, MA, USA). EMG signals were high-pass filtered at 10 Hz (zero-lag, 8th-order Butterworth), rectified, then the linear envelope was calculated by low-pass filtering at 3 Hz (zero-lag, 8th-order Butterworth). All signals were visually inspected prior to processing by blinded study personnel. Using the maximum amplitude recorded for each muscle across all MVC tests, the excerpt EMG signals were then normalized and expressed as %MVC.

**Statistical Analysis**

Statistical analyses were performed using Statistica version 10 (StatSoft Inc., Tulsa, OK, USA). The EMG data were checked and confirmed to be normally distributed using probability plots. Effects of physical symptoms and excerpts on muscle activity were determined with a 2 x 5 x 16 (physical symptom (yes/no) x excerpt x muscle) repeated-measures analysis of variance (ANOVA) for each physical symptom location: right shoulder, elbow and wrist. A two-way (physical symptom × excerpt) repeated-measures ANOVA was used as a post-hoc analysis to determine the precise locus of changes in muscle activity resulting from right shoulder/wrist/elbow symptoms for each muscle. Differences among the levels where significant main or interaction effects were observed were tested using pairwise comparisons with Bonferroni adjustment. Effect sizes (Cohen’s d) were also calculated for muscle activity levels in symptomatic versus asymptomatic violinists and defined according to the following scale: no effect (0 – 0.19); small (0.2 – 0.49); moderate (0.5 – 0.79); large (0.8 – 1.0). Differences in RPE and symptom intensity between physical symptom groups and overall mean symptom intensity were determined using independent sample t-tests. A significance level was set at α=0.05.

**RESULTS**

**Physical Symptoms**

Physical symptoms at the time of testing were reported by 31 (56%) participants. Of these, 8 reported one symptom, 15 reported two and 8 reported three. Mean overall symptom intensity was 5.2/10 (range 1/10 – 10/10), and did not significantly differ from mean right shoulder (5.7/10) and right wrist symptom (3.5/10) intensities (F ≤ 0.21, p >0.64). Table 1 presents a breakdown of right arm physical symptom locations and their occurrence with other symptom locations.

Table 1. Physical symptom locations.

<table>
<thead>
<tr>
<th>Location</th>
<th>Total</th>
<th>Also reported symptoms in other locations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Right shoulder</td>
</tr>
<tr>
<td>Right shoulder</td>
<td>13</td>
<td>-</td>
</tr>
<tr>
<td>Right elbow</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Right wrist</td>
<td>10</td>
<td>3</td>
</tr>
</tbody>
</table>

**Muscle Activity: Effect of excerpts**

Average muscle activity levels ranged from 2.1 ± 1.0 %MVC (right posterior deltoid, excerpt 5) to 51.3 ± 32.0 %MVC (right wrist flexors, excerpt 4) and varied significantly across the five musical excerpts (F4,120 ≥ 64.0, p<0.01), thereby confirming the face validity of the selected excerpts.
Muscle Activity: Effect of physical symptoms
The number of participants with right elbow physical symptoms (n=2) was insufficient for statistical analysis. Accordingly, Figure 1 displays average shoulder and right arm muscle activity levels for right-shoulder symptomatic, right-wrist symptomatic and asymptomatic participants, organized by excerpt. See Figure 2 for average core muscle activity levels.

Global effect of symptoms (3-way ANOVA)
Average overall muscle activity was significantly increased in right-wrist symptomatic versus asymptomatic violinists (F1,28 = 5.40, p< 0.03) but was not different between right-shoulder symptomatic and asymptomatic violinists (F1,30 = 0.13, p = 0.72).

Right shoulder physical symptoms (2-way ANOVA)
Average right upper trapezius activity levels were significantly decreased in participants reporting right shoulder physical symptoms compared to those reporting no symptoms (F1,35 = 4.91, p <0.04) but no other individual muscles were significantly different between right-shoulder symptomatic and asymptomatic participants(F1,35 ≤3.03, p ≥0.09). Moderate and large effect sizes reported in Table 2 demonstrate a trend toward reduced left upper trapezius and right upper abdominal activity, and increased right pectoralis major, right biceps brachii and right anterior deltoid activity in right-shoulder symptomatic violinists.

Right wrist physical symptoms (2-way ANOVA)
Average right posterior deltoid activity levels were significantly increased in participants reporting right wrist physical symptoms compared to asymptomatic participants (F1,32 =6.80, p> 0.02)(Figure 2) but no other muscles were significantly different between right-wrist symptomatic versus asymptomatic participants (F1,32≤2.50, p ≥0.12). Moderate and large effect sizes reported in Table 2 demonstrate a trend in right wrist symptomatic violinists toward decreased right upper trapezius activity and increased activity levels in the following muscles: left upper trapezius; right/left erector spinae; right pectoralis major; right biceps brachii; and right wrist flexors.

Rating of perceived exertion (RPE)
The RPE of subjects reporting physical symptoms—general, right shoulder or right wrist—was not significantly different from that of asymptomatic participants (p> 0.10).
Figure 1. Muscle activity in right-shoulder/right wrist symptomatic and asymptomatic violinists. Lt: Left, Rt: Right. * Right-shoulder symptomatic significantly different than asymptomatic ($p<.05$). # Right-wrist symptomatic significantly different than asymptomatic ($p<.05$).
Figure 1. Shoulder and right arm muscle activity in right-shoulder/right wrist symptomatic and asymptomatic violinists. Lt: Left, Rt: Right.
**Figure 2.** Shoulder and right arm muscle activity in right-shoulder/right wrist symptomatic and asymptomatic violinists. Lt: Left, Rt: Right.

**Table 2.** Effect sizes (Cohen’s d) for comparisons between right-shoulder symptomatic (RSS) versus asymptomatic and right-wrist symptomatic (RWS) versus asymptomatic violinists.

<table>
<thead>
<tr>
<th>Excerpt 1</th>
<th>Excerpt 2</th>
<th>Excerpt 3</th>
<th>Excerpt 4</th>
<th>Excerpt 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lt upper trapezius</td>
<td>0.51*</td>
<td>0.46</td>
<td>0.56*</td>
<td>0.29</td>
</tr>
<tr>
<td>Rt upper trapezius</td>
<td>0.95^</td>
<td>0.64*</td>
<td>0.82^</td>
<td>0.69*</td>
</tr>
<tr>
<td>Lt erector spinae</td>
<td>0.11</td>
<td>0.28</td>
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</tr>
<tr>
<td>Rt erector spinae</td>
<td>0.03</td>
<td>0.52*</td>
<td>0.01</td>
<td>0.50*</td>
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<tr>
<td>Lt upper abdominals</td>
<td>0.09</td>
<td>0.21</td>
<td>0.15</td>
<td>0.32</td>
</tr>
<tr>
<td>Rt upper abdominals</td>
<td>0.45</td>
<td>0.03</td>
<td>0.42</td>
<td>0.03</td>
</tr>
<tr>
<td>Lt lower abdominals</td>
<td>0.17</td>
<td>0.17</td>
<td>0.06</td>
<td>0.34</td>
</tr>
<tr>
<td>Rt lower abdominals</td>
<td>0.70*</td>
<td>0.24</td>
<td>0.50*</td>
<td>0.06</td>
</tr>
<tr>
<td>Rt pectoralis major</td>
<td>0.30</td>
<td>0.29</td>
<td>0.24</td>
<td>0.29</td>
</tr>
<tr>
<td>Rt anterior deltoid</td>
<td>0.33</td>
<td>0.18</td>
<td>0.06</td>
<td>0.08</td>
</tr>
<tr>
<td>Rt posterior deltoid</td>
<td>0.24</td>
<td>0.80^</td>
<td>0.27</td>
<td>0.62*</td>
</tr>
<tr>
<td>Rt lower trapezius</td>
<td>0.23</td>
<td>0.33</td>
<td>0.32</td>
<td>0.08</td>
</tr>
<tr>
<td>Rt biceps brachii</td>
<td>0.43</td>
<td>0.51*</td>
<td>0.45</td>
<td>0.54*</td>
</tr>
<tr>
<td>Rt triceps brachii</td>
<td>0.20</td>
<td>0.42</td>
<td>0.13</td>
<td>0.16</td>
</tr>
<tr>
<td>Rt wrist flexors</td>
<td>0.34</td>
<td>0.64*</td>
<td>0.23</td>
<td>0.64*</td>
</tr>
<tr>
<td>Rt wrist extensors</td>
<td>0.06</td>
<td>0.17</td>
<td>0.21</td>
<td>0.28</td>
</tr>
</tbody>
</table>

Lt: Left, Rt: Right, *Moderate effect size (0.5-0.79), ^Large effect size (≥0.8).

**DISCUSSION**

The results of this investigation suggest that differential changes in muscle activity patterns occur in the presence of proximal compared to distal physical symptoms. Where right wrist symptoms were present, a global increase in muscle activity was observed, whereas when right shoulder symptoms were present, there was a more nuanced change in other muscles. Right-shoulder symptomatic violinists displayed significantly decreased right upper trapezius muscle activity across all excerpts, while the effect sizes demonstrated a trend toward decreased activation of abdominals, and increased activation of right arm muscles.

This study confirms prior research reporting a reduction of upper trapezius activity levels in violinists and violists with neck-shoulder pain and adds weight to the suggestion that this reduction in upper trapezius activity is accompanied by compensatory increases in synergistic muscles (pectoralis major, biceps brachii, anterior deltoid). These compensatory increases demonstrated by effect sizes are most prevalent in excerpts requiring slower bowing movements and more sustained muscle contractions (excerpts 3 and 5); given the low levels of muscle activity during violin performance, sustained slow bowing movements likely best highlight any biomechanical alterations in symptomatic violinists.

The impact of this muscle load redistribution on performance biomechanics and the mechanisms of its etiology, however, remains unclear. Contraction of the upper trapezius creates elevation and...
lateral rotation in the scapula, typically associated with elevated arm positions, whereas pectoralis
major does not attach to the scapula, instead acting to create flexion of the humeral component only
of the glenohumeral joint. While biceps brachii and anterior deltoid have attachments to the scapula,
they primarily act on the humerus to create shoulder flexion and are not reported to be involved in
scapula positioning.\textsuperscript{24, 25} This redistribution of muscle load from upper trapezius to pectoralis major,
biceps brachii and/or anterior deltoid suggests that there may be an alteration of the normal
combined movement between the scapula and humerus during arm movements (i.e. scapulohumeral
rhythm), with shoulder symptomatic violinists potentially displaying an altered scapulohumeral
rhythm favoring relatively more humeral motion during bowing movements. Interestingly,
concomitant reduced right upper abdominal activation across all excerpts suggested that the right
shoulder symptoms relate not only to reduced scapula positioning but also to less trunk support or
‘core stability’; aside from this suggested increase in right upper abdominal activation, core muscle
activity remained at uniformly low levels and unchanged between right shoulder symptomatic and
asymptomatic violinists. It should be noted that the above is only a hypothesis from preliminary
results emerging from this study and requires further research.

While our data indicate that symptomatic violinists appear to be utilizing bowing actions that are
more reliant on humeral motion, our single-test study design did not allow for determination of
whether this altered muscle loading precedes or occurs in response to the onset of physical
symptoms. In past research, chronic pain symptoms have been associated with reduced variability in
adaptive motor patterns, while acute symptoms tend to increase variability in muscle activation
patterns.\textsuperscript{26} While the duration of symptoms in these musicians was unknown, similarity of
compensatory patterns associated with shoulder pain may reflect a long-term, suboptimal motor
strategy, although whether this is a cause or effect of the shoulder symptoms cannot be determined.
Sports medical research has also previously linked scapular dyskinesis with shoulder injury,\textsuperscript{27}
although the current study can only indicate an association without a clear indication of whether
possible scapular dyskinesis results from or is caused by shoulder symptoms in this population.
Further research analyzing chronicity of symptoms and cause-and-effect mechanisms of symptoms
and muscle loading in elite instrumentalists is necessary.

The significant increase in muscle load across all muscles in right-wrist symptomatic violinists seems
to imply that there is a characteristic response to physical symptoms based upon the proximal/distal
location of symptoms. Specifically, muscle activity in violinists with right wrist symptoms follows
the psychological stress response patterns detailed in the introduction\textsuperscript{7, 8} more closely than the load
redistribution mechanisms suggested with presentation of right shoulder symptoms. This global
increase in muscle activity associated with right wrist symptoms may reflect a tension in playing
technique that interrupts the normal proximal to distal kinetic chain mechanics and makes a
performer vulnerable to wrist injury. Prior research has illustrated that limited forearm motion—a
likely byproduct of increased tension in the playing technique—results in significant alterations to
shoulder kinematics, specifically increased range of motion of shoulder adduction, flexion/extension and internal/external rotation.\textsuperscript{28} Significant increases in activity in proximal right
arm musculature, as well as increases in core muscle activity to support increased shoulder mobility,
support the occurrence of such kinematic alterations during bowing movements in right-wrist
symptomatic violinists. Conversely, however, wrist pain has been shown to reduce range of motion,\textsuperscript{29, 30}
likely resulting in the same alterations to shoulder kinematics as increased tension in the playing
technique. As with the shoulder symptoms, further research is necessary here to determine cause-
and-effect mechanisms and muscle loading.
Consideration should also be given to the fact that 3 of 10 right-wrist symptomatic violinists were also right-shoulder symptomatic, although these potential confounders did not affect overall trends. The only result changed by the exclusion of these three confounders was that right posterior deltoid activity was no longer significantly different in right wrist symptomatic versus asymptomatic violinists. A significant global increase in right wrist symptomatic violinists, as well as a significant decrease in right upper trapezius activity in right shoulder symptomatic violinists, was still observed with the three right wrist and shoulder symptomatic violinists excluded from analysis. In future research, larger cohorts of symptomatic violinists may elucidate differential EMG responses to multiple and single right arm symptom locations.

Additionally of note in this study are the large standard deviations of right wrist flexor and extensor data. This considerable variability is likely a reflection of considerable cross-talk between wrist flexors as reported in prior sEMG recordings. Further research with less cross-talk, potentially through indwelling EMG recordings, is necessary to clarify bowing demands on forearm musculature. Additionally, a validated MVC protocol for wrist flexors and extensors—no such protocol currently exists—would likely further enhance data accuracy. Further, while discomfort or pain may have interfered with the ability of symptomatic violinists to produce maximal effort during MVCs, no violinists reported pain during MVC tests.

Finally, RPE was not significantly altered by the presence of physical symptoms. This suggests that the redistribution of muscle activity presenting with symptoms does not change the perceived difficulty of violin performance. It is possible that a variety of motor control strategies can achieve similarly high-quality sound production on the violin. Accordingly, the redistribution of muscle activity presenting with physical symptoms may be undetectable to the musicians solely from the sound produced. Given the potential link with injury of the redistribution of muscle activity during performance shown in this study, further research is necessary. Such research should clarify whether changes in muscle load distribution are linked with altered scapulohumeral mechanics during performance and whether interventions that aim to resolve this issue in their technique may then lead to decreased shoulder pain.

**CONCLUSION**
Differential motor control responses to proximal and distal physical symptoms appear to occur. Right shoulder symptomatic violinists displayed decreased right upper trapezius activity, with a suggestion of increased synergist right pectoralis major, biceps brachii, and anterior deltoid activity levels, especially in excerpts requiring slower bowing movements. Right wrist symptomatic participants displayed global increases in muscle activity levels. RPE did not differ between symptomatic and asymptomatic participants. Future research should focus on further confirming differential responses to presentation of proximal and distal physical symptoms, and begin to identify effective intervention strategies.

**ACKNOWLEDGEMENTS**
This work was supported by the Australian-American Fulbright Commission and an Australian Research Council Linkage Project Grant (LP0989486). Special thanks to Associate Professor Nicholas O’Dwyer for his assistance in editing the manuscript.

**REFERENCES**


N.B.: Significant portions of this submission have been removed for brevity.

Previous literature has established that musicians experience performance-related injuries and pain. Musculoskeletal pain has been the focus of several publications. Recent studies have demonstrated that over 84% of professional musicians in orchestral settings have experienced maladies associated with playing their instruments. In an effort to promote good musician health at an early stage, the National Association of Schools of Music (NASM) adopted health and safety standards in 2011 to ensure institutions of higher learning make faculty, staff, and students aware of the health concerns associated with live music production. However, previous studies have demonstrated a lack of music students’ willingness to take appropriate actions when they experience pain or other medical problem.

Although excellent studies on musician pain are in the literature, most studies involve musicians at the professional level, usually orchestras. A literature search yields a limited supply of studies devoted to musicians at colleges or conservatories, where many of tomorrow’s professionals train. The studies that have assessed college musicians typically were small in sample size and only assessed players of one specific instrument. Prior to this study, there have been no large comprehensive studies that assess performance-related pain of all instruments and voices among college music students and faculty at multiple institutions.

The main purposes of this study were to determine the prevalence and anatomical locations of performance-related pain among students and faculty at the college level, learn what musicians do when they get pain, and learn the playing/singing habits at institutions of higher learning.

Conclusion
The majority of college music students and faculty experience pain when they play or sing. Although pain is experienced in different sites, depending upon instrument played and voice, the most common site for pain is the upper back. Further research should be done to examine interventions that may be successful in both treating and preventing pain among musicians at colleges. Findings indicate an opportunity for an organization such as PAMA to provide early education on resources and techniques to prevent or alleviate performance-related pain of future professionals.
Reducing NIHL Risk in Collegiate Music Ensembles Using Ambient Technology

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N.B.: Significant portions of this submission have been removed for brevity.

Abstract
Student musicians are at risk for noise-induced hearing loss (NIHL) as they develop skills and perform during instructional activities. Studies using longitudinal dosimeter data show that pedagogical procedures and instructor behaviors are highly predictive of NIHL risk, thus implying the need for innovative approaches to increase instructor competency in managing instructional activities without interfering with artistic and academic freedom. Ambient information systems (AIS), an emerging trend in human-computer interaction (HCI) that infuses psychological behavioral theories into technologies, can help construct informative risk-regulating systems. The purpose of this study was to determine the effects of introducing an AIS in the music classroom. The system used two ambient displays and a counterbalanced within-subjects treatment study approach with six jazz ensemble instructors to determine if the system could induce a behavior change that alters the NIHL risk. This study uses time series analysis as indicators of change in eight statistical measures of behavior over a nine-week period. Analysis showed that this system was effective as all instructors showed changes in a combination of behavior measures. An ambient information system can significantly change NIHL risk within music classrooms without interfering with artistic or academic freedom.

Conclusion
While this study suggests that NIHL risk reduction is achievable through real-time information acquisition using an AIS, there is a need for further studies. Different visualizations, including specialized visuals for the music context may provide more information. Longitudinal studies over several semesters may also help identify the specific areas of risk for individual instructors and determine long-term behavior changes. Having a larger sample size of instructors, including other ensemble types, may yield important information on individual behavior.

The hypothesis was that exposing an ensemble instructor to an AIS while teaching will produce behavior changes that significantly alter the trend in dosimeter data. The hypothesis is accepted because the AIS induced significant behavior change without interfering with academic or artistic freedom. Furthermore, the results confirm that instructor behavior is associated with the NIHL risk on an individual basis as each instructor had changes in some combination of measures. This study is an important first step in using non-interfering ambient technology to reduce NIHL risk among academic musicians.
An estimated 34%-87% of musicians report a medical problem that affects their performance.\textsuperscript{1,3} Common medical conditions reported by musicians are typically grouped into diagnostic categories including: musculoskeletal pain and overuse syndromes, entrapment and peripheral neuropathies, and focal dystonias.\textsuperscript{4} These medical issues are often associated with age, gender, instrument played, practice time, playing conditions, general health and conditioning, posture, and stress.\textsuperscript{5,7} Although these risk factors have been identified, little research has examined an association between individual physical characteristics and playing-related musculoskeletal disorders (PRMDs). The intent of this study is to determine whether demographics, reported playing patterns, or physical impairments have the greatest influence on predicting if an instrumentalist will suffer from a PRMD.

**Conclusion**

The study provides analysis of posture, cervical range of motion and average upper body strength in a group of collegiate instrumentalists. Impairments of posture and cervical active range of motion were identified. Additionally, statistically significant differences in isometric upper body strength were found between musicians in different instrument classes. Though conclusions cannot be made to determine this association and its relationship to PRMDs, the results demonstrate the need to consider individual physical characteristics when assessing an instrumentalist’s risk for sustaining a playing-related musculoskeletal disorder.
Objective: To survey members of the performing arts community on their sleep qualities and occurrence of sleep disturbance in regards to their general health, well-being and performance quality.

Method: An anonymous, online survey was developed for this study, complemented with a standardized, self-reported measure of sleep quality – the Pittsburgh Sleep Quality Index (PSQI) (Buysse, 1988) and distributed to members of the performing arts community.

Results: The majority of respondents reported good sleep qualities and obtained recommended sleep durations. Experienced performing artists reported that their performance quality and career was affected by sleep disturbance. Risk groups suffering impaired sleep qualities were detected; being predominantly female, aged between 18 to 28, instrumentalist or singer and freelancing in performing arts.

Conclusion: Members of the performing arts community reported good sleep qualities; however negative trends in sleep durations and impaired performance capabilities caused by insufficient sleep were highlighted. To optimize and provide guidelines on sleep and rest for the individual performer further investigations focusing on specific performing arts genre and types were concluded.
Notes
Arts Medicine for Veterans: Exploring Creative Strategies for Posttraumatic Stress Disorder

Mary Rorro, DO, Veterans Administration, Princeton, New Jersey, USA

Background: I am a psychiatrist and musician and blend music and poetry into my practice with war veterans. I have witnessed the powerful therapeutic effects music has had for my patients and how poetry can be applied as a complement to care.

Purpose(s)/Aim(s): The purpose of this presentation is to show how music, poetry, art and photography can be utilized to help in veterans in their treatment and journey to healing.

Approach of Presentation: The approach of the presentation will involve a slide presentation including music videos of my playing viola during group therapy sessions for Vietnam veterans. The veterans are interviewed and provide feedback on their reaction to the music. In addition, patient narratives and my poetry will be shared with the audience. Patient artwork and photography will also be featured. I will also perform on the viola for the audience.

Content of Presentation: I present details on how I began my music program in the Veterans Administration. Slides will be shown of the program in action with employee photos and employee and patient feedback on its effectiveness. I also will explain how attendees can incorporate such a program in their work.

Conclusions and Practical Relevance: Music has served as a mode for expressing grief loss and joy in the music program. Listening to music is encouraged to help veterans cope with anxiety, irritability and insomnia. Patient and employee feedback regarding the music program will be shared. Music can be utilized as a vital tool to aid veterans suffering from suffering from posttraumatic stress disorder (PTSD) and mental illness. Music and poetry have served as a rewarding and creative means in my practice of connecting with patients and deepening the doctor-patient bond. Music serves as a powerful therapeutic intervention to help veterans through the healing process.
Instrument Assisted Soft Tissue Mobilization (IASTM) Graston Technique® Treatment of Dance Injuries

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Background: With a high injury rate among dancers, 65% of which are reported to be overuse syndromes, healthcare practitioners need to be equipped with the most current, evidence based technologies which will help performing artists return to functional activity with the least amount of time.

Purpose(s)/Aim(s): The purpose/aim of this presentation is to provide the dance medicine community with information on an evidence based therapeutic option by introducing instrument assisted soft tissue mobilization (IASTM) using Graston Technique® (GT), describing its benefits for treating dance injuries.

Approach of Presentation: A systematic review will be presented which compares GT to traditional soft tissue massage (STM) and other IASTM techniques.

Content of Presentation: There are multiple therapeutic approaches to GT: pro-inflammatory, facilitory, edema reduction, pain reduction, scar mobilization, true Cyriatic approach (CFM), and fascial mobilization. Current GT research has shown in animal and case studies that GT is advantageous in treating multiple types of overuse syndromes. Examples include plantar fasciosis, Achilles tendonitis, ilio-tibial band syndrome, patellofemoral syndrome, and ankle sprains. All of these examples are reported as prevalent injuries among dancers. Not only has this research shown GT to be beneficial for patients, it has also been shown to be associated with decreased clinician fatigue due to decreased pressure placed on clinicians’ hands. This is important because, after spinal pain, the second most common cause for absenteeism from physical therapy work is overuse of the thumb. Ninety-one percent of physiotherapists that use massage modify their treatment techniques due to thumb pain.

Conclusions and Practical Relevance: With the combination of a comprehensive fitness program, incorporating the use of GT in treating overuse dance injuries has the potential to not only aid dancers in returning back to functional activity faster, but also provide long term results associated with the proper realignment of tissues. Clinicians benefit as well due to the decreased amount of strain placed on the joints of their hands, potentially increasing the longevity and capacity of clinicians to manually treat dancer patients. Further research on the use of GT within the dancer patient population will likely help validate the use of GT for specific dance related injuries.

Key References:

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The Perception of Trust Between Athletic Trainers and Musical Performing Artists

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Shannon David, PhD, ATC, ROT, PES, North Dakota State University, Fargo, North Dakota, USA

**Background:** Trust is an attribute that gives medical relationships intrinsic value and increases the chance of a successful patient-clinician relationship. Many factors have been determined through research to affect trust between patient and clinician including clinical competence, benevolence, approachability, and predictability. While implementing a patient-centered approach in athletic training (and other medical practices), a focus can be placed on personalization of care in regard to patient feelings, perspectives, and needs. Though the foundational idea of trust is known to be important, it is currently unknown the extent of trust intact between musical performing artists and athletic trainers. Furthermore, performing artists have unique skill sets and face strenuous physical/mental demands; thus, requiring increased necessity of allied healthcare professionals. By identifying factors that inhibit or maintain the patient-clinician relationship, we as clinicians can provide optimal healthcare to better serve the needs of performing artists.

**Purpose(s)/Aim(s):** To critically evaluate the amount of trust performing artists, specifically drum corps members, had in their athletic trainer and how it relates to the patient-clinician relationship.

**Methods:** A qualitative semi-structured interview approach was conducted utilizing 12 World Class Drum Corps International (DCI) members. Each member participated in 1 one-hour interview responding to pre-determined questions about trust and their thoughts on past interactions with athletic trainers. Efficacy was maintained through member checks, triangulation, and negative case analyses.

**Results:** Subject responses were separated into 25 codes by assigning labels to reoccurring units of data that portrayed meaning to the research purpose. These labels were organized into key-word categories (e.g. accessibility) and then were identified through 6 emergent themes. The subjects unanimously reached saturation in their responses. These themes indicate factors that promote and hinder the patient-clinician relationship in the drum and bugle corps setting. All subjects perceived trust as an important aspect (regardless of positive or negative clinician interactions) in achieving ideal healthcare as a musical performing artist.

**Conclusions and Practical Relevance:** Trust plays a role in determining patient rapport, compliance, and timely return-to-play via patient-clinician relationship in the performing arts setting.

**Key References:**

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Intermittent Muscle Cooling as an Intervention to Reduce Tremor Amplitude and Activity-Induced Fatigue in String and Keyboard Musicians

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Background: Musical performance requires physical fitness and aerobic capacity. Fine motor control and dexterity become exacerbated by fatigue and tremor during exercise, the effects of which are multiplied with aging. This study quantified the extent to which muscle cooling delays the time to fatigue and the severity of tremor in active musicians. Since muscle cooling has been shown to improve these measures in athletes, the cooling intervention was expected to improve subjects’ performance on tests of tremor and fatigue.

Purpose(s)/Aim(s): The purpose of this study was to determine non-pharmacological methods of reducing the potential risk for overuse injury and playing-related pain (PRP) in pianists and string musicians. The muscle cooling intervention explored in these musicians could be translated to other performing arts activities.

Methods: Subjects completed a maximum voluntary isometric contraction of the 4th and 5th digits until fatigued. After the exercise, subjects were allowed a simulated "intermission" period, while wearing a liquid cooling/warming garment at either 32 C (control) or 5 C (intervention) for 10 minutes. Tremor was recorded on two axes and time to fatigue was based on maximum voluntary contractions. Electromyographic analysis of dominant forearm musculature and frequency analysis was performed to determine if a shift in the time frequency domain correlated with a reduction in force production.

Results: Results showed that intermittent muscle cooling resulted in significantly (p<.001) lower physiologic tremor amplitude in string and keyboard musicians, suggesting that muscle cooling may have a protective effect against exercise-induced tremor. No significant effect was observed in muscle fatigue of the dominant forearm flexors and extensors.

Conclusions and Practical Relevance: The significant reduction in tremor amplitude with muscle cooling is consistent with previous research, translation of this therapy to athletes in the arts might provide a protective affect against injury and PRP. While no effect was seen in time to fatigue, this measure is commonly variable due to motivational factors. Ultimately, this research is applicable to those who wish to reduce exercise-induced tremor to improve musical performance.

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Acceptance and Commitment Therapy for the Treatment of Music Performance Anxiety: Preliminary Results of a Pilot Study Involving Student Vocalists

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Background: Musical performance anxiety (MPA) is a debilitating form of anxiety that affects musicians of all skill levels and can shorten careers if not successfully treated. A variety of treatment options exist, including Cognitive-Behavioral Therapy and beta-blocker medications, but they appear limited by practical considerations. For a review of MPA treatments see C. McGrath (2012). Shame over having MPA is another variable that compounds one’s experience of MPA (McGrath, 2012). Acceptance and Commitment Therapy (ACT; Hayes, Strosahl, & Wilson, 2011) has yet to be applied to the treatment of MPA, with the exception of one case study conducted by this author in which ACT was used to treat a student violinist with MPA (Juncos & Markman, 2015). The results of that case study were promising and the topic deserves to be further investigated in a pilot study design. The reader should know the goal of an ACT treatment is different than previous MPA treatments. Rather than aim to reduce MPA symptoms, an ACT treatment helps increase acceptance of unwanted symptoms by enhancing psychological flexibility in response to them, i.e., the ability to feel MPA and related discomfort while simultaneously engaging in chosen, self-directed & valued behavior during one’s performances. ACT has been used to effectively treat all clinical anxiety disorders and performance-related problems, i.e., public speaking anxiety (Block, 2003) and sports performance difficulties (Gardner & Moore, 2007), so there is strong reason to believe it will effectively treat MPA.

Purpose(s)/Aim(s): This pilot study is the next step in a series of research conducted by the primary author, in which the effectiveness of ACT as a treatment for MPA is investigated. Here, an uncontrolled pilot study design was used to investigate ACT’s effectiveness as an MPA treatment using 7 undergraduate and graduate vocalists as participants. The hypotheses were that 1) the participants would make significant improvements on ACT-related processes from pre to post-therapy, using their baseline functioning as a “control” condition, 2) their performance quality would improve, and 3) their shame over having MPA would decrease from pre to post-therapy.

Methods: Here, all participants received the same manualized ACT treatment (Eifert & Forsyth, 2005) as in the case study, they completed a full battery of self-report measures, they gave regular performances in front of one another throughout the study, and they recorded performances at pre and post-therapy.

Results: The results for hypothesis #2 are still being assessed, however hypotheses #’s 1 & 3 appear to be borne out; the participants made significant improvements on ACT-related processes at post-therapy and their shame over having MPA also appeared to decrease possibly due to the group performance condition.

Conclusions and Practical Relevance: Consistent with the results of the case study, the participants made significant improvements on ACT-related processes and reported less distress over having MPA. Increases in valued-behavior during performances were also observed, i.e., performances were more emotionally expressive at post-therapy. Implications of the results are discussed, i.e., that the ACT therapy led to improved performance quality and reduced shame over having MPA.

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Dietary Intakes of a Cohort of Elite Adult Dancers in New York City

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Background: The demands placed on aesthetic athletes are intense. These sports, including dance, require athleticism while also emphasizing an ideal or low body weight. In order to achieve an ideal body shape, dancers may limit energy intake. Restricting energy intake may decrease performance and increase the risk of inadequate micronutrient status. Micronutrients are essential for optimal performance and play an important role in energy metabolism, the production of healthy red blood cells, maintaining immune function, protecting tissues from oxidative damage, and building adequate bone. Little research has examined the dietary patterns of adult dancers.

Purpose(s)/Aim(s): The purpose of this cross-sectional study was to examine self-reported macronutrient and micronutrient intakes of elite adult dancers.

Methods: Fifty dancers (42 female, 8 male; age = 24 ± 5 years; body mass index [BMI] = 22.0 ± 2.3 kg/m²) were recruited from pre-professional dance programs, university dance programs, and local dance studios in New York, NY. Participants completed a 7-day weighed food record and health history questionnaire. Self-reported diet was analyzed using Food Processor (ESHA Research, Salem, OR, version 10.10.1). Descriptive statistics were determined using IBM SPSS Statistics, version 23.0.

Results: Dancers reported a mean energy intake of 1975 ± 518 kcal/day (32.8 kcal/kg/day) and 1.2 ± 0.4 g/pro/kg/day. Most dancers met the estimated average requirements (EAR) for thiamin (54%), riboflavin (62%), niacin (64%), vitamin B6 (68%), vitamin B12 (50%), vitamin C (70%), and iron (90%). Greater than 50% of dancers did not meet the EAR for folate (38%), calcium (58%), magnesium (73%), and zinc (70%), increasing the risk of micronutrient deficiencies.

Conclusions and Practical Relevance: These findings provide insight on the dietary intakes of adult elite dancers. Future research, including nutrition education interventions, should focus on improving the intake of micronutrients of elite dancers, especially folate, calcium, magnesium, and zinc.

Key References:

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Flexibility and Range of Motion in Dancers: The Effects of Social Media and Competition

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Background: This research covers flexibility, range of motion, and stretching techniques used by dancers and how social media and participation in competition affect their perspective on this topic. The world of convention and competition dancing has recently increased its focus on hypermobility of the hips and spine without considering the physical and psychological risks of extreme stretching and flexibility training from a young age. Research focuses on the muscle and joint movements most highlighted through these platforms: hip flexion, extension and external rotation, spine extension, and plantar flexion.

Purpose(s)/Aim(s): The purpose of this study is to shed light on how social media and competition affect the goals, stretching methods, range of motion, and mentality of young dancers.

Approach of Presentation: A review of the literature and results of a survey of competition dancers age 12-18 will be presented.

Content of Presentation: A review of the literature concerning different stretching techniques, their effectiveness, and safety was performed, as well as on the prevalence of hip, spine and ankle injuries in young dance populations. Furthermore, a social media search was conducted to confirm the presence and influence of some of the most followed young dancers as well as to determine some of the stretching and other activities performed in extreme ranges of motion.

Conclusions and Practical Relevance: Results could help provide information for teachers, parents, and dancers and help them maintain a balanced dance-training program.

Key References:

Evaluating the Positive Effects of the Pilates Practice on Collegiate Level Dancers as it Relates to Injury Prevention and Rehabilitation

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The work of Joseph Pilates stresses the importance of the mind/body connection, and primarily focuses on one’s core strength and power. Studies have shown that the Pilates practice improves alignment, flexibility, strength, and posture, emphasizing the principles of core strength and flexibility, which increase dynamic control supporting dance performance.

The purpose of this study is to conduct an extensive review of past and current literature analyzing the possible benefits the Pilates practice has to offer to dancers and their training. Dancers must be educated on subjects such as injury prevention and rehabilitation due to the rigorous activities their bodies encounter.

An extensive review of past and current literature was conducted to assess the possible benefits the Pilates practice has to offer to dancers and their training. Using Discover Search engine, the word “Pilates” was searched. Over forty-four thousand results appeared. “Pilates training for dancers” was searched, and of the previous forty-four thousand, two hundred and seventy-seven results which correlated Pilates to dance appeared. To further examine the strength of these literature works, the searched results were broken down into different categories. 190 of these results were excerpts from magazines. Only 45 of the total 277 results were presented in academic journals. From the studies examining the effect of Pilates on dance training, improvement has been shown in numerous areas. However, it is clear from assessing different articles and clinical data that scholarly evidence is lacking. It is critical that scientists continue to pursue this field in order to efficiently provide dancers with optimal recovery and training. Due to the Pilates training which emphasizes the ideals of core-strength and body-mind connection, it is clear that dancers can benefit from increased strength and flexibility, leading to lower injury rates and faster healing times.

Key References:
Yoga as a Form of Cross Training for Dancers

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Background: The practice of yoga contains a physical aspect that is meant to increase strength, balance, flexibility and range of motion. In any sport or physical activity, cross training is important in order to develop strength, reduce risk of injury, and improve performance.

Purpose(s)/Aim(s): This presentation is purposed to inform dancers about the importance of cross training in injury prevention, how to safely incorporate a yoga practice into one’s lifestyle, and performance enhancement through a regular yoga practice.

Methods: This review of literature examines the different benefits or disadvantages that yoga may have. Different styles of yoga are examined to discover what kind of yoga is best for dancers.

Results: Depending on the schedule that a dancer has (class/work/performance/rehearsal/rest time), a number of different classes can be incorporated throughout the week. It is important that a dancer incorporates the style of yoga that suits them best. All dancers have different strengths and weaknesses that they need to work on. Therefore, yoga should be incorporated into a dancer’s lifestyle based on their schedule, strengths, and weaknesses.

Conclusions and Practical Relevance: With the cross training and supplemental strengthening that yoga provides, a dancer is less subject to typical dance injuries that are the result of overworking certain muscles and under working others. It can help to fix any muscular imbalances that one may have due to lack of cross training. Instead of compromising the weakness of a muscle by overusing another, dancers should implement yoga as cross training to heighten their facilities as dancers.
Assessment of Diet Quality Among Marching Artists

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Background: Marching artists are a unique group of athletes whose health and performance can be influenced by poor dietary choices. Physical demands are moderate to high, due to long rehearsals and environmental stressors, requiring adequate energy to fuel training and a variety of foods to meet nutrient needs.

Purpose(s)/Aim(s): The purpose of this study was to assess the diet quality of marching artists using the Healthy Eating Index (HEI) 2010 guidelines.

Methods: Marching artists were eligible to participate in the study if they were ≥ 18 years of age and participated in marching band during 2015. Potential participants were recruited via social media (Facebook and Twitter). Participants completed an online survey distributed using Qualtrics, which included the NCI Diet History Questionnaire II. The dietary intake data were assessed using the HEI-2010, which consists of 12 components to measure diet quality in conformance to Federal dietary guidelines. The DHQ II Diet*Calc program generated the HEI scores and IBM SPSS Statistics (version 22) computed the descriptive statistics.

Results: 50 participants completed the questionnaire (37 females, 12 males, 1 undisclosed; age=19.9 ± 2.6 y; BMI=24.4 ± 5.3 kg/m2; years participated in marching arts=6.3 ± 3.0 y). Participants represented different captions with 22 (44%) in brass, 3 (6%) in percussion, 17 (34%) in color guard, and 8 (16%) in miscellaneous captions. The average total HEI score was 55.7 ± 10.9, with 28% of individuals scoring “poor”, 70% scoring “fair” and only 2% scoring “good”. Average intake of fruit and vegetables was inadequate as only 46%, 30%, 26%, and 18% met the recommendations for whole fruit, total fruit, vegetable, and greens & beans, respectively. No participants met the whole grain recommendation, 18% met the dairy recommendation, and only 4% met the suggested fatty acid guideline. Although 60% of participants met the protein recommendation, only 40% met the seafood/plant protein guidelines. Furthermore, few participants fulfilled recommended restriction levels for refined grains (12%), sodium (2%), and empty calories (4%).

Conclusions and Practical Relevance: The results of this study suggest that overall diet quality of marching artists is fair to poor. More research is needed so that marching arts programs can develop healthy eating interventions.

Key References:

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Notes
Achieving Successful Online Delivery of Musicians' Performance Health Education

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Background: Research into the occupational health of music students has shown that up to 25% of music students who enter tertiary music schools already have some kind of playing-related musculoskeletal injury, and 70% of these face the likelihood of sustaining an injury so severe that it will impede their ability to perform. Implementing health education is challenging in an industry where it is not seen as a priority, despite the devastating effects of ill health throughout the careers of musicians that is well-established in the research literature. Music teachers, educational institutions and healthcare professionals all play a crucial intermediary role in changing attitudes towards prioritising performance health for student musicians, yet they often do not have access to the information or tools required. The need for a widely accessible educational resource has been met by the development of an online course focused on healthy music performance and practice, built on an expert information base.

Purpose(s)/Aim(s): The purpose/aim of this study was to discuss the development process, outcomes, and challenges in creating a sustainable online course for the effective provision of educational information on healthy music performance and practice.

Methods: Oral presentation with power point and demonstration of online content (internet access needed).

Results: 1) A brief overview of the project's approach and outcomes, online course content, and the research process informing its development. 2) Discussion of challenges in effecting sustainable uptake of this online resource, such as attitudinal barriers among educators and students, lack of institutional resources to support it, and the translation of health imperatives into educational outcomes. 3) Results of research conducted with university-aged music students doing the course demonstrate low levels of self-responsibility and a low level of efficacy for independent student learning modes in relation to the acquisition of crucial performance-health information.

Conclusions and Practical Relevance: The internet platform of this expert-designed resource has the power to promote awareness of healthy performance among music students, educators and healthcare professionals inexpensively and on a wide scale. The efficacy of alternative learning modes and the engagement of different target audiences, such as music educators, for student learning outcomes needs to be investigated. This will assist in realizing this course's full potential to impact the knowledge base of musicians and their attitudes about music performance health.
Exploring the Violin Studio Instructor's Role in Injury Prevention

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Background: Post-secondary music students are often exposed to a variety of injury risk factors simultaneously, and studies and ethnographies assert that within this setting, it is the studio instructor who holds the most significant power in shaping the student’s physical and conceptual approach to their instrument. While it is acknowledged that these instructors can greatly impact the student’s experience with potential or existing playing-related injuries, the role of studio instructors in injury prevention has not been thoroughly studied.

Purpose(s)/Aim(s): The purpose of this presentation is to increase music pedagogues’, students’, and health professionals’ understanding of violin instructors’ beliefs and practices surrounding injury prevention education, as well as to explore how health promotion may be most inobtrusively and effectively incorporated into the studio teaching environment.

Approach of Presentation: This presentation will describe the findings of an instrumental case study undertaken with four violin studio instructors at a Canadian post-secondary music school. The study comprised 19 lesson observations as well as pre- and post-observation interviews with each instructor.

Content of Presentation: The instructors employed a wide array of teaching techniques to influence their students’ performances, ranging from aural/visual demonstrations and verbal imagery to hands-on manipulations and technical instructions. While physical instructions were sometimes given, anatomical language was rarely used, and the instructors acknowledged having limited familiarity with anatomical concepts. Furthermore, the instructors attested to receiving minimal formal education in injury prevention, yet expressed an interest in expanding their knowledge in this area.

Conclusions and Practical Relevance: This research reinforces the importance of engaging the influential studio instructor in injury prevention education.

Key References:

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The Immediate Effects of Somatic Approach Workshops on Physical and Musical Aspects of Pianists’ Performance

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**Background:** The Alexander Technique, Body Mapping, and Feldenkrais Method are types of somatic approaches sought out by musicians for the betterment of their playing. Perceived benefits of these methods include better body usage and improved musical quality. Workshops can be used to introduce ideas to musicians and many positive comments can be heard after these sessions. Feedback appears to indicate an obvious and large change immediately after the workshop. However, there is little quantitative data to support these claims. There has also been little research conducted to examine the effects on pianists specifically.

**Purpose(s)/Aim(s):** To examine if a single somatic workshop had an immediately observable effect on the body usage and musical quality of pianists.

**Methods:** Ten pianists performed specific requirements before and after a 50-minute somatic session with a certified practitioner. Video and audio recordings of these performances were edited and sent to two blind-review evaluation panels who rated performances on specific aspects of body usage and musical quality.

**Results:** Results revealed that there was a tendency for post-somatic performances to be rated higher than pre-somatic ones. However, statistical analysis revealed that very few changes were significant. Variables examined under the category of body usage showed only one significant change, that of the head and neck (p = .02, d = 1). Under the category of musical quality, only evenness of sound showed a significant change (p = 0.4, d = .57).

**Conclusions and Practical Relevance:** There are small perceivable changes in pianists after having participated in a somatic workshop. Given that these changes were small and rarely statistically significant, it brings into question the real impact of these workshops after only one session. However, if we observe small changes after a short period of time, perhaps long-term involvement in somatic approaches may provide more significant changes.

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A Physiological Analysis of Current Violin Technique and Pedagogy

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**Background:** There appears to be a disunion between the techniques taught by violin pedagogues compared to the research-based basic advice for maintaining healthy function of the human body through biomechanically informed movement patterns. Considering that quality music-production relies on proficient and balanced use of the body, music pedagogues should prepare themselves to teach students healthy body use and uncover unhealthy techniques before such techniques become significantly problematic. It seems plausible to assume that these pedagogical skills would necessitate a basic understanding of human musculoskeletal anatomy and healthy movement. However, researchers have yet to examine the extent to which violin teachers possess this knowledge, nor have researchers identified techniques currently being taught.

**Purpose(s)/Aim(s):** The purpose/aim of this study was... to gather information from the violin teacher population as to their level of knowledge concerning musculoskeletal understanding and healthy movement through an examination of opinions expressed by teachers concerning proper technique and position.

**Methods:** A survey was created using Qualtrics and completed by 130 violin educators. The survey poses specific questions on physiological aspects of violin playing (such as ideal left wrist angle, head positioning, and level of shoulder activity). This project examines the violin pedagogues’ understanding of basic musculoskeletal anatomy and healthy playing position and movement, as well as the level of teacher training in these areas.

**Results:** Descriptive statistics were gathered on participants' demographic information, training and knowledge in healthy body-use, anatomy, and related topics, and the teachers' violin techniques and pedagogy.

**Conclusions and Practical Relevance:** The information gathered in this survey will provide insight into commonly taught violin techniques. Further, the results will provide researchers a basis for comparing current trends in technique to physiological playing recommendations, allowing for evaluation of the physiological quality of currently taught techniques. Finally, based on the healthy movement/musculoskeletal anatomy training reported by the teachers, along with their self-reported teaching techniques, evaluation on the effectiveness of current music educator training can be made.
Lost in the (Neuronal) Stars; the Artistic, Social, and Psychological Consequences of Non-Playing-Related Neurological Dysfunction on Performing Musicians

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Background: Research into musicians’ playing-related disorders such as focal dystonia, tenosynovitis, and nerve entrapment syndromes has flourished in the past years. Less research has been conducted on playing dysfunction arising from other illnesses, particularly those that affect function at the level of the CNS. These movement disorders can stem from ataxic syndromes caused by cerebellar and basal ganglia degeneration, demyelination, and genetically predetermined or age-related illnesses. Epidemiologically, this could be viewed as a set of rare cases that are of marginal interest to the music-medicine community. It could, however, be argued that the lifetime prevalence for such disorders is higher than reflected in epidemiological studies, and that the effects on the suffering musician are sufficiently catastrophic to warrant more attention in the literature and in clinical/pedagogical work.

Purpose(s)/Aim(s): The purpose/aim of this presentation is to increase awareness of musicians' non-playing-related neuromusculoskeletal dysfunction and to explore the consequences on musicians’ playing abilities, on their physical and psychological well-being, and on their social and living conditions.

Content of Presentation: Included are short retrospective case studies, including the presenter herself - a pianist with an autoimmune syndrome, a flutist with sudden-onset paralysis on the left side of her face, and a violinist with MS. Suggestions will be provided for the construction of an institutional framework to assist musicians medically, psychologically, and socially adjust to living and working with their illness or dysfunction (parallels will be drawn to institutions for dancers that provide counselling for medical problems or career transitions).

Conclusions and Practical Relevance: This presentation is intended to increase awareness of playing disorders that are caused or compounded by non-playing-related neurological dysfunction in order to encourage more research as well as to broaden the awareness of nontypical causal factors involved in musicians’ playing disorders. It explores possibilities for the creation of institutional support networks to assist these musicians.

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Background: Sports literature has indicated that static stretching before exercise is of mixed benefit. Research has indicated that there is resulting increase in flexibility, but a loss of muscle strength shortly after stretching. Dancers and some musicians routinely use static stretching as part of their warm-up. This study seeks to determine the state of the literature on the effects of stretching on music and dance performance.

Purpose(s)/Aims(s): To report the findings of a scoping review, using Arksey and O'Malley's method, of the literature on stretching for dance and music performers. Such a review has not previously been conducted in Performing Arts Medicine.

Methods: Two researchers- Robson, a physician with expertise in treating dancers, and Guptill, a therapist with expertise in treating musicians- conducted the review. Guptill has previously conducted a scoping review and is active in academic research. Databases searched included PubMed, SCOPUS, Web of Science, and Embase. In addition, the bibliography of relevant papers were searched and the journal of Medical Problems of Performing Artists online archive was searched in order to extract all relevant papers. The terms dance, stretch and injury and music, stretch and injury were used. When the term injury was removed, there were considerably more articles identified but only one or two new articles that were relevant. The initial search resulted in 1,597 articles, 214 of which were deemed relevant. The final list of articles reviewed in full consisted of 28 dance and 17 music articles published 1996-2015.

Results: Most of the studies were review articles. Our results included 6 randomized control studies in dance and 1 in music. Of the 17 music articles, one indicated potential negative effects of static stretching, and 16 articles that did not address the primary research question. The single study showed a correlation between piano teachers’ self-reported pain and performing a warm-up, which 95% described as ‘stretching’. In dance, 5 studies suggested negative effects, and 8 suggested positive impacts. Fifteen studies did not address the primary research question. Negative effects included self-report of injuries occurring during muscle stretching; sciatic nerve injury; and hamstring strain. A number of studies indicated stretching as a treatment option for injury, e.g. to address a high incidence of Achilles tendonopathy and plantar fasciitis in Irish dancers. Dancers took longer to recover from hamstring strain than sprinters. Positive impacts centered around increased flexibility/range of motion. One study also found that when SS was combined with dynamic stretching, this resulted in increased vertical jump height. Finally, a reduction in muscle-blood volume that typically results from stretching may be attenuated in long-term ballet trained dancers.

Conclusions/Practical Relevance: The results of the study suggest that there are a minimum of high quality intervention studies that address this issue in performing arts medicine. There are definite gaps in the dance literature providing guidance on safe, effective stretching protocols. In musicians, there is a need for more research, including prospective studies examining the effects of different forms of stretching. In conclusion, more research is needed to guide clinicians in making evidence-informed clinical recommendations.
Normative Concussion Baseline Values for Groups within the Dancer Population

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Background: A baseline assessment may be helpful in identifying abnormal findings after concussive injury, but many dancers do not have access to baseline testing. Normative values may be helpful in recognizing concussion but can be influenced by numerous factors so it is important to establish normative values for specific, target groups.

Purpose(s)/Aim(s): The aim of this study was to establish normative values for various subgroups within the dancer population.

Methods: Onsite pre-season screenings were conducted during summers 2013-2015 on a cohort of university and professional dancers. Baseline scores were conducted one-on-one with a trained investigator in an isolated area. Groups were analyzed by sex, age, height, professional status, history of depression, eating disorder, concussion, and or thopedic injury, general alcohol intake, hours of sleep the night before baseline testing, and general amount of sleep each night. Symptom severity score, cognitive score, King Devick (KD) score, and modified Balance Error Scoring System (mBESS) score were analyzed with Mann Whitney U, t-test, Pearson & Spearman’s Rho correlations to determine significance.

Results: 239 dancers (68 male; 171 female; 154 university; 85 professional) participated. 4.2% had a self-reported history of concussion. Mean age was 21.09 years (±4.837). Mean symptom score was 16.48 (±12.798); mean cognitive score was 27.49 (±1.780); mean KD was 41.565 seconds (±8.19 sec); mean modified BESS was 3.21 errors (±3.123). Females had superior KD scores (p=.030). Hours of sleep before testing showed a moderate, negative correlation to symptom scores (p < .001); increased weekly alcohol consumption showed a low, positive relationship with symptom scores (p=.048). History of depression was related to increased symptom scores (p=.029) Females had less errors than males on mBESS (p=.013). Height was positively correlated to mBESS scores (p=.001). There were no significant findings in those with history of concussion, eating disorder or repeated orthopedic injury, and no differences between university and professional dancers.

Conclusions and Practical Relevance: Similar to athletes, it cannot be assumed that a dancer’s baseline symptom score is zero. Dancers may have higher baseline symptom severity scores than athletes. KD and mBESS scores are different between sexes, with females performing better on both. Baseline symptom severity scores are influenced by lifestyle habits and mental health history. Normative values should be used with caution.

Key References:


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Reliability and Validity of a Dance Outcomes Instrument. Part I. Comparison of the 16 Question DFOS to Knee, Foot and Ankle Outcomes Tools

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Background: Comprehensive surveillance of dance injuries is needed to better understand injury severity, risk factors, assess the effectiveness of injury prevention strategies, and measure outcomes following injury rehabilitation.

Purpose: To investigate preliminary reliability and validity of the Dance Functional Outcome Survey (DFOS), focusing on back and lower extremity function. We compared i) test – retest of Likert and analog versions of the DFOS completed twice within one week; ii) Likert versus analog versions of the DFOS; and iii) the DFOS versus two well established joint-specific tools to assess functional outcomes: the Cincinnati Knee Rating System (CinnKnee) and Olerude and Molander Foot-Ankle Questionnaires (FAQ). In this first round of testing, the DFOS was comprised of two parts: an ADL and a dance-specific portion with 16-questions.

Methods: Data were collected from a group of fifty healthy adult ballet and modern professional dancers surveyed with the DFOS, CinnKnee, and FAQ. The mean age of the group was 25.53 ±6.42 (range18 to 48), with 33 females and 17 males. Data inclusion was based on previous experience in ballet and modern dance and the completion of all questionnaires. Intraclass correlation coefficients (ICC) were used to compare total scores and similar items within the questionnaires.

Results: Test-retest of Likert and analog DFOS were r≥0.94. ICC for total scores of Likert versus analog DFOS were r=0.71, with self-rating scores r=0.81. ICC for total DFOS and CinnKnee scores were r=0.77 and DFOS and FAQ were r=0.64. Cronbach’s alpha for the DFOS and CinnKnee questions for stairs and overall movement or activity were r=0.91 and 0.77; for questions related to jumping, twisting, running were r=0.65; and between DFOS and FAQ overall movement and work were r=0.78.

Conclusions and Practical Relevance: The DFOS had high repeatability and acceptable criterion validity compared to two well stablished joint-specific tools to assess functional outcome. Based on item analyses, two questions were eliminated from the DFOS. Because it was designed to assess functional outcomes related to specific dance movements, not present on other questionnaires, these results support further study of the DFOS Likert version as an alternative clinical tool to measure functional outcomes for dancers.

Key References:


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Reliability and Validity of a Dance Outcomes Instrument. Part II. Comparison of the 14-Question DFOS to the SF-36

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Background: To better understand effectiveness of our surgical and rehabilitation intervention, it is important to have valid ways to measure recovery. Previously, there were no dance-specific outcomes tools available to evaluate physical function and recovery in ballet and modern dancers.

Purpose(s)/Aim(s): The Dance Functional Outcome Survey (DFOS) was developed to evaluate the impact of orthopaedic injury on dance function in ballet and modern dancers of all levels following back or lower extremity injury. The purpose of this second study was to assess reliability of the revised 14-question DFOS and criterion validity compared to a well-studied generic health measure, SF-36, in adult professional and pre-professional ballet and modern dancers.

Methods: Subjects were comprised of 89 healthy dancers (age 24±6 yrs, 14±6 yrs dance training, 30 males). 52 professional and 37 pre-professional dancers completed the DFOS within a two-week period. A subset completed the DFOS and SF-36 to assess concurrent validity. Statistical analyses included: i) Cronbach’s alpha to determine internal reliability of the data set; ii) Intraclass correlation coefficients (ICC) to assess relative reliability (test-retest repeatability); iii) standard error of measurement (SEM) to assess absolute reliability; and iv) ICC to assess criterion validity of the DFOS and SF-36.

Results: i) Cronbach’s alpha for DFOS demonstrated high internal reliability (r=0.827). ii) ICC for DFOS repeatability was high for total scores (r=0.836), and Dance (r=0.803) and ADL (r=0.797) sub-scores. iii) SEM for DFOS total, Dance, and ADL components was 2.44, 3.30, and 2.63 respectively. iv) Concurrent criterion validity of DFOS and SF-36 Physical Component Score (PCS) was moderate (r=0.605), while DFOS and Mental Component Score (MCS) relationship was weak (r=0.400).

Conclusions and Practical Relevance: DFOS demonstrated acceptable reliability. Results provide convergent/divergent evidence for validity with SF-36, comparable to currently used tools such as Cincinnati Knee-Rating and Lysholm/Tegner Activity scales. The lack of higher correlation with SF-36 suggests that DFOS fulfills a need to determine function not addressed by SF-36. Investigation of instrument responsiveness to change following injury is underway. DFOS focuses on dance-specific movements that are unaddressed in other sports or generic questionnaires and provides an important tool for investigating clinical efficacy.


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An Examination of the Relationship Between Baseline Screening Scales

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**Background:** Researchers have found that dancers may have greater risk for negative emotional traits such as depression, low self-esteem, anxiety, and PTSD than the general population. In one recent paper, it was suggested that dancers have the ability to experience a greater range of emotions than non-dancers. Additionally, it is well documented that dance injury rates are high wherein as many as 80% of dancers experience a major injury during their careers. For these reasons, it is important to screen the emotional and psychological as well as physical health of dancers and to investigate the relationship between these variables. A variety of validated instruments exist to examine psychodynamic factors. Better understanding of psychodynamic variables can assist clinicians in fully addressing dancers’ whole health needs.

**Purpose(s)/Aim(s):** The purpose/aim of this study was to explore the relationships between several baseline screening scales that measure physical and/or emotional states.

**Methods:** 234 dancers (21.19±4.9 years, 66 men, 168 women) in four professional companies and one collegiate dance major program completed pre-season screenings as part of the International Performing Arts Injury Reporting System (IPAIRS). Screenings included baseline psychodynamic scales completed by the dancer (Discomfort Rating Scale, Profile of Mood States [POMS-Brief], Eating Attitudes [EAT-26]) and baseline Sports Concussion Assessment Tool (SCAT-3) scales conducted by a clinician or trained researcher (Graded Symptom Checklist [GSC], Cognitive Score, Modified Balance Error Scoring System [BESS]).

**Results:** Subjects demonstrated mean baseline scores: Discomfort Rating, 59.71±55.0; POMS-Brief, 6.46±13.0; EAT-26, 5.56±6.9; GSC, 16.59±12.8; Cognitive Score, 27.45±1.8; BESS, 3.15±3.1. A Spearman’s rank-order correlation revealed strong, positive correlations between Discomfort Rating and POMS-Brief (rs(222)=0.408, p<0.001), and POMS-Brief and GSC (rs(221)=0.422, p<0.001). There was a moderate positive correlation between Discomfort Rating and GSC (rs(233)=0.300, p<0.001), and a weak positive correlation between Discomfort Rating and EAT-26 (rs(232)=0.136, p=0.039).

**Conclusions and Practical Relevance:** Results indicate that mood, intensity of certain sensations, and physical discomfort are related, and that mood might be the most influential factor, which gives further evidence that psychological states have significant effects on physical wellbeing. Physical discomfort is also related to eating attitudes. Future research should continue to examine how emotion is integrated with physical status, and progress to advance our understanding of how this affects artistic performance and injury occurrence.
Updates on the Assessment and Management of Patellar Tendon Injury in the Dancer

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Background: Presenter is an expert in dance medicine and is a consulting physician to a professional ballet company.

Purpose(s)/Aim(s): Update clinicians on the assessment of patellar tendon injuries and discuss options in the treatment of these common and potentially disabling injuries.

Approach of Presentation: This talk will discuss the current literature concerning patellar tendon injury and the presenter's personal experiences in the clinical management of this issue.

Content of Presentation: The anatomy of the extensor mechanism of the knee will be reviewed. The differential diagnosis of anterior knee pain will be discussed. Risk factors for the development of patellar tendon injury will be identified. Participants will gain new knowledge concerning current options in the assessment of the patellar tendon. Finally, attendees will learn about options in the rehabilitation and treatment of patellar tendon injuries.

Conclusions and Practical Relevance: Patellar tendon injury, sometimes called "jumper's knee" is a common and potentially disabling injury for the dancer. The patellar tendon is subjected to high force loads in dance and the dancer is at high risk of acute and chronic tendon injury. The assessment and management of these injuries is complex. This talk will review the knee extensor mechanism anatomy and will discuss the differential diagnosis of anterior knee pain. Risk factors for the development of patellar tendonopathy will be reviewed. The clinical history and physical exam findings of patellar tendon injury will be presented. Clinicians will learn about options in imaging of the relevant anatomy, including musculoskeletal ultrasound and MRI evaluation. Finally, clinicians will be updated on the treatment pathways available to manage this often difficult to resolve injury. This talk should help to optimize the assessment and management of a common and potentially disabling knee injury.
Adult Manifestation of Osgood Schlatter Disease in Pre-Professional and Professional Dancers

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Background: Osgood-Schlatter disease (OSD) is typically a pediatric diagnosis for traction apophysitis of the tibial tubercle. Research suggests that OSD can result from disruption of the extensor mechanism due to recurring microavulsions of the anterior portion of the secondary ossification center. The knee accounts for approximately 74% of adolescent athletic injuries, of which, 10% are due to OSD. Symptoms include local pain with direct pressure/contact on the tibial apophysis; symptomatic pain before, during, and after physical activities that include jumping and sprinting; enlargement or prominence of the tibial apophysis; and pain with resisted knee extension. Risk factors for OSD include growth spurt, regular sports activities (higher risk with sport-specialized athletes), shortening of the rectus femoris muscle, quadriceps muscle strength, and flexibility of hamstring muscles. About 90% of patients respond well to nonoperative treatment that includes rest, icing, activity modification, and physical therapy. OSD results in patients typically self limiting their activities until symptoms resolve.

Purpose/Aim: The purpose of this presentation is to increase awareness of OSD in fully developed dancers due to alternate types of repetitive movement. We will identify treatment options to treat this population considering their limited ability for rest.

Approach: A retrospective chart review of 679 pre-professional and professional modern dancers was conducted. A case series of two dancers will illustrate the pathophysiology and treatment of adult manifestation of OSD in dancers.

Content: We found a prevalence of 2.8% in our cohort. Fully matured pre-professional and professional dancers presented with similar symptoms of OSD including local pain, swelling, tenderness, and enlargement of the tibial tubercle that increased with movement that stressed the extensor mechanism. However, their onset of symptoms was a result of choreography that included back hinges, turning on the knees, and falls to the knees; movements unique from the typical presentation of jumping and running in adolescent athletes.

Conclusions and Practical Relevance: Two dancers participating in rigorous choreography that stressed the extensor mechanism aside from the typical mechanism of jumping, were referred and successfully treated for OSD. Various treatment interventions were created to account for the limited ability for rest in this patient population.

Key References:


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Notes
Hearing Screening in Healthy Teachers of Singing and Voice Students at a State and Regional NATS Competition

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Mitchell Isaac, BS, Medical University of South Carolina, Charleston, South Carolina, USA  
Deanna McBroom, MM, College of Charleston, Charleston, South Carolina, USA

Background: Singers are exposed to a wide variety of noise levels during a normal working day and many voice teachers and students complain about auditory symptoms such as tinnitus and subjective loss of hearing. While Hu et al has documented hearing loss in singers presenting with vocal complaints, no formal study has looked at this issue in a generally healthy population, which may lack adequate insurance or motivation to examine their hearing.

Purpose(s)/Aim(s): Seeks to quantify the hearing level in a large sample of generally healthy professional teachers of singing and voice students participating in a State and Mid-Atlantic Regional Competition of the National Association of Teachers of Singing (NATS) to be held February 20, 2016 and March 18 & 19, 2016 and to determine the possible prevalence of hearing loss through the use of a portable calibrated audiometer with “over the ear” ear phones and masked sound delivery which allows for a very high quality hearing test in the field.

Methods: Voice teachers and students participating in the above competitions can volunteer for a hearing screening of 8 standard frequencies in a quiet room environment with the ShoeboxTM audiometer and fill out a brief survey. Informed consent will be obtained. Data will be analyzed for the incidence of hearing loss in teachers and students, severity of hearing loss by age, years of teaching and/or performing, and by voice part utilizing T tests and ANOVA.

Results: Based on the literature and our preliminary work on studio noise exposure in college level teachers of singing, we expect to find a broad range of hearing loss in both voice teachers and students.

Conclusions and Practical Relevance: Hearing loss in a generally healthy cohort of voice teachers and students may be more widespread than previously thought. Raising awareness in this population which is normally considered to be at minimal risk, may prompt teachers and students to adopt strategies that decrease exposure to high noise levels in a variety of rehearsal and performance settings.
Perceived Psychological and Laryngeal Health in Undergraduate Performing Arts Students

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Background: Laryngeal health may be impacted by psychological stress—a modifiable factor—and is thus worth examining in undergraduate performing arts students dependent on optimal vocal function.

Purposes/Aims: The purpose of this project was to 1) examine levels of self-reported psychological distress and self-reported laryngeal health in these students; and 2) examine the unique predictive ability of psychological distress in terms of laryngeal health.

Methods: Participants were 72 undergraduate students (46.6% female, Mage = 19.74, SD = 1.77) studying classical voice performance, drama performance, and musical theater at a Midwestern University. Participants completed self-report questionnaires assessing vocal health, symptoms suggestive of laryngopharangeal reflux, perceived stress, substance use, and symptoms of anxiety/depression. Multiple regression models were used to examine the relationship between psychological symptom variables and vocal health.

Results: There were elevated scores for perceived vocal pathology (M = 19.6, SD = 16.2), singing vocal pathology (M = 33.7, SD = 21.1), perceived stress (M = 20.17, SD = 5.9), anxiety (M = 44.9, SD = 10.1), and depression (M = 17.7, SD = 9.6) in these students. Alcohol was the most common substance used in this population, with 55.6% of students consuming alcohol at least weekly. This was followed by cannabis, with 26.4% of students reporting current cannabis use, and then 9.7% of students reporting current tobacco use. After controlling for the effects of demographic factors, higher levels of perceived stress (9.1% unique variance), trait anxiety (20.0% unique variance) and depressive symptoms (13.5% unique variance) significantly predicted poor perceived vocal health.

Conclusions and Practical Relevance: Psychological distress was pervasive in this sample of performing arts students. In addition, psychological distress is associated with poor perceived laryngeal health. Future research should examine the impact of a potential stress reduction intervention on the psychological functioning and resulting perceived laryngeal health of performing arts students.

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Introduction
Musical theatre performers (MTP) have been considered as part of a risk group for the development of a myriad of voice disorders based on the understanding of their high vocal load and low recovery time between shows. There have been attempts to evaluate the effect this tough routine has on them, utilizing the Singer’s Voice Handicap Index (SVHI) (Cohen et al., 2007) and interviewing them to obtain their perception on the matter (Phyland et al., 2013). The result was as expected: many of these performers complained of the presentation of vocal fatigue.

The use of acoustic (Ac) and electroglobtographic instruments in this specific field has not been widely reported in comparison with other musical genres. “Electroglottography (EGG) is a method to measure the impedance to a weak alternating current through the tissues of the neck” (Kitzing, 1990).

The hypothesis of this study is that the objective markers (Ac and EGG) of the MTPs will show a negative change throughout the week, more marked in the last working day. With the second hypothesis being that the self-reported strain, both in the voice and general health, will present a rise when comparing before and after the shows, being even greater on double show days.

Conclusions
The MTP do present changes in the objective and subjective markers of vocal fatigue throughout their highly vocally loaded working week. These markers were able to provide us with enough information to be able to say that both hypotheses outlined at the beginning of the study are true, relevant to this specific population. However, further research is needed to be able to make a generalisation.

Self-perception is still one of the best markers for measuring vocal fatigue, as even if it is subjective, it still provides us with a better understanding of the state of a MTP voice.
“Pulsed, Connected Giggle” A Treatment Option for Singers with Essential Tremor

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Lucinda Halstead, MD, Medical University of South Carolina, Charleston, South Carolina, USA

Background: Benign Essential Tremor is a neurological disorder involving abnormal control of muscle contraction that causes rhythmic shaking primarily affecting the head, hands, and voice. BET can occur in the muscles of the palate, tongue, throat, and vocal folds, resulting in an inability to keep the speaking or singing voice steady. Myoclonus, a Tremor-like Voicing disorder, exhibits similar symptoms. These disorders are potentially disabling to singers, creating wide variations of tone and pitch especially noticeable on sustained notes.

Purpose(s)/Aim(s): The purpose of this presentation is to describe and demonstrate a treatment option for singers with tremor. By connecting short pulses of singing tone in a repeated, supported, and sustained “giggle”, these singers can learn to approximate legato singing, partially defeat the annoying tremor, and continue to perform and enjoy singing.

Approach of Presentation: A brief review of symptoms and treatment options of tremor in the voice will be presented, referencing the work of Speech-Language Pathologists Julie Barkmeier-Kraemer and Jessica Tayseer Hilo. A description of the Singing Voice Specialist's habilitation of 3-4 singers from different singing styles (church choir, classical opera, bluegrass, and CCM Christian styles) using the “Pulsed, Connected Giggle” technique will follow.

Content of Presentation: After a review of symptoms and treatment options, the treatment protocol of "Pulsed, Connected Giggle" will be described and demonstrated. Beginning with short, pulsing [ss] sounds, the singer progresses to singing a series of detached tones on various vowels using "puffs" of air, and finally to singing a "Pulsed, Connected Giggle" tone, which sounds similar to a legato (sustained) singing tone. Applying this technique to singing songs allows the singer to approximate sustained phrases and interrupt the tremor-induced wide variation of tone and pitch. Additionally, the SVS corrects other vocal faults, such as reestablishing abdominal breathing, relaxation of jaw/throat/tongue tension, and enhancing resonance.

Conclusions and Practical Relevance: Using this treatment option, singers from various singing styles can begin to overcome the unpredictable, yet recurrent interruption in singing tone that occurs with tremor. Combined with basic retraining in singing technique and increased confidence that develops from using the “Pulsed, Connected Giggle”, singers with these tremor disorders may be able to return to some or all of the singing tasks they love and enjoy.
The Medical Complications of Eating Disorders

Ovidio Bermudez, MD, FAAP, FSAHM, FAED, F.iaedp, CEDS, Eating Recovery Center, Denver, Colorado, USA

Background: Ovidio Bermudez, MD, FAAP, FSAHM, FAED, F.iaedp, CEDS, is the Chief Clinical Officer of Eating Recovery Center in Denver, Colorado. Dr. Bermudez is a Fellow of the American Academy of Pediatrics, the Society for Adolescent Health and Medicine, the Academy for Eating Disorders and the International Association of Eating Disorders Professionals. He is Past Chairman and Senior Advisor on Media for the Board of Directors of the National Eating Disorders Association, Co-Founder of the Eating Disorders Coalition of Tennessee (EDCT), Co-founder of the Oklahoma Eating Disorders Association (OEDA) and a founding member of Houston Eating Disorders Specialists (HEDS). Dr. Bermudez has lectured nationally and internationally on eating disorders, childhood obesity and other topics related to pediatric and adult healthcare, and has been repeatedly recognized for his dedication and advocacy in the field of eating disorders.

Purpose(s)/Aim(s): The purpose/aim of this study was to educate attendees on identifying and addressing eating disorders in performers, therefore, contributing to advancing performing arts medicine; to present evidence-based information and discuss the complexity and severity of the medical complications of eating disorders; to raise awareness of the critical importance of early detection and intervention; to discuss treatment options and referral to higher level of care.

Approach to Presentation: Presentation is didactic lecture format, with PowerPoint slides and clinical examples. The presenter's style is engaging and dynamic, audiences connect with the presentation content through relevant stories, graphics and clinical language appropriate for any level of education or understanding of eating disorder diagnosis and treatment. Dr. Bermudez's presentation last year received positive feedback from attendees.

Content of Presentation: This presentation will address common medical complications of anorexia nervosa and bulimia, strategies for identification and intervention, and recommendations for effective treatment. Discussion will focus on the consequences of eating disorder behaviors, including cardiovascular, gastro-intestinal, neurological and endocrine system abnormalities and issues. Clinical vignettes, graphics and case studies are incorporated. Time is allotted for interactive discussion, questions and answers.

Conclusions and Practical Relevance: Following this presentation, attendees will be able to identify common medical complications associated with eating disorders, and appropriately refer performers for treatment.
Breathing, Stress, And Tension: How They Can Help And Hurt Performance, And How You Can Control Them

Paul Lehrer, Rutgers Robert Wood Johnson Medical School, Piscataway, NJ

Background: 50 years of research and clinical practice of stress management

Purpose(s)/Aim(s): Introduce attendees to the psychophysiology stress, how breathing and muscle tension can contribute to it and be used to manage it.

Approach: Lecture

Content: Although at times a moderate amount of stress can enhance performance, too much stress can impair it. ‘Allostasis’ describes stability and resilience through ability to change, regulate, and adapt; but it uses body resources. If allostatic load is too high because of stress, symptoms occur and performance suffers. Anxiety and depression are common results, and common pre-performance events. Improved skill (practice) and frequent performances can reduce performance stress.

Breathing: Many musicians stop breathing when playing a difficult passage. Breath holding increases respiratory drive, which can cause hyperventilation, which causes muscle tightness, heart pounding, chest pain, clouded thought, breathlessness, and poor visuomotor performance. Frequent yawning or sighing also causes hyperventilation. Hyperventilation symptoms can cause anxiety, which potentiates more hyperventilation. Heart rate variability biofeedback and relaxed breathing at about 10 seconds/breath can decrease hyperventilation.

Muscle tension. Muscle tension increases in and challenging tasks. The muscles are part of the ‘fight or flight’ reaction, which includes increased heart rate and blood pressure, sweating, trembling, and increased respiratory drive. Progressive relaxation teaches voluntary muscle relaxation. Attendees will learn to detect and control very subtle levels of muscle tension in several important muscle groups.

Conclusions and Practical Relevance:
Sufficient practice and frequent performances can reduce performance stress and make stress facilitate performance. Overbreathing and muscle tension can augment the stress response. Understanding the physiology can reduce anxiety. Heart rate variability, 10-second breathing, and progressive muscle relaxation can reduce physiological effects of stress.


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Clinician’s Guide to Musicians: Playing Posture and Movement Analysis

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**Background:** Poor posture and repetitive movement patterns are known to predispose artists to overuse injuries and cumulative trauma. Given the various tasks and physical demands placed on performing artists, it is essential for health care providers and educators to be able to systematically observe playing positions and movements. The analysis of specific athletic populations has been widely studied from overhead athletes to runners. Currently, there is not a consensus on a comprehensive approach to analyzing the movement patterns of instrumental musicians in the classroom or clinical setting.

**Purpose(s)/Aim(s):** The purpose/aim of this presentation is to propose a systematic method to analyze playing position and movements of instrumental musicians based on validated and widely used ergonomic and sports performance assessment strategies.

**Approach of Presentation:** The presenters will introduce ergonomic and sports analysis concepts in a lecture-based format. Case studies will be utilized to demonstrate a systematic method to analyze the static and dynamic task of playing an instrument.

**Content of Presentation:** It is widely known that musicians are predisposed to high rates of repetitive strain injuries (RSI) due to abnormal postures and playing positions. Using common analysis techniques found within the ergonomic and sports medicine fields, a systematic method was developed to help analyze the physical tasks required to play an instrument. The method incorporates static postural analysis, instrument setup and movement assessment based on biomechanical principles. This presentation will demonstrate how to use this tool across various instruments and playing positions.

**Conclusions and Practical Relevance:** Healthcare practitioners see a wide range of performers and artists. It is challenging to have extensive knowledge on playing techniques, positions and ergonomic modifications that can be used across different instruments and genres. The skill of movement analysis will help the healthcare professional be efficient and versatile in identifying key areas that may predispose the musician to greater risk of injury. This method will contribute to the musician’s individuality and artistic expression and supplement the known pedagogy for each instrument.

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Heart Rate Variability Biofeedback for Optimizing Performance: A Deeper Look at the Mind/Body Connection

Kathleen Riley, PhD, Cleveland Clinic Center for Integrative and Lifestyle Medicine, Ohio, USA
Presented by Paul Lehrer, PhD

Background: Performance stress, whether stemming from mental /emotional stress or physiological stress, primarily technical difficulties or uncertainties, all manifests in the physiological profile as well as the emotional. This workshop will assess the effects of performance anxiety on technique and biomechanics, and the effect of improper technique and biomechanics on performance anxiety.

Purpose(s)/Aim(s): The purpose/aim of this study was to educate on the modality of heart rate variability (HRV) biofeedback. Participants will learn to identify what conditions biofeedback can help; learn the methodology behind HRV biofeedback training; explore what results can be expected from biofeedback.

Approach to Presentation: A short PowerPoint presentation to begin - explaining heart rate biofeedback. This will be followed by hands on work with three volunteers, addressing aspects of performance anxiety through HRV biofeedback. Dynamic surface electromyography/video biofeedback will be used to present the physiological responses and changes in muscle activity under stress, as well as in a relaxed, focused state.

Content of Presentation: Explanations of the physiological stress response, i.e. increase in heart rate, contraction of voluntary skeletal muscles, release of arenalin and noradrenalin, etc., and the perceived stress response: the impact of performance stress on physiologic responses. Working with volunteers with biofeedback in real time, participants will learn to analyze changes that are occurring in both heart rate variability and physiological muscle tension.

Conclusions and Practical Relevance: Identifying mental and emotional anxiety and working with self regulation training can help improve physiological control and execution in performers.
Respiratory Training for Positional Control, Performance & Recovery

Michael Mullin, ATC, PTA, PRC, Cumberland, Maine, USA

Background: The importance of optimal ventilatory (air movement) and respiratory (gas exchange) control cannot be understated when it comes to the performing artist. Ventilation is both voluntary and involuntary and it has a considerable affect on the system in its ability to influence position, performance and recovery. The ability to obtain a Zone of Apposition, which is that aspect of the diaphragm that apposes the rib cage, is a critical aspect of optimizing respiratory control and helps to reduce tone in the system and improve recruitment of muscle activity into more desirable areas. Improving the capacity to volitionally train and manage these internal pressures is incredibly beneficial to the performing artist.

Purpose(s)/Aim(s): The purpose/aim of this study was to gain a background on proper diaphragmatic anatomy and function in order to learn how to control respiratory balance through specific breathing activities aimed at establishing thoraco-pelvic positional control for improving performance and recovery of many types of performing artists.

Approach to Presentation: Informational lecture of respiratory mechanics, inherent system asymmetry and supplemented with specific training exercises that can be performed before, during or after involvement in instrumental, vocal, or dance and performance-based activities.

Content of Presentation: Anatomical and physiological background of the respiratory cycle, proper diaphragmatic anatomy and function and the influence it has on the rest of the system and subsequently performance will be reviewed. Specific activities will be discussed in order to learn how to control ventilatory balance for tone reduction, performance enhancement, managing anxiety and to aid in recovery. Once able to perform properly, then introducing props such as common balloons or straws for increased somatosensory input further aids in optimal diaphragm restoration. Cues on positional retraining and awareness for optimal carry-over to a number of different performing arts activities will also be reviewed.

Conclusions and Practical Relevance: A critical component for the performing artist is the ability to manage pressures, both physically and psychologically, as they have a significant influence on the ability to maintain good control during activity. Respiratory activities which aid in developing system neutrality, decrease muscle tone and aid in performance enhancement can provide significant benefits and also provide a sound alternative in the ability to recover following.
Investigation and Application of a New Mobility Device for Dancers with Disabilities

Merry Lynn Morris, MFA, PhD Candidate/Faculty - University of South Florida, USA

Background: Dancers with disabilities have gradually become more of a presence in professional dance over the past 20-30 years. These dancers often use assistive devices such as wheelchairs. However, this population and the devices they use have received little attention in dance-science literature. Standard devices have not been designed or analyzed from a dance-science perspective as a tool of artistry supporting the physical, interactive demands of dance. The prototype wheelchair explored here serves as an intervention in the current unexamined condition of mobility device use for dance.

Purpose(s)/Aim(s): The purpose of this study was to qualitatively assess the movement effects of a new prototype wheelchair for use in dance.

Methods: A dance-specific, wireless-controlled, omni-directional wheelchair was developed over a two year period by an interdisciplinary team led by a dance lens. Qualitative data was collected from a purposeful sampling of seven adult wheelchair users from different geographical locations, recruited to test the chair for this IRB-approved study. Five of seven had been dancing for at least 10 years in professional dance. Each participant experimented in the chair in a dance studio w/other dancers. Participants engaged with all chair features including: height change, seat rotation, omnidirectionality, and the mobile control. Participants wore the mobile control - directing chair movement by leaning/tilting (torso/back/head) and also experienced reciprocally being moved by other dancers. Sessions were video-taped and post-experience interviews were conducted addressing difficulty level, applicability, and general sensations experienced.

Results: Dancers reported minimal difficulty in chair operation and described the chair’s expansion and enhancement of their performance abilities and creative range, including: movement initiations, spatiality and interactivity. Emergent themes were: the emotional impact of eye level connectivity due to height change feature, the physical/mental freedom of “hands-free” movement, and the new possibilities engendered by sideways movement in comparison to their existing (powered & manual) chairs.

Conclusions and Practical Relevance: Results indicate that new device options in dance are beneficial and desirable in expanding movement possibilities. As more types of bodies explore dance, examining mobility device options and impact, both physical and psychological, is a needed area of study to improve training methods and attend to the rigor and artistry of dance.

Key References:

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Notes
Fit to Perform: A Picture of Music Students' Health and Wellbeing

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Background: Research has shown that musical practice and performance can expose musicians to pain, musculoskeletal problems and psychological distress which may prevent them from realising their full potential. While developing and honing musical and technical skills are undoubtedly important, other skills and behaviours – such as being physically fit, building psychological resilience and engaging in health promotion – are also needed to respond effectively to the challenges of the profession.

Aim: The aim of this study was to investigate the physical and psychological correlates of musicians' health and wellbeing through an investigation of musicians' perceptions, attitudes and behaviours towards health promotion, as well as indicators of health-related fitness.

Methods: 483 advanced music students from ten conservatoires were invited for a 90 minute individual health screening session that included self-report and objective measures of psychological and physical fitness. Sex was evenly distributed across the sample, and all instrument groups were represented.

Results: Exploratory analyses showed no significant differences between instrumental groups or institutions of study. There were some significant differences between men and women, although effect sizes were small. Overall, the music students reported good levels of wellbeing, and the types of health promoting behaviours in which they engaged were similar to those of non-musicians, although scores for stress management and health responsibility were low. Tendencies for maladaptive perfectionism and limited use of coping skills were also found. The music students reported low levels of perceived fatigue; however, the data indicated a risk of sleep disorders and generally negative perceptions of health. On the other hand, the participants exceeded recommended levels of physical activity and showed good levels of shoulder flexibility and range of motion, normal to excellent grip strength, and above average to good levels of cardiovascular fitness. High fatigue and poor sleep quality were strong predictors of perceived ill-health.

Conclusions and Practical Relevance: Whilst our indicators of physical fitness among these music students may be encouraging, the findings suggest that their psychological wellness require further attention especially in such a competitive field where cultures of perfectionism are still present. Implications for training of advanced music students, as well as suggestions to increase health education in the conservatoire setting, will be discussed.
Key References:


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Saliency of the “Singer” Identity in Classical Singers and the Pursuit of the “Ideal Singer”

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Background: A singer’s instrument is biologically embedded. Consequently, cultivation of the instrument requires negotiation between oneself and the embedded mechanism. Understanding how central or “salient” the identity of being a singer is to one’s own identity as a person, as well as one’s feelings, thoughts and beliefs about the “ideal” singer as an identity, may be as critical to determining the impact of the vocal identity as is vocal talent itself.

Purpose(s)/Aim(s): To probe singer saliency by combining the frameworks of identity and the ideas relative to self-concept and to develop and validate a Singer Identity and Attitudes (SIAA) questionnaire.

Methods: The SIAA questionnaire was given to a sample of 10 singers (mean age = 24.5 ± 2.4 yrs.). Test and retest trials were performed, followed by statistical analysis for reliability and validity.

Results: Results revealed a reliable questionnaire that could provide profiles of singers with potential risk factors for unhealthy emotional and psychological responses. The study also found perceived differences between females and males. Additionally, a four-factor identity component was established and charted for each participant.

Conclusions and Practical Relevance: The saliency and related information produced by the SIAA questionnaire may allow for early identification of students at-risk for psychosocial issues related to singing, along with more individually based pedagogy that is related to identity and psychological factors, rather than focused solely on technically based pedagogy.

Key References: Saliency, ideal-self, inclusion, identity, NATS

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Hearing Screening in Healthy Teachers of Singing and Voice Students at a State and Regional NATS Competition

M. Isaac¹, D. McBroom², S. Nguyen³, L. Halstead⁴

Objectives: Singers and voice teachers are exposed to a wide variety of noise levels during a normal working day. This study seeks to quantify the hearing level in a large sample of generally healthy professional voice teachers and voice students to determine the prevalence of hearing loss in this population.

Study Design: Cross-sectional study

Methods: Voice teachers and vocal students were given the option to volunteer for a hearing screening of 6 standard frequencies in a quiet room with the Shoebox™ audiometer, and fill out a brief survey. Informed consent was obtained. Data was analyzed for the prevalence and severity of hearing loss in teachers and students based on several parameters assessed in the surveys. All data was analyzed utilizing Microsoft Excel and SPSS statistics software.

Results: 158 participants were included, 58 of them identified as voice teachers, 106 of them identified as vocal students, and 6 identified as both. Of the 162 participants, 36 had some level of hearing loss. 51.7% of those who identified as a voice teacher had hearing loss, and 7.5% of vocal students had hearing loss. Several parameters of noise exposure were found to positively correlate with objective hearing loss and severity of hearing loss(p<0.05).

Conclusions: Hearing loss in a generally healthy cohort of voice teachers and students appears to be more widespread and severe than previously thought. Raising awareness in this population may prompt teachers and students to adopt strategies to protect their hearing.
Developing Awareness, Improving Ergonomics and New Learning Strategies in Instrumental Music

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Background: The repetition of harmful habits in performing music with accordion results in a great compression at the lumbar and cervical vertebrae due to the way the weight of the instrument is distributed onto the body and to a technique that most of the time does not take into account a proper psycho-physical approach. The type of straps commonly used to support the instrument have dramatic consequences on breathing, since they block shoulders movement, impeding freedom, and by stressing the floating ribs area.

Purpose(s)/Aim(s): The purpose/aim of this presentation is...to increase the awareness of accordionists, but in general, of all musicians, of the need of psycho-physical coordination in order to prevent injuries and in order to gain freedom in playing, and of music teachers of improving attention and learn new strategies to prevent and overcome harmful habits in music playing.

Approach of Presentation: A retrospective case study of twelve Bachelor and Master students from the most advanced European Accordion Schools will illustrate the main issues and problematics arising when considering the influence of ergonomics and weight-support of the instrument on the psycho-physical functioning and on the artistic result.

Content of Presentation: Twelve Accordion students have drastically decreased their back and shoulders problem, and have gained general coordination and improved their artistic potential thanks to some practical Alexander Technique lessons applied to accordion playing and by changing the straps system. The authors of this paper have experimented a progressive and dynamic approach to accordion playing that takes into account learning movement patterns at the base of instrument holding, rhythmical exercises as bases for studying and interpretation strategies that keep the unity of body and mind as guideline throughout practice and performance.

Conclusions and Practical Relevance: The students were successfully re-addressed for a new system of straps to support the weight of the instrument and for a new approach in daily practice and performance. The result was positive and all the musicians have continued practicing and performing with much better results thanks to the new straps and learning method.
Fit to Play: Mind-body Integration Program for Collegiate Musicians

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Stephanie Carey, PhD, Research Professor, Department of Mechanical Engineering, University of South Florida, Tampa, Florida; Matthew Lazinski, PT, DPT, OCS, Assistant Clinical Professor, School of Physical Therapy & Rehabilitation Sciences, University of South Florida, Tampa, Florida, USA

Background: Music performance demands high level of physical/mental fitness. College musicians were found to be average or below average of the general population in their cardiovascular fitness and the target BMI and less aware of their body posture/tension than their musical awareness.2 (41)

Purpose(s)/Aim(s): We examined the effectiveness of a program designed to improve physical/mental fitness of collegiate musicians. (15)

Methods: Students were given yoga, physical, and mental training to develop integrated body-mind fitness skills. Yoga sessions included breathing (pranayama), poses (asanas), and meditation-relaxation-mindfulness training. Physical exercises were tailored to improve posture, aerobic conditioning, and upper-body strength. Mental exercises included imagery skills, mental rehearsal, zooming in-out, and in the moment training, and free improvisation. Students took pre-post Injury Susceptibility Quiz (MASIQ) and a survey instrument to measure effectiveness of the program.4 Posture, strength and endurance were tested before and after the program. Individual motion captures were analyzed to detect changes in movement and posture. (93)

Results: Among twenty students (2013-2016), eleven were female, nine male; thirteen graduate students, one freshmen, two juniors, and four seniors. MAISQ results improved from 8 to 6 (susceptibility threshold-10). Pain-injury report did not change, the most prevalent being neck, shoulder, wrist, hand, and fingers. Practice warm up stayed the same, while warm down increased from zero to five. Awareness of posture and tension changed noticeably (scale of 1 to 5), 3.2 to 3.9 and 2.95 to 3.6, respectively; comfort with posture increased from 3.3 to 4 and flexibility from 3.3 to 3.85. Musical awareness of tone and flow were noticeably improved, 3.8 to 4.4 and 3.9 to 4.2. Most salient change about improvisation was comfort with “my sound” and “environment,” 3.08 to 3.72 and 3.41 to 4, respectively.

Deep neck flexor strength increased from 24.8 seconds at initial testing to 37.6 seconds in post testing (p=.003). Scapular strength increased in 44/77 (57%) of muscles that tested as weak in initial testing. There were no noticeable overall changes in preferred resting head posture, a retracted forward head position, nor the aerobic endurance of the 3 minute YMCA step test. (187)

Conclusions and Practical Relevance: College musicians’ mind-body integration program demonstrates effectiveness in improving physical/mental fitness for college musicians. (14)
Key References:


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Health and Gender in Young Music Students - Music Teachers’ Experiences

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Background: Making music can increase well-being, creativity and joy (1, 2). Despite positive health aspects of creating music, musicians often develop playing-related health problems. Music teachers are important role models for music students, they both educate and inspire music students (3).

Purpose(s)/Aim(s): To explore music teachers’ experiences of playing-related health among young music students, from a gender perspective

Methods: A purposive sample was chosen according to gender, age, teaching experiences, music instruments and genres. Semi-structured interviews with eighteen music teachers, eleven women and seven men were carried out. The interview guide concerned experiences of health issues from learning music, among the music teachers themselves and among music students. Qualitative content analysis was used for the analysis (4).

Results: The analysis resulted in an overarching theme: “Supporting students’ personal growth through music making” and four categories: “Music making to feel good”, “Pressure on girls and acceptance for boys”, “Painful injuries” and “Blame on the individual”. Positive health aspects were perceived as central with focus on the joy and well-being that music created. The most important mandate as music teacher was to help students develop themselves as individuals. Making music was an important source of well-being for the teachers themselves and they expressed that it was a means for the students to find their identity. They experienced that students, most often girls, had muscle pain that the music teachers needed to deal with. The music teachers assumed that an injured musician was one who practise too much, too intense, in a static position or simply the wrong way. They perceived that injured musicians had used bad or wrong playing technique and had too much muscle tension. The female music teachers perceived a difference between girls and boys in that it was accepted for boys to be something of a music nerd, focusing on their instrument and performing less in other school subjects. The girls were expected to be ambitious in all school subjects, including their instrument, aiming at high grades.

Conclusions and Practical Relevance: Health promotion may be helpful to prevent ill-health among young musicians. Physiotherapists may together with music teachers develop health promotion courses for young music students.

Key References:  
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Notes
Therapists on Tour

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Background: In North American ballet companies 67-95% of dancers are injured per year. Touring companies may experience even higher rates as chronic injuries become acute with time on tour. By providing direct therapeutic services to dancers, costs due to injuries are greatly reduced.

Purpose(s)/Aim(s): To describe the effects of supportive and injury prevention practices to a Classical Ballet Company touring 29 of 38 contract weeks. This study also aimed at describing the additional stresses and coping strategies the dancers experienced on tour.

Methods: One member of the company's Health and Wellness team solicited volunteer therapists to come to the theatre for 1.5 hours service before each performance. There was a follow-up with the providing therapists and they completed when appropriate injury surveillance forms, according to the Dance USA Task Force on Dancer Wellness protocol. IRB consent was obtained at two separate institutions. Consenting dancers completed a 12-item survey at the end of both 2014/15 and 2015/16 seasons. The survey was developed by the authors to ascertain the effects of the intervention and what stresses and coping strategies the dancers experienced on tour.

Results: During the 2014/15 season, volunteer therapists were at the theatre for 75% of the 51 major stage productions. Out of the 14-21 company members, 12 completed the survey and 91.7% of them used the services. For the second half of the season, one level 1 injury and injuries for 1000 hrs of exposure were at 0.03. In the 2015/16 season, event coverage was at 100% and 17 out of 18-24 dancers completed the survey. Services were used by 88.2%. Seven level 1 injuries were observed and injuries for 1000 hrs of exposure were at 0.23. For both years, the majority of surveyed dancers wished for the program to continue and preferred therapists who had previous experience with dancers. Additional stresses reported were riding in vans, altitude changes, colds and flu, poor floors and nutritional concerns.

Conclusions and Practical Relevance: The survey of the dancers indicated they were satisfied with the program and wanted it to continue. Practically, this is a simple cost saving intervention for smaller touring companies and most rewarding for the therapists involved.

Key References: Tour, touring, stresses, injury, injuries, therapy, therapist

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Using Surgery Prevalence to Determine the Need for Post-operative Return to Dance Guidelines

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**Background:** Post-operative return to sport guidelines help rehabilitation professionals determine plans of care and set realistic return to activity timeframes. However, post-operative return to sport criteria have not been validated in dancers. Understanding dance injury prevalence helps determine injury burden and the need for return to dance guideline development.

**Purpose(s)/Aim(s):** The purpose/aim of this presentation is to increase awareness of post-operative dance injury prevalence presenting to physical rehabilitation (PT) and to identify body regions for which post-operative return to dance criteria are most needed. A secondary aim is to determine if these body regions are similar across dance affiliation groups.

**Approach of Presentation:** Data from retrospective chart reviews of dancers presenting to outpatient PT post-operatively over 5-years will demonstrate injury/surgery burden in dance affiliation groups. This will illustrate body regions for which post-operative return to dance guidelines are most needed.

**Content of Presentation:** Over 5 years, 43 dancers presented for post-operative outpatient PT, all after lower extremity surgeries. Overall proportions of foot/ankle and knee surgeries were nearly identical at about 35% each. About 23% of episodes were at the hip, and 7% were at the shin. Shin surgeries only occurred in collegiate dancers (n=3) and consisted of fasciotomies and compartment releases. No professionals had hip surgeries. Professionals had significantly more post-operative ankle episodes (80%) than collegiate dancers (0%, p=0.02). About 80% of teachers’ surgeries were at the knee and hip. Overall, only 3 of 15 knee surgeries addressed the ACL. About 26% of ankle surgeries were for os trigonum removal.

**Conclusions and Practical Relevance:** Nearly all post-operative PT in dancers is after lower extremity surgeries. Ankle surgeries appear to be more prevalent in professional dancers, whereas shin surgeries are most common in collegiate dancers. Only 6.9% of all episodes addressed the ACL, indicating a low incidence of ACL tears in dancers. However, 2/3 of knee surgeries involved meniscal repairs or meniscectomies, so it is important to understand the impact of dance activities on the menisci. Post-operative return to dance guidelines, especially at the ankle for professionals, at the shin and knee for collegiate dancers, and at the knee and hip for dance teachers, should be developed and validated in the future.

**Key References:**


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Positive Effects of Platelet Rich Plasma Injections: Case Study of 50% Achilles Rupture

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Background: Dancers are constantly placing excessive loads through their joints leading to increased strain on the muscles, tendons and ligaments. Due to the constant strain repeated micro trauma is a constant. At the beginning of a dance career the body is able to adapt and tolerate the continued stress but as the dancer ages these micro traumas can lead to larger tears. When a large enough tear occurs in the Achilles tendon the choice in the past was either surgical repair with a 9-12 month recovery time or the end of a career. With the advances in medicine today we are finding the benefits of Platelet Rich Plasma (PRP) injections to promote healing and return the dancer to performance sooner.

This case study describes a 39-year-old professional female dancer, who was diagnosed with a 50% longitudinal tear of the Achilles tendon. The dancer chose a less-invasive approach that used two rounds of PRP injections over surgical repair.

Purpose(s)/Aim(s): The purpose/aim of this study was to use PRP as a less-invasive approach to treating a partial tendon ruptures and try to return the dancer to performance faster.

Methods: The first PRP injection was completed after six weeks of immobilization. One month later the dancer began a graded progression back to dance. Two months after the injection the patient faced increased difficulty when jumps against gravity were added. A second round of PRP was completed three-months after the first. The patient began therapy three days after injection, which included exercises to increase vascularization of the lower leg. At three weeks the dancer was able to return to rehearsals in sneakers. A Pilates based jumping program was incorporated six weeks after the injection and pointe progression at seven weeks.

Results: MRI and ultrasound images taken throughout the process showed positive healing and healthy tissue recovery. Six months after the initial injury the dancer was back to full performance, as compared to the 9 months that it would have taken with a surgical approach.

Conclusions and Practical Relevance: PRP may represent a less-invasive approach to treating partial tendon ruptures and return the dancer to performance faster.
Plantar Plate Disruption of the Second Metatarsophalangeal Joint in a Professional Modern Dancer: A Case Study

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Background: Professional ballet and modern dancers spend an inordinate amount of time on demi pointe (rising onto their forefeet), placing excessive force on the metatarsophalangeal joints (MTPJ) and putting them at risk of instability. Surgical treatment of plantar plate disruption in the second MTPJ is well described in the literature. However, studies describing conservative management in dance populations are lacking.

Purpose: The purpose of this presentation is to describe successful management of plantar plate disruption and consequent 2nd MTPJ instability in a professional dancer

Approach: We present the presentation, conservative treatment and outcomes through a case study format.

Content of Presentation: A 33-year-old dancer presented with insidious onset of medial arch and second and third MTPJ pain. Functional deficits included the inability to walk barefoot, perform demi relevé, or balance in demi pointe. Orthopaedic examination found a positive drawer sign with 50% subluxation of the second MTPJ. Imaging studies revealed osteoarthritis of the first MTPJ, second MTPJ calcification, capsulitis, and plantar plate rupture leading to a diagnosis of instability. The dancer underwent a treatment program that included taping, padding, physical therapy, a series of prolotherapy injections, and activity modification. The dancer was seen for 37 physical therapy sessions over a 16-week rehabilitation period.

At the time of discharge, the patient had returned to full duty and performed all choreography with taping and padding. Repeated single-leg jumps and turns on the right foot, however, still caused discomfort. At her 6-month follow-up, the dancer's total Dance Functional Outcome Survey (DFOS) score had improved from 11% to 90%, and her Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36) physical scores improved from 24 to 47. One year after discharge, the dancer reported pain-free dancing with no taping or padding.

Conclusions and Practical Relevance: This case describes the conservative management and outcome of a professional modern dancer diagnosed with second MTPJ instability. Early diagnosis, coupled with, a multimodal treatment approach effectively resolved symptoms and returned this professional dancer to full-performance capacity.

Key References:


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Premature Growth Plate Closure in a Young Ballet Dancer on Pointe

Selina Shah, MD, FACP, Center for Sports Medicine, St. Francis Memorial Hospital a member of Dignity Health, Walnut Creek, CA

Background: I am a sports medicine physician and treat dancers in my clinic. This is the first known case of premature growth plate closure associated with dancing on pointe.

Purpose(s)/Aim(s): Educate the audience that premature growth plate closure can occur from dancing on pointe.

Approach of Presentation: Case Presentation using Power Pointe.

Content of Presentation: I will present the case and discuss premature growth plate closure.

Conclusions and Practical Relevance: Premature growth plate closure is rare due to pointe, but something to be aware of. It would be helpful to create a collaborate with others who may have seen this to possibly document frequency of occurrence.

Premature growth plate closure can occur in gymnasts resulting in a shortened radius, also known as positive ulnar variance. In gymnastics, this closure is a result of repetitive weight-bearing on the hands, which is otherwise unnatural. Early growth plate has not been reported in the literature in dancers who go en-pointe.

The author will present a case of premature growth plate closure of a unilateral second metatarsal leading to a shortened second ray. The dancer began dancing en pointe at the age if ten and presented to the clinic two years later with an asymptomatic, shortened second ray. The dancer did not have Freiberg’s disease. Similar to gymnastics, this growth plate closure is likely a result of “unnatural” weight bearing on the tips of the toes.

Premature growth plate closure may be occurring more frequently in dancers but is under-reported in the literature. The consequences of premature closure may or may not have clinical significance depending on the bones involved.

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**Depth Jumps for Dancers: Why, How and When?**

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**Background:** The performance in dance requires the ability to jump high and land safely. To improve the height of the jump and accomplish the set of enormous complex jumps that are part of the choreographic repertoire, dancers need strength, power and coordination. Dance training alone is insufficient to improve strength, power, and jumping ability in intermediate and advanced dancers. For who makes about 200 jumps per class body weight itself is not enough for an improvement. Sports and dance literature suggested that plyometrics training had a large effect on improving the ability to jump. Depth jumps is in the top of plyometrics exercises relatively to intensity. The use of boxes creates the problem of determining the optimal height of fall to obtain a positive effect in the transition from eccentric to concentric phases. On the other hand, jumping is associated with a large number of dance injuries, so we have to discuss the safety precautions on this type of training.

**Purpose:** Demonstrate why dancers need an additional workout that includes plyometrics training and depth jumps, how to assess the optimal drop height, when to start or increase the height of the boxes, and alert to the safety conditions in which they must be performed.

**Approach:** It will be presented the results of five years of implementation of a regular training program (1-2 days/week, with 48/72 hours rest) of depth jumps with about 50 professional and pre-professional dancers. Through videos, testimonies and quantitative data we will show the individualization of training (assess of ideal height of boxes, using the Chronojump), the training specificity (specific jumps: soubressant, échappé, assemblée, grand jeté, sissonne, etc.) and the variables associated with safety precautions.

**Conclusions:** Based on the findings, it was concluded that plyometrics training programs with depth jumping can be safe, effective and highly recommended for dancers if appropriately supervised and sensibly progressed. Sports literature recommended height that varies from 41 to 107, and can even reach 120 cm. These values appear to us completely exaggerated to dance needs. With values below 40 cm it is possible to obtain excellent results, and the risk of injury are obviously smaller.

**Key References:**

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Notes
Under-Investigated Performer Populations: Fertile Ground for the Arts-Medicine Researcher

William J. Dawson, M.D., Glenview, Illinois, USA

Background: As the specialty of performing arts medicine has progressed and matured, the breadth and scope of its publications has changed; this was documented in two prior quinquennial reviews and a historical review, all published in MPPA. From personal practice experience through early basic research to multitudes of articles on neurobiology, publications have increased numerically, but with accompanying decrease in epidemiologic and outcome studies. Recent emphasis has also been on studying additional performer populations.

Purpose: To determine if any groups of performers have been underrepresented in the research literature. Such populations would be likely candidates for focused epidemiologic and clinical research, especially on performance-related disorders.

Methods: PAMA’s bibliography from 2006 through 2014 was searched for journal articles that investigated performer populations having heavy performance schedules. By their nature, these groups would be likely to develop performance-related problems.

Results: Two such underrepresented musician populations were identified.
(1) Military musicians. Only 8 references were found, 7 in English, 3 foreign. This relatively large group (more than 6,500), has extensive performance and travel schedules resulting in long work hours. Musicians are highly trained and play in multiple ensembles; most play multiple instruments. They can be followed easily; all have health care and medical records are available.
(2) Free-lance musicians playing for opera, ballet, musical shows, circus, weddings, etc. This is an extremely large and varied population, although it is difficult to obtain accurate figures. There is a similar dearth of research studies for this group (87/7,923 total publications). These musicians have a wide variety of training experiences and play multiple types of musical gigs. Even with busy performance schedules, many must have “day jobs” to cover expenses. Free-lancers have a broad spectrum of medical and health insurance plans; many lack insurance altogether.

Relevance: These two populations are vastly different in character, but both appear to be understudied. Each presents its own problems in gathering and evaluating data, challenging to the researcher but potentially a source of important information for those who treat them.

References:
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Frequency, Severity and Predictors of Playing-Related Musculoskeletal Pain in Professional Orchestral Musicians in Germany

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Background: Playing-related musculoskeletal disorders (PRMD) in professional musicians are common. Existing literature demonstrates that up to 86% of musicians are affected.

Purpose(s)/Aim(s): The purpose of this study was to evaluate the frequency of musculoskeletal pain in professional orchestral musicians with regard to their instrument affiliation. Of special interest were pain intensity and its association with predictors such as gender, instrument group, age or stage fright.

Methods: Professional orchestra players completed a self-report questionnaire to assess playing-related musculoskeletal pain and its frequency and intensity in various body regions on a Numeric Rating Scale (NRS). Relative frequencies and prevalence ratios for different instrument groups were estimated.

Results: Out of 720 approached musicians, 408 were included in the sample (response rate 57%); overall, 89.5% had been affected by current or past playing-related musculoskeletal pain, 62.7% reported pain in the previous three months, and 8.6% reported current pain. Pain distribution and frequency varied between instrument groups. For all instrument groups the neck was the most common pain region. About 43% of musicians presented more than five pain regions, in particular violin players. Approximately 40% of musicians indicated frequent or permanent pain. Average pain intensities increased from NRS 3.8 up to a range of 5.9 and 7.4 for frequent and permanent pain, respectively. Female gender and stage fright were proven to be predictors for musculoskeletal pain.

Conclusions and Practical Relevance: Professional orchestral musicians are greatly affected by PRMD, often experiencing frequent or permanent pain, high pain levels and pain in various body regions. As PRMD might contribute considerably to performance disability, sick leave and the possibility of premature termination of a musicians’ career, this study highlights the necessity for tailored therapeutic and preventive strategies in performing arts medicine.

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Vocal Fold Hemorrhage: Incidence, Risk Factors, Recurrence and Long-term Outcomes

Lucian Sulica, MD - The Sean Parker Institute for the Voice, Weill Cornell Medical College

**Background:** Vocal fold hemorrhage (VFH) is an acute phonotraumatic injury occurring predominantly in performers, and frequently regarded as a threat to voice by both patients and physicians, largely in the absence of evidence.

**Purpose(s)/Aim(s):** We aim to characterize vocal fold hemorrhage with respect to risk factors associated with incidence of VFH, factors predicting recurrence after initial VFH, and long-term outcomes in order to establish counseling and treatment recommendations.

**Methods:** Patients who were vocal performers presenting for care during a 24-month period were analyzed to determine incidence of VFH. Demographic and occupational information and examination findings (presence, location, character and size of varices; presence of mucosal lesions or paresis) were analyzed to determine predictors of hemorrhage. Cases of VFH were reviewed to determine rates of recurrence, in relation to demographic and occupational information and examination findings. Patients who experienced VFH were contacted by telephone to complete a follow-up survey, consisting of the Voice Handicap Index -10 (VHI-10), Singing Voice Handicap Index -10 (SVHI-10) where applicable, and a condition-specific questionnaire to assess long-term effects of VFH on occupation and vocal function.

**Results:** In a study of 499 subjects, incidence of VFH was 1.08 cases/1000 person-months. Patients with varix (112; 22.4%) were more likely to develop VFH than those without, with incidence of VFH at 3.3 cases/1000 person-months, compared to those without varix at 0.5 cases/1000 person-months. The Cox Proportional Hazard Regression model found that patients with varix had a hazard ratio of 10.1 compared to the non-varix group, and in 12 months 2.7% of patients with varices experienced VFH, compared to 0.8% of those without varices. In 47 subjects who experienced VFH, recurrence rates were 26% overall. Varix as the only statistically significant predictor of recurrence; 47.8% of patients with varix experienced recurrence (p=0.0089) with an odds ratio estimate of 21.09. However, recurrent VFH did not adversely affect patients’ self-ratings of voice quality on followup, as shown on VHI-10 and SVHI-10 scores. Responses on the condition-specific questionnaire showed agreement/high agreement with statements related to positive vocal function characteristics and disagreement/strong disagreement with statements related to negative vocal function characteristics.

**Conclusions and Practical Relevance:** Patients with vocal fold varices should be counseled that while the presence of varices increases the risk of hemorrhage, the effect is slight (3 of 112 patients with varices at 12 months; 2.68% vs 3 of 387 patients without varices; 0.775%). The overall incidence of hemorrhage is low (6 of 499; 1.2%), therefore, preventive ablation or excision of varices may not be warranted. However, patients with varices and history of hemorrhage are markedly more likely to experience recurrence (47.8% with varices vs 4.2% without varices). Based on this information, surgical intervention is recommended in this subset, particularly in patients with heavy vocal demand. Patients should be reassured in any case that VFH does not appear to result in long-term voice handicap or limitation in a performance career; the hiatus from performance necessary for VFH resolution appears to be its principal impact.
Physical Condition and Musculoskeletal Disorders among String Players in Montreal

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Background: Understand the context in which musicians work and live in, specifically related to their physical condition, their lifestyle habits and their age, as well as the posture, muscle fatigue and common musculoskeletal troubles of string musicians.

Purpose(s)/Aim(s): Assess the relationship between the physical condition and the musculoskeletal disorders in string players.

Methods: Thirty-one string players from professional and amateur orchestras (conservatories and universities) voluntarily participated in this study, by answering a questionnaire that assessed their practice habits, their physical condition, their lifestyle habits and their musculoskeletal disorders.

Results: Amongst the questioned musicians, 90% indicated that they had at least one physical problem in the past year (pain (38%), movement impairment (30%), numbness (16%)). An elevated number of practice hours is linked to an increase in injuries (low correlation : R=0.365, p=0.0215). The length of unease increases when the number of reported musculoskeletal disorders increases (low correlation: R=0.421, p=0.009). The reported intake of fruits and vegetables is inversely proportional to the number of reported injuries (R=0.420, p=0.0095, R=-0.374, p=0.019). Those without any physical problems also had a higher vegetable intake (average 21+- 18.5 vs 10.3 +-4.5, p=0.011) as well as a higher frequency and intensity of physical activity compared to musicians presenting physical issues (p=0.011). There is a significant difference in weekly vegetable intake when comparing physically active musicians vs inactive ones (average 13.5 +-7.82 vs 7.5 +-3.56, p=0.025). Warm up habits are also more present for physically active musicians (60% vs 18%, p=0.025). The three musicians that did not report any musculoskeletal disorders in the last twelve months were physically active (not a significant difference).

Conclusions and Practical Relevance: The majority of musicians reported a musculoskeletal disorder in the last twelve months. In this study, the problem is related to the weekly number of practice hours. The level of physical activity, as well as fruit and vegetable intake in musicians is a subject that should be covered in a future study, with a higher sample of participants.

Key References: injuries, musculoskeletal disorders, physical condition, physical activity, musician.

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Adverse Childhood Experiences and Healing Through Attachment

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Background: There has been increasing recognition of the lasting impact on individuals' physical and mental health of what Drs. Anda and Felitti termed Adverse Childhood Experiences (ACE). Based on a large sample of Kaiser Permanente members at primary care visits, these researchers concluded that there is a direct relationship between the number of ACE reported and the incidence of negative health outcome. That these findings are relevant for performers is self-evident and was further highlighted by Bellis et al (2012) in their retrospective study of pop stars mortality and its association with ACE.

Shifting from population statistics to clinical application, the impact of childhood trauma in adulthood is seen in the lasting effects it has on one's capacity to think clearly, to self-regulate emotion, and to develop authentic connections with others. As clinical psychology has been increasingly informed by neuroscience, the crucial role of attachment and parental attunement in the emotional life of the child is clear. Children who grow up with "insecure attachments" remain vulnerable rather than resilient. The psychotherapeutic treatment of early trauma significantly focuses on the establishing of what has been termed an "earned secure attachment" between the client and the therapist over time.

Purpose(s): to increase awareness of the ACE research and it's importance; to describe types of attachment; and to illustrate the potential efficacy of psychotherapy in healing the attachment ruptures and resulting consequences so often seen in individuals impacted by ACE.

Approach: A 15 minute Power Point presentation (with Q and A after as time allows).

Content: The ACE questionnaire will be presented with findings on health outcomes with an illustration of how the ACE questionnaire has been used with musicians. Types of attachment will be described. Lastly, a briefcase study of a musician with a history of multiple ACE indicators and adult addiction will be summarized.

Practical Relevance: PAMA members will increase their awareness of the ACE information and the usefulness of psychotherapeutic interventions to support their practices as well as to better ascertain when psychotherapeutic support is warranted.

References:

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Ambition, Competition, and Envy: Enemies or Allies?

Jeanne Even, LCSW, IPTAR, New York, NY, USA

Background: Former professional dancer; Psychoanalyst in private practice who works with professional dancers, musicians, and actors.

Purpose(s)/Aim(s): The purpose of this presentation is to define ambition, competition, and envy; describe their psychological manifestations among aspiring and professional dancers; enumerate their potentially harmful consequences; and present strategies for managing these emotions in a constructive way.

Approach of Presentation: Oral Presentation

Content of Presentation: Working psychoanalytic definitions of ambition, competition, and envy; theoretical and clinical examples of dancers’ experiences; an explanation of mentalization and reflective thinking as positive strategies.

Conclusions and Practical Relevance: Ambition, competition and envy are inescapable realities for all performers which can insidiously impact and distract from their professional and personal lives in a harmful way. However, techniques such as mentalization and reflective thinking can enable a performer to harness these emotions in a way that can enhance his or her artistic creativity and professional success.

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Background: Student and professional musicians practice highly complex actions for many hours daily with the goal of performing at a high level of competency under the constant scrutiny of teachers, peers and audiences. These physical and psychological demands make musicians highly vulnerable to injuries, with 84% of Australian professional orchestra musicians report suffering performance-related injuries, and up to 67% of Australian school-aged children playing music. Quantitative Performance Measurement Technology can be utilized to study mechanisms underpinning performance-related injuries, leading to more accurate diagnosis and targeted rehabilitation strategies. By identifying muscle activity characteristics during movements involved in musical performance, reduction of risk factors for playing-related pain conditions can be achieved.

Purpose(s)/Aim(s): The purpose of this workshop is to describe and demonstrate how Quantitative Performance Measurement Technology can be used in clinical, research, and educational settings.

Approach of Presentation: Technological advances incorporating wireless technology to allow synchronized capture of muscle activity and 3D motion with audio and video information during musical performance will be described and demonstrated. Muscle activity analysis in time and frequency domain and 3D motion analysis of a live musical performance will be explained during the demonstration.

Content of Presentation: Surface Electromyography (sEMG) allows the measurement of muscular load and patterns of muscle activity, detected from nerve impulses travelling through muscles during their activation. These measurement tools can be used to evaluate: normal and abnormal muscle activation patterns; causes of muscle overload sustained in work-related musculoskeletal disorders; the characteristics of fatigue-related changes in muscle activity; and the impact of stress and environmental conditions on the muscular activity patterns. In the clinical setting it can be also used as a biofeedback device, where information on the computer screen can be used by the performer to alter their movements and levels of muscle activity during real music performance demands. Recent technological advances have dramatically improved diagnostic accuracy and efficiency in clinical research and educational applications.

Conclusions and Practical Relevance: Participants in this workshop will be introduced to Quantitative Performance Measurement Technology and explore the practical application of these methods in their own scope of practice.
Conditioning for Upper Extremity Use in Dancers

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Background: Traditionally, dance technique class provided a thorough preparation for dancers to execute and perform movements that emphasize the lower extremities and the spine in terms of flexibility, strength, and power. In more recent years, choreography has expanded to include movement material that is placing increasing demands on the upper extremities. Dancers are expected to have levels of strength and endurance that allow for extreme work in weightbearing on the arms, aerial work, partnering for both women and men as lifters, as well as extreme range of motion in the shoulder joints and thoracic spine. Additionally, in order to accommodate these additional demands on the upper extremities, dancers must place more emphasis on developing core support and trunk stabilization. In response, many dancers have begun including various forms of supplementary training, such as traditional weights, yoga, and more recent systems involving a wide variety of apparatus.

Purpose(s)/Aim(s): The purpose of this presentation is to provide a movement session looking at means of increasing range of motion and strength in the upper extremities, as well as the necessary core support, without the use of additional apparatus.

Approach of Presentation: Movement session

Content of Presentation: The movement session will begin with a gentle warmup followed by exercises that target the upper extremities. Both mobilization (flexibility) and strength will be addressed. Core support and trunk stabilization work will be included throughout the session.

Conclusions and Practical Relevance: The session will include practical recommendations for implementing supplementary training for upper extremity work in the context of preparing dancers for today's choreography.

Key References:


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Is Health Promotion Among Musicians in Tune with the Evidence? Literature Review and Future Directions (‘Better Practice’)

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Background: The physical and psychological demands of the training and practice that musicians must achieve to perform to a high standard can produce deleterious effects on health and wellbeing, arising from musculoskeletal and neurological causes. The available evidence on promoting musicians’ health has been reviewed. Musical Impact, an AHRC-funded research project involving all nine UK conservatoires (2013-2017) seeks to enhance the health and wellbeing of musicians in Britain. Better Practice, one of three sub-projects, asks 1) What can be learned from existing approaches to promoting musicians' health? 2) How can such approaches be adapted, applied and evaluated across educational and professional contexts in the UK and internationally?

Purpose(s)/Aim(s): To examine existing a) interventions aimed at reducing performance-related musculoskeletal disorders among adult musicians, b) interventions aimed at reducing music performance anxiety among non-adult music students, and c) health promotion courses among music students

Methods: Given the complexity and context specificity of the interventions and programmes, a realist synthesis approach was applied. Databases were searched for interventions targeting musculoskeletal issues, music performance anxiety and health promotion courses among non-adult and adult musicians. Published and unpublished, full-text, quantitative and qualitative studies in English were included. Quality and validity are being enhanced by continuous discussion among the reviewers.

Results: Few taught courses on health and wellbeing have been evaluated systematically. One study, using pre-post, longitudinal testing of one programme in Germany, reported a stabilising effect on psychological health, but no effect on physical symptoms. Purpose-designed interventions based on endurance exercises reduced levels of perceived exertion, pain and fatigue. Programmes based on cognitive behavioural therapy elements and yoga showed reduced anxiety levels. Current approaches vary widely and present substantial methodological flaws.

Conclusions and Practical Relevance: This project could inform new evidence-based pathways for promoting health, behaviour change and managing ill-health in musicians.

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Vocal Health Protocols at Undergraduate Liberal Arts Music Programs

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Background: The university voice student, like the collegiate athlete, requires specific institutional procedures and protocols regarding the maintenance of vocal health and treatment of voice injury. While there are a handful of organizations that provide basic vocal health guidelines for institutions, many schools have not developed a concrete vocal health protocol that provides the appropriate proactive strategies and reactive responses required of an undergraduate music program. Data collected from the pilot study suggests a need for standardized and individualized vocal health protocols at NASM accredited institutions in the northeast.

Purpose(s)/Aim(s): The purpose of this study was to determine the current availability of proactive strategies and reactive responses at music departments at undergraduate liberal arts music programs in the United States with the intention to guide future recommendations and suggestions for proactive and reactive protocol development at Bucknell University.

Methods: In November 2015, a survey was sent to a total of 194 voice faculty at music departments of institutions similar to Bucknell University based on the Carnegie Classification of Baccalaureate Colleges-Arts & Sciences.” Participants were asked to report (1) institutional demographics (2) experiences with student voice injury, (3) proactive strategies and reactive responses utilized at their institution, and (4) any specific vocal health resources and strategies for establishing partnerships with vocal health professionals.

Results: Thirty-one faculty (75.61%) of the 41 participants reported they have experienced at least one student with a vocal injury, and out of those 31 faculty, 20 faculty (64.52%) reported that the injury made it difficult for the student/students to complete major requirements. The most common proactive strategy was “Sharing Vocal Health Knowledge in the Studio,” and the most common reactive responses were “Adjusted Repertoire,” and “Medical Attention.” “Mental Health Attention.” All other vocal health strategies were shared by fewer than half of the participants.

Conclusions and Practical Relevance: This data suggests a need for a formalized institution-specific protocol that outlines both proactive strategies and reactive responses. The results of this study have informed the development of a proposal for a Wellness Initiative Protocol for the voice area of the Bucknell University music department. The proposal includes specific formalized proactive strategies required of all voice students, reactive responses to be utilized as needed, as well as vocal health additional resources.

Key References:

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The Health of Instrumental and Vocal Music Teachers

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N.B.: Significant portions of this submission have been removed for brevity.

Introduction: Performance-related problems (PRPs) such as performance-related musculoskeletal disorders (PRMDs), music performance anxiety (MPA) and hearing impairments are prevalent amongst performing musicians (Ginsborg, Spahn & Williamson, 2012; Help Musicians UK, Health and Wellness Survey, 2014; Ranelli, Straker & Smith, 2011). PRPs can affect musicians’ physical, emotional, social and financial well-being (Guptill, 2011; Schoeb & Zosso, 2012) but most are preventable if appropriate education and support are available (Chan & Ackermann, 2014; Winspur & Warrington, 2010). Treatment strategies may be able to return musicians to near or fully functional capacity, but there are implications in terms of distress, loss of income, and cessation of musical activities. This has led to the suggestion that the best form of treatment is prevention, or as Manchester (2006) quipped “a sixteenth note of prevention is worth a whole note of cure” (p.1). Da Costa and Vieira (2010) suggested that health promotion programs should mitigate risk factors by calling on the expertise of qualified professionals and the educated opinion of stakeholders in the target environment. Instrumental and vocal teachers are central stakeholders in music education and play a role in primary and secondary prevention of PRPs: for these reasons researchers have advocated the need to involve teachers in health promotion (e.g. Britsch, 2005; Chong & Chesky, 2001; Guptill & Zaza, 2010; Ranelli et al., 2011). Goodson stated that “in understanding something so intensely personal as teaching, it is critical we know about the person the teacher is” (1981, p.69). Having nominated teachers as health promotion advocates it is crucial for Performing Arts Medicine specialists to seek to ‘know’ teachers including exploration of teachers’ personal health and how health experiences may influence their attitudes and actions.

Three early American studies estimated the prevalence of playing-related injuries (PRI) amongst music teachers from 29% to 59% (Brandfonbrener, 1989/90; Barrowcliffe, 1999; Quarrier, 1995). In a sample of piano teachers 55% had sought advice for a musculoskeletal problem that affected their ability to play (Redmond & Tiernan, 2001). More recent research reported a high prevalence of musculoskeletal discomfort amongst Swedish teachers: 77% of 47 teachers had experienced a PRMD during the preceding 12 months (Edling & Fjellman-Wiklund, 2009) and 82% of 208 teachers had experienced discomfort during the preceding 12 months (Fjellman-Wiklund et al., 2003). Hearing studies have focused on the sound exposure of conductors of student ensembles (Cutietta et al., 1994; Zivkovic & Pityn, 2004); in this research teachers’ activities exposed them to sound levels that exceeded the legal limit for the music industry. Two studies have tested hearing loss in USA high school band directors using audiograms (Cutietta et al., 1994; Pisano, 2007); results suggest that hearing problems may be more severe for musicians and more likely to be noise-induced. Only two studies have focused on MPA amongst teachers (Kirchner, 2002; Wesner, Noyes & Davis, 1990); these studies were conducted in America with small samples of musicians working in higher education. Unpublished research by Tim Patston (cited in Patston, 2014) suggests that about a third of those who discontinue their performing career due to debilitating MPA go on to
become educators. Conditions that are mainly physical by nature (e.g. PRMD and NIHL) affect emotional, psychological and social well-being and conditions that are perceived as emotional, psychological or sociological (e.g. MPA) influence physical well-being (Guptill, 2011; Kenny & Ackermann, 2013; Wristen & Fountain, 2013; Zaza, Charles, Muszynski, 1998). Research has not investigated the physical, psychological and hearing health of a large sample of teachers to investigate the co-morbidity of PRPs.

**Aim of the Research:** Instrumental and vocal teachers in the UK have not been the focus of research relating to PRPs. A large-scale online survey was designed to address four main research aims: results relating to the second research aim ‘Investigate the extent to which UK instrumental and vocal teachers experience performance-related problems’ will be summarised in this report.

**Conclusion:** The majority of respondents who have experienced PS have sought and received advice or treatment, primarily from a qualified healthcare professional. Efforts have been made over the past couple of decades to educate musicians about musculoskeletal health and provide appropriate support; it appears that some of these efforts have been successful. Conversely, although fewer respondents have experienced MPA, the proportion of those who have received advice or treatment for MPA symptoms is much lower than for PS; either support for MPA is not yet available, teachers are not aware of the support that is available, or they are reluctant to access support. Less than 30% of those who think advice or treatment for hearing impairments would be relevant to them have accessed support. This research only asked teachers to comment on advice for hearing problems if they have experienced issues already, future research should ask teachers to report whether they have received advice regardless of whether they have already experienced symptoms. The significant association between report of MPA and report of PS or hearing impairments within this sample suggests that MPA may occur co-morbidly with those conditions. To the researcher’s knowledge this is the first research project designed to investigate the health of UK instrumental and vocal teachers: the results indicate that further research is warranted. In addition to investigating teachers’ health for their own benefit it is also vital that research is carried out to assess the extent to which music teachers’ personal experiences are influencing their health-related behaviour and attitudes.

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The Effect of an Educational and Prevention Course for University Music Students on Their Body Awareness and Attitude Towards Health and Prevention

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Background: Studies show high cumulative prevalence of musculoskeletal disorders among musicians, both professional musicians and music students. Increased emphasis is therefore on studying the effectiveness of educational and prevention courses in music schools and how health promotion might impact the high prevalence of musculoskeletal disorders in musicians.

Purpose(s)/Aim(s): The purpose of this study was to investigate the effects of the participation of music students in an educational and prevention course, specially designed for music students, on body awareness and their attitude toward health and prevention strategies. This was the first time that a specific health promotion course was taught and developed by a physical therapist at the Iceland Academy of the Arts.

Methods: A prospective descriptive comparative study. Twenty-three music students participated in the study. Thirteen students in a prevention education group (PG), that participated in the course and ten students in a control group (CG). The structure of the course included both lectures and practical work and was taught once a week, throughout the academic year 2014/15. The participants answered a questionnaire, before and after the course, about the prevalence of regular physical activity, doing warm-up exercises prior to musical activities, engaging in health-promoting activities and subjective body awareness during musical performance in different situations and during activities of daily living (ADL).

Results: Over the study period the PG group increased, while the CG lessened, the amount of warming up prior to music performance. Thereby a statistically significant group difference was found after the course \( p=0.036 \). Significant interactions were seen for group and subjective body awareness scores during practice \( p=0.026 \) and during ADL \( p=0.004 \) where the PG group had significantly higher scores after participating in the course.

Conclusions and Practical Relevance: The results indicate that participating in a prevention and educational course may benefit music students through improved subjective body awareness and attitude toward prevention strategies. The results also show that health promotion can be important in reducing risk factors for musculoskeletal disorders in musicians. More studies are needed to investigate the long term effect of such an intervention on the incidence of musicians’ injuries.

Key References:

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S.W.A.N.I.--A Novel Approach to Preventing Overuse Musculoskeletal Injuries among Middle School Orchestra Students

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Background: There is a paucity of research that investigates the impact of overuse injuries in the instrumental musician. The literature that is available suggests that the instrumentalist has the potential to sustain the same types of trauma as the elite athlete given the nature of the body mechanics and prolonged duration that is required to play an instrument at a high level. The general consensus among researchers is that prevention is the most effective means of mitigating the risk of playing-related musculoskeletal pain in the instrumentalist. However, we are not aware of any formal and widely-recognized protocols that are unique to instrumentalists. Furthermore, we believe that the preventative strategies must be implemented in the pediatric population prior to the development of habitually poor body mechanics in the more mature musician.

Purpose(s)/Aim(s): To educate both young instrumentalists and music instructors about the importance of developing good playing habits and provide easy-to-perform strategies to dramatically reduce the risk of injury in the adolescent instrumentalist.

Approach of Presentation: We will discuss the significance of pain in the performer, highlight common postural pitfalls while playing, and provide information regarding a unique method of minimizing pain and improving posture in the middle school-aged instrumentalist.

Content of Presentation: The term S.W.A.N.I. is an acronym which stands for "Shoulders, Wrists, Arms, Neck, and Instrument". It is a comprehensive and quick daily stretching program that is not only effective in minimizing overuse injuries but enjoyable to perform for the young instrumentalist. These two factors are key as they in combination can improve compliance with the protocol in this particular demographic. It is designed to prepare the muscles of the upper limb and cervicothoracic spine for the rigors of playing a musical instrument. It is also designed to reinforce proper instrument-specific playing posture to decrease associated somatic discomfort.

Conclusions and Practical Relevance: We believe that regular stretching and continued awareness of body mechanics while playing musical instruments can minimize the risk of repetitive overuse musculoskeletal injuries. The S.W.A.N.I. stretching protocol has been been developed to help facilitate proper playing in the young instrumentalist.

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Lecture of Music Physiology at the University of Applied Sciences Osnabrueck, Germany

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Background: It is unquestioned that instrumentalists and singers have a high demand in performing their artistic activity. Even in basic education at a young age incriminating factors such as poor posture, stress or wrong exercise management may contribute to develop playing-related musculoskeletal disorders (PRMD). The University of Applied Sciences Osnabrueck offers a lecture in music physiology specially developed for music students. This lecture thematically includes neuromusculoskeletal strain of musicians, consequences on the body or performance capability and effective treatment approaches. In addition to sensitizing their own body this lecture targeting to convey the prospective music educationalists a basic knowledge of music physiology, which can be used in their function as a teacher. The music students constitute an important multiplier for music physiology.

Purpose(s)/Aim(s): The purpose/aim of this presentation is to illustrate the lecture "music physiology" for music students at the University of Applied Sciences Osnabrueck as an impartation example of physiological and health-related musicians specific contents.

Approach of Presentation: This work will be an oral presentation. Thereby examples from the lectures are used to illustrate the learning objectives.

Content of Presentation: It is presented the concept of the lecture and the main topics. The three pillars "theory", "practice for instrumentalists" and "practice for singers" are illustrated in their structure.

Conclusions and Practical Relevance: It has been shown that music students are receptive to physiological and health-related topics. The theory-practice transfer within this lecture illustrates the students own musculoskeletal deficits and contributes to their awareness. Students´ feedback indicates that these prospective music educationalists want to incorporate the issue of musicians´ health in their own activities as a teacher.

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Notes
Injury Rate, Risk, and Affected Body Part Among Elite Collegiate vs Professional Dancers

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**Background:** Researchers examining student youth and professional adult dancers have found that 67-90% of dancers experience musculoskeletal problems. Collegiate dancers fall between these groups and are not as frequently tracked for injury occurrence. Collegiate dancers are expected to be older, more physically mature, have more exposures, and have higher intensity exposures than youth dancers. While these differences more closely resemble professionals, injury occurrence among collegiate dancers might still differ from professionals due to the effects of experience - that is, professionals may be more pre-disposed to injury due to previous injuries and years of intense work. Injury site for collegiate dancers might more closely resemble those of youth as dancers are known to physically mature at later ages than the general population, and injury site is sometimes related to growth.

**Purpose(s)/Aim(s):** to examine differences in risk and rates of injury between professional and collegiate dancers.

**Methods:** 238 dancers (21.51±5.3 yrs, 69 males, 169 females) from four professional dance companies and one collegiate dance major participated in the International Performing Arts Injury Reporting System (IPAIRS); 92 were professional (26.6±4.8 yrs, 41 male, 51 female), 89 were collegiate (18.33±0.9 yrs, 21 male, 68 female). Injury diagnosis was obtained by clinician. Data was collected over two years.

**Results:** Professional dancers experienced 28 injuries, a risk of 26.0%, and a rate of 1.09 per 1000 exposures. Collegiate dancers experienced 20 injuries, a risk of 14.6%, and a rate of 3.1 per 1000 exposures. Professionals were primarily injured at foot/ankle 14(50.0%) and leg 6(21.4%) while collegiate dancers were primarily injured at foot/ankle and head each with 5(25%) and trunk/back 4(20%). Statistically, this sample of collegiate dancers were more likely to experience head injuries, and professional dancers more likely to experience leg injuries ($\chi^2(8,N=48)=15.503, p=0.05$).

**Conclusions and Practical Relevance:** Over the course of two years, collegiate dancers experienced a higher rate of injury than professional dancers. Both groups experienced foot/ankle injuries most frequently, supporting previous research. However, rates differed by anatomic sites, specifically head and leg. This analysis was a first step in an ongoing line of research; future research should include an exploration of the relationship between physical/emotional maturity and injury risk.
Pre-Professional and Professional Dancers' Experiences with Perfectionism in the Dance Environment

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Background: Within the dance perfectionism literature, perfectionism has been explored in relation to disordered eating attitudes and behaviours (Penniment & Egan, 2012; Thomas, Keel & Heatherton, 2005), stress and injury (Krasnow, Mainwaring & Kerr, 1999) and performance (Nordin-Bates, Cumming, Aways, & Sharp, 2011). While these studies provide a framework for understanding the dance environment, there remains a need for directed qualitative research to explore perfectionism from the perspective of the high-performance dancer. More research is required to determine a) whether dancers view themselves as perfectionists, b) if perfectionism affects the social dynamics of the dance environment, and c) the relationship between perfectionism and response to injury.

Purpose(s)/Aim(s): To explore perfectionism in the dance environment through the subjective, lived experiences of high performance dancers.

Methods: Eight currently active pre-professional and professional female dancers participated in the study, aged 19 to 41 years old. The primary investigator conducted individual, semi-structured interviews. Interview questions were developed using the multidimensional perfectionism perspective of Hewitt and Flett (1991) as the guiding theoretical framework. Thus, questions regarding perfectionism probed for both self-oriented and socially-driven perfectionistic standards or expectations. Interviews were transcribed verbatim and coded for salient themes.

Results: Dancers expressed perfectionistic expectations of themselves, towards others, from others and from the dance culture. Relationships among a dancer, the audience, the choreographer and other dancers were reported to facilitate or detract from the idea of a perfect performance. Performance and artistry considerations were described as creating unique perfectionistic demands on dancers; however, dancers suggested that they may demonstrate perfectionistic behaviours despite believing that perfection may not be attainable. A 'culture of tolerance' (Mainwaring, Krasnow & Kerr, 2001) is evident via responses to injury management and performing through pain.

Conclusions and Practical Relevance: These findings highlight how dancers experience perfectionism in the dance environment. Perfectionism in dance manifests through aesthetic, artistic and performance-related demands on the dancer. In turn, these perfectionistic demands lead to positive and/or negative outcomes on the well-being and success of the dancer. A greater understanding of perfectionism in dance is needed to lessen the detrimental effects of negative or maladaptive perfectionism in dancers' lives.

Key References (optional):


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Risk of Depression with Chronic vs. Acute Dance Injuries

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Background: Injury and musculoskeletal complaint occurrence are often associated with emotional sequelae such as depression. Dancers - injured and uninjured - self-report higher depression and distress scores than the average population. Researchers have found that the majority of dance injuries/complaints are chronic or slow-onset in nature as opposed to traumatic, and that injured dancers tend to become more depressed the more time they spend away from dance; however, the relationship between injury/complaint type and risk for depression has not, to our knowledge, been previously examined in the dance population.

Purpose(s)/Aim(s): To determine the correlation between risk for depression and injury/musculoskeletal complaint type, and to examine if self-reported history of, or current, depression and PHQ-2 responses were correlated.

Methods: 295 subjects (28.7±12.4 yoa; 53 men, 239 women) who presented to orthopedic dance clinic for initial evaluation completed the PHQ-2 depression screening tool as part of the International Performing Arts Injury Reporting System (IPAIRS) medical questionnaire prior to evaluation.

Results: Subjects presented with 57(19.3%) traumatic and 238(80.7%) slow-onset/chronic injuries/complaints, and demonstrated an overall average PHQ-2 score of 0.84±1.3, indicating no need to further screen for depression. Additionally, 264(89.5%) subjects scored 0-2 for the PHQ-2, indicating no need to further test for depression, whereas 31(10.5%) scored 3-6 for the PHQ-2, suggesting need to further test for depression. A Pearson’s chi-square test was used to examine whether injury/complaint type was independent of no risk (0-2) or at risk (3-6) PHQ-2 score groupings, revealing that PHQ-2 score grouping was independent of injury/complaint type ($\chi^2(1,N=295)<0, p=0.996$). Additionally, PHQ-2 score grouping was independent of self-reported current depression ($\chi^2(1,N=29)=2.833, p=0.092$) but was not independent of self-reported history of depression ($\chi^2(1,N=295)=25.718, p<0.001$).

Conclusions and Practical Relevance: There is no statistical evidence to suggest a relationship between dance injury/complaint type and risk of depression using the PHQ-2 instrument. However, risk of depression classification was correlated with self-reported history of depression, indicating that acknowledgement of past depression influences current emotional state. Emotional wellbeing has been shown to play a role in the psychological as well as physical health of dancers and response to injury; further research is recommended in this domain in order that our society optimize prevention efforts.
Elite Dancers and Cross-Training: The Relationship Between Self-Reported Pre-Season Cross-training and Both Seasonal Injuries and Perception of Fatigue

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Background: Professional dance is a physically demanding task comparable to conventional sports. However, researchers suggest that dancers do not possess the same fitness levels as athletes. Athletes commonly train during the off-season to improve their fitness parameters and prepare for the coming season. Fatigue has been implicated as a major factor in injury occurrence among athletes and dancers. If dancers cross-train, they may be able to increase their resistance to fatigue and stave off injuries.

Purpose(s)/Aim(s): to investigate the relationship between pre-season self-reported cross-training activity and both injury occurrence and perceived fatigue at the time of injury onset.

Methods: 166 subjects (22.6 ± 5.4 years; 56 men, 110 women) from 4 professional dance companies and one pre-professional collegiate dance major program participated in a pre-season screening that included self-report questions about pre-season cross-training activity. The screening was part of the International Performing Arts Injury Reporting System (IPAIRS), which included injury tracking by clinician and post-injury interview.

Results: Forty-two subjects (25.3%) experienced a total of 53 time-loss injuries. Sixty nine of all subjects (41.6%) reported that they did not cross-train while 97 (58.4%) reported that they did cross-train. Reported participation in cross-training was independent of injury occurrence ($\chi^2(1,N=166)=0.028, p=0.868$) and of perceived fatigue at the time of injury onset ($\chi^2(1,N=51)=2.789, p=0.095$). Dancers who reported cross-training engaged in aerobic, anaerobic, and mixed modalities. Reported modality was independent of reported subjective sense of fatigue at time of injury ($\chi^2(1,N=51)=3.826, p=0.281$). However, dancers who cross-trained for greater than 30 minutes per bout were more likely to recall feeling fatigue at injury onset ($\chi^2(1,N=51)=9.177, p=0.002$).

Conclusions and Practical Relevance: Half of the dancers reported engaging in cross-training outside of dance, and cross-training bout duration appears to be associated with perceived fatigue at the time of injury onset. Further investigation is required to better understand how cross-training for durations greater than 30 minutes might influence perception of fatigue such as by studying in more detail the overall work volume of dancers who participate in cross-training, or other factors.
Injury Rate among Dancers on Cruise Ships

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N.B.: Significant portions of this submission have been removed for brevity.

INTRODUCTION

Entertainment on cruise ships has undergone a transformation from a small scale of cabaret to full-length musicals as they aim to attract and encourage people to experience new ways to spend their holidays on luxurious ships. Production shows on cruise ships range enormously from full-length musicals, revue production shows, aerial vignette, cabaret, and more, which demands the dancers in the production cast to be multi-disciplined. The predominance of high injury rates among dancers has been established from previous studies in the past two decades. In 2013, Russell stated that although many studies have conducted investigations on injury prevalence among dancers, ballet has received the greatest focus in scientific research, followed by break dance and then modern/contemporary dance. Other dance genres have comparatively received less research consideration.

There is a need for standardized methods of injury reporting in the dance science community to more effectively compare injury prevalence and reduce injury has been frequently noted. In 2004, the International Association of Dance Medicine and Science (IADMS) launched the Standard Measures Consensus Initiative (SMCI) to develop evidence-based recommendations for the standardization of testing and reporting methods. SMCI has reviewed, evaluated, and recommended that the best practice definition in dance medicine and science would be consistent with those that been used for The National Collegiate Athletic Association’s Injury Surveillance System (ISS) over the past 30 years. ISS defined the term “injury” refers to an anatomic tissue-level impairment as diagnosed by a licensed health care practitioner that results in full-time loss of activity for one or more days beyond the day of onset. Musculoskeletal complaints do not rise the level of a reportable injury event within the surveillance system (p. 144). In 2007, Hodgson, Gissane, Gabbett and King reviewed the existing literature on team sports and proposed the argument that although a narrow injury definition has been suggested because of its inferred reliability. Athletes will challenge the healing process by participating with injuries, and this is a confounder that must be considered in all data collection. The injury definition used in the two nation-wide surveys in the United Kingdom, Fit to Dance, did not limit the definition of injuries to those that were only diagnosed by a licensed health care practitioner, which was recommended by SMCI. The injury definition of the two Fit to Dance surveys consisted with the concept of an all-encompassing injury data collection proposed by Hodgson et al. Considering the novel nature of this current study and the aim is to evaluate the injury prevalence to present a comprehensive picture among dancers on cruise ships. Therefore, the definition of the injury in this current study would be based on the one from Fit to Dance 2 survey with small modification.

A contract on a cruise ship for a dancer is approximately six to nine months long, which constitutes the rehearsals to learn the shows, installations (e.g., familiarization of the stage and set, adding the elements of lighting, costumes and wigs), and performances. Sophisticated technical stage
equipment, elaborate costumes, dancing on high heels, aerial rigging, living and performing on a moving vessel, and the lack of immediate specialized medical support at Sea make dancers on cruise ships more susceptible to injuries. A publication from International Maritime Health also reported that dancers seem to be the most accident-prone work group on cruise ships with higher rates of serious injuries than both the hotel crew and marine crew. Dancers also tend to report only accidents that will stop them from performing. Therefore, the aim of this current study is to evaluate the prevalence of physical injury among dancers on cruise ships during the three different periods of a contract by investigating the possible risk factors, and identifying what preventative measures could be established.

CONCLUSION
The importance of injury epidemiology study in dance science has been noted. Several studies had focused specifically on different dance genres and provided valued injury-related information. The results of this current study seemed to be consistent with the findings from previous studies and showed that dancers performing on cruise ships had high injury incidences with the lower extremity as the most commonly injured anatomical location. One statistically significant difference was found that female respondents had a larger average numbers of ankle injuries than male respondents after opening the shows. Fatigue and overwork were the most perceived causes of injury. Respondents of this current study were more likely to take their own preventative steps when they suspected an injury and reported only the injuries that would stop them from performing. These findings offer only an overall understand of the prevalence on physical injuries in this particular population. Future studies including exploring the influences of psychological factors, in-depth injury history, and effect of dancing in high heels for a prolonged time will help to create a better understanding of the injury prevalence. This may provide beneficial information to assist developing and enhancing a comprehensive management program to reduce cost and time-loss of injury incidences. The author hopes that this study will offer the insight of this unique population and generate interest for further research to promote the well-being of performers on cruise ships.
Prevalence of Homohysteria in Dance

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Background: There are few major publications which address issues of Sexual Orientation and Gender Identity (SOGI) within the dance community. Although there is evidence of the growing acceptance of homosexuals and non-gender conforming individuals within the United States (US) sports community, there is no current reputable evidence or documentation of this acceptance within the dance community.

Purpose(s)/Aim(s): To address the issue of SOGI within the dance community in order to determine the current social climate of today’s sexual minorities and gender non-conforming youth and establish areas of necessary research in order to inform performers, teachers, and parents of ways to support these individuals.

Approach of Presentation: A systematic review of current research and publications on SOGI within the dance community in comparison to the sports community in order to illustrate the necessary advancements needed within the dance community.

Content of Presentation: Comparing the limited amount of research and publications that address SOGI within the dance community to the more up-to-date research of SOGI within US sports, analysis shows that US sports has increased its acceptance of LGBT identities. As cultural homophobia diminishes within the US, this frees heterosexual athletes to act in gender non-conforming ways without threat to their heterosexual identity decreasing homohysteria, a term used to describe one’s fear of being thought homosexual because of behavior considered gender atypical. With the decrease in homohysteria, homophobia, the chief policing mechanism for heterosexuality, has been shown to diminish within US sports. There is no viable evidence that indicates the current state of homohysteria within the dance community. Given wider access to information and positive media images, anecdotal data suggests that national LGBT adolescents are coming out at younger ages than previous generations. Research contrarily shows that LGBT individuals are at an increased risk of bullying and victimization by peers and adults including teachers, coaches, and family members, and that victimization is associated with an increased risk of depression and suicide.

Conclusions and Practical Relevance: Due to the unknown state of homohysteria within dance, and because victimized LGBT youth are at increased risk of victimization, support for SOGI minorities within the dance community is crucial in the enjoyment of dance for everyone.

Key References:

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Notes
Influence of Task Variables on Execution Variability in Violin Bowing

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Background: Upper extremity musculoskeletal disorders are common among stringed musical instrument players, such as violinists. Musical task demands may conflict with mechanical bow-violin workspace constraints, constituting an under-recognized risk factor for injury. Performance conditions requiring highly constrained bow handling, for example, could result in relatively invariant patterns of loading of articular and/or musculotendinous limb structures, thus exposing them to undue cumulative stress. However, it remains unknown whether such performance conditions are indeed associated with globally reduced variability of limb motion in highly skilled violinists.

Purpose(s)/Aim(s): To test the hypothesis that highly constrained bowing tasks are associated with reduced movement variability in the performer’s bowing limb.

Methods: Expert violinists performed bowing tasks that differed, across trial conditions, in requested stroke loudness and duration (independent variables) in a factorial design. These manipulations of task variables generated conditions that varied in degree of error tolerance at the level of the bow-violin workspace. We obtained bowing arm, bow and violin kinematics via 3D motion capture; we also obtained bow-on-string force data via a force-sensor-augmented bow. Combining the limb kinematic data with the bow force data, we carried out an inverse dynamic analysis of moments (i.e. rotational forces) at the shoulder, elbow and wrist. We hypothesized that both torque and kinematic variance would decrease during bow strokes under conditions of low error tolerance, reflecting a general tightening of control across the limb.

Results: Our results do not support the notion that variability in execution at the level of either bowing arm or bow-violin is large in easier tasks but restricted in more difficult, constrained tasks. Rather, analysis with respect to task conditions reveals complex, joint-specific relationships between bowing arm moment variability and the bow-on-string kinetic and kinematic workspace variables that chiefly determine the volume and timbre of the violin sound. On the whole, variability at both bow and limb levels remains low as tone duration and loudness vary.
Conclusions and Practical Relevance: Experienced violinists may maintain low variability of execution relative to bow-string tolerance for such variability. Our findings should raise considerations for injury prevention and/or return to playing.

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Augmented Reality: Using Motion Sensing Technology to Teach Action in Violin Playing

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**Background:** Playing the violin involves the learning of difficult motor skills and the coordination and mastery of complex motion patterns. Inadequate mastery of these can lead to poor musical performance and, in the worst case, injuries. Recent advances in motion sensing technology such as the Kinect sensor by Microsoft may provide opportunities for musicians and violin students to improve their craft and reduce the threat of injury. A key component to psychomotor learning involves the use of practice to master a particular skill. Many successful artists have had their practice constantly supervised by their teacher or an assistant to the teacher. This is not possible for all students and it is suggested that the use of motion sensing technology may be an alternative or complementary tool to improve learning outcomes of violinists and reduce the rates of injuries to upper string players.

**Purpose(s)/Aim(s):** To provide some preliminary findings on an exploratory study where an intervention using software that employed the Kinect sensor was used to enhance the learning of beginning violin students. The presentation hopes to inform teachers and performers about ways that interactive technology can be used to improve the motion profiles used when performing a musical instrument.

**Approach of Presentation:** Results from an explorative feasibility study using the Kinect sensor will be presented.

**Content of Presentation:** Thirteen students ranging in age from 6 to 13 years undertook a two stage study involving the use of software and a kinect sensor during their practice and lessons over a period of 8 weeks. The first stage involved a four week period of recorded practice and lessons with no interactive feedback. The second stage involved the use of an interactive game that monitored and gave real time feedback about 6 key playing movements as well as pitch accuracy and amplitude of sound. Corelations between the use of the game and improvement were positive and participants found this means of communicating about playing movements helpful.

**Conclusions and Practical Relevance:** Athletes have utilised motion sensing technology to improve the movements that are used in their sports so therefore it seems logical that musicians should also be employing these methods to enhance the way they move. This study shows that not only is this possible but accelerated development of learning may be possible with this approach.

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Evaluation of the Perception of the Subjective Visual Vertical (SVV) and the Comfort in Two Types of Seats for Instrumentalists

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Background: Instrumentalists spend many hours sitting, therefore we consider that the posture induced by the type of seat used can have an influence on the perception of the subjective visual vertical (SVV) and on the comfort.

Purpose(s)/Aim(s): The aim of this study is to describe the modification in the perception of the SVV and the comfort of musicians when being sat in two different types of seats.

Methods: 40 volunteering musicians (20 men and 20 women) between the age of 13 and 70 sat for two minutes in each of the seats, named 1 and 2 randomly. The first was a stool for pianists and the second, a special type of ergonomic chair. Then, we carried out the measurement of the SVV and the comfort experienced for both seats. The comfort was measured with a visual analogue scale (VAS), 0 being the lowest level of comfort and 10 the maximum level of comfort. SVV was measured using the bucket test, taking two consecutive measurements and using the average for the statistical calculations.

Results: Seat 2 obtained better results in SVV and in comfort. There is a statistically significant relation between the curvature of the verticality (of 90 degrees) of seat 1 in relation to seat 2. Seat 2 presents a lower gradient of curvature (average of 0.95°) than seat 1 (average 1.51°) (p< 0,0009). Seat 2 presents more comfort (average of 7.69 out of 10) than seat 1 (average of 6.35 out of ten).(p< 0,0009)

Conclusions and Practical Relevance: Seat 2 encourages the improvement of the SVV and the comfort of the instrumentalist.

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Playing Related Musculoskeletal Disorders (PRMD) Exposure Investigating
Anthropometrics through Biomechanics and Gender

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Background: Research with respect to pianists has focused on classical execution, injury or pedagogy. A direct correlation between hand anthropometrics and factors associated with Playing Related Musculoskeletal Disorders (PRMDs) symptoms has been reported without incorporating motion capture and statistical analysis of non-classical pianist with respect to gender.

Purpose(s)/Aim(s): To investigate how hand and wrist anthropometrics directly correlate with gender and exposure to factors directly related to PRMDs.

Methods: 38 male and 22 female self-identified non-classical pianists participated in 5-5 minute personally (test 1 and 5) and research selected song with varying tempos (test 2-4). Wrist width and hand length of the right and left hand was correlated with the wrist angle and angular velocity measured through motion capture. The musicians were separated into four anthropometric categories (<25, 26-50, 51-74, >76) based on wrist and hand lengths.

Results: The preliminary findings show that male participants within the 50 percentile range experienced the most Angle vs Angular Velocity activity with the left hand. Also, the smallest average wrist angle and the highest wrist angular velocity was recorded in all five tests. There was a significant difference (<0.05) in Angular Velocity in Test 3 (60 beats per minute - bpm) and Test 4 (120 bpm) in the subject and side comparisons. Additionally, hand and wrist comparisons with respect to Angular Velocity was also significant (<0.05) in Test 3 and Test 4. The highest wrist angles were recorded within the <29 and 51- 75 percentile ranges. In comparison, the lowest wrist angels were prevalent at 26-50 and >76 percentile within the hand length ranges. Female participants had a significant difference between both hands with respect to wrist angle (<0.05) for Test 2 (80 bpm). When comparing wrist angles and angular velocities across all tests, the mean angle increased over time with the left and right wrist. Female participants with the <25 percentile wrist width experienced played farther from the 0° over time for all anthropometric hand length groups except <25% in the right hand.

Conclusions and Practical Relevance: We look to provide an initial framework for assessment and pedagogical adjustments for all musicians who may have a hand and wrist anthropometric imbalance which may increase the exposure to factors leading to PRMDs.

Key References: Biomechanics, anthropometrics, gender, Non-classical pianists, motion analysis

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Hand Span, Upper Extremity Pain and Muscle Activation in Pianists

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Background: Playing-related upper extremity pain (PRUEP) is reported frequently by pianists. One variable that may relate to this is the size of the hand compared to the size of a pianist’s keyboard. In addition, pianists with small hands may require greater activation of the muscles in the forearm and hand while playing than pianists with larger hands. This may lead to comparatively earlier fatigue and result in playing-related pain.

Purpose(s)/Aim(s): To determine the prevalence of and contributors to PRUEP in a sample of skilled pianists and to determine if there are correlations among hand size, keyboard size, hand pain, and muscle activation.

Methods: An online survey was sent to potential pianist participants. Questions asked about years of experience, playing time, keyboard size, number of breaks taken while playing, utilization of a warm-up or cool-down protocol, and PRUEP factors such as frequency, location, and severity of pain. Respondents were asked to measure their 5-finger and 4-finger hand spans using a ruler. Lastly, the short form Disabilities of Arm, Shoulder, and Hand (QuickDASH) was administered. A second group of respondents are being recruited for the electromyography (EMG) portion of the study to determine if pianists with small hands exhibit greater muscle activation while playing a piano piece compared to pianists with large hands.

Results: Forty-three individuals completed the survey fully and correctly (11M, 30F, 2NA; mean age=52±14.8; mean piano experience=46±15.2 yr). All respondents played on full size keyboards. PRUEP was reported by 88%. Mean 4 finger span=16.0±2.3 cm (6.3 in); mean 5 finger hand span=20.7±2.2 cm (8.1 in). Mean QuickDASH score was 9.8±11.0; mean of the performing arts QuickDASH module was 15.1±22.1. There were no significant correlations among any collected variables. However, pianists who reported 2 or more past episodes of PRUEP had significantly larger hand size in both 4 and 5 finger spans (p<0.033) versus pianists who reported 0 or 1 past episodes of PRUEP.

Conclusions and Practical Relevance: Unexpectedly, pianists with larger hands reported more past episodes of PRUEP, but other variables were not significantly correlated. Further research to understand the contributors to PRUEP is needed because pianists encounter pain and injury frequently.

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**The Do's, Don’ts, and Unexpected of a New Athletic Training Program in the Collegiate Dance Setting**

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**Background:** Currently, there are few full time athletic training positions within collegiate performing arts programs. Athletic trainers (ATs) are health care professionals who collaborate with physicians to provide services of injury prevention, emergency care, clinical diagnosis, therapeutic intervention and rehabilitation of injuries and medical conditions. ATs are commonly employed in the traditional collegiate athletic setting for athletes engaging in sports. Performing arts athletes are subject to the same physical and mental demands with the added pressure of executing their work for an academic grade. Performing artists demonstrate the same need for health care as traditional athletes.

**Purpose(s)/Aim(s):** The purpose of this presentation is to provide recommendations of how to successfully create and establish the position of an athletic trainer into a collegiate performing arts program, as well as management of challenges faced along the way. Athletic trainers will gain an understanding of the benefits of working within academia and the concept of retention.

**Approach of Presentation:** An oral presentation detailing first hand experiences will be discussed, followed by Q & A.

**Content of Presentation:** Attendees will gain an understanding of the background and the creation process of a current new athletic training position in a collegiate dance program. The do's, don’ts, and unexpected of each of the following concepts will be addressed based upon a newly created dance athletic training position: student life involvement, professional staff/faculty relationships and interactions, marketing, education, documentation, policies and procedures, communication, and mental health and wellness.

**Conclusions and Practical Relevance:** Athletic trainers are a key component to developing an advanced dance education program with comprehensive medical care for the performing artist.

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Notes
Physiology and Psychology of Keyboard Performance: A Course for College Students

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Background: I will report on a college course for pianists and organists that I taught in fall, 2015, “Physical and Psychological Aspects of Keyboard Playing. I designed and teach it every other year for one semester.

Purpose(s)/Aim(s): to show college students (undergraduates and graduate students) that by understanding physiological and psychological manifestations of anxiety in performance and by learning techniques to manage them, they can increase their confidence, success, and enjoyment of public performance.

Methods: Classes met two times each week for one hour. Lectures, discussion, videos, readings, and weekly journals were assigned. Class participation included performances that occurred after opportunities for learning and experiencing breathing techniques, progressive relaxation, visualization, mental rehearsal, memorization approaches such as mapping, Inner Game of Music applications, and mindfulness exercises. Guest lecturers included a clinical psychologist who brought equipment to demonstrate heart rate variability and breathing and taught sample exercises in progressive relaxation, a voice teacher with special breathing techniques who also had studied Mindfulness meditation with psychologist, Don Green, and an Alexander Technique teacher.

Results: All of the students kept journals and shared them with me; they wrote about nutrition and exercise choices, and their experiences after applying the techniques to their practicing and performing. (The techniques are listed in the Methods section.)

Conclusions and Practical Relevance: All the students felt they were more confident in their performances and had new tools to use to reduce stress and physical tension as they prepared in advance of their performances, just before performing, and during their performances. Awareness of the relevance of nutrition, exercise, posture, and new approaches to technique was greatly heightened. In addition to general positive comments in their final course evaluations, particular mention was made regarding breathing techniques, mapping for memorization, and Inner Game of Music applications. A one semester course for music students can help them gain awareness of how to reduce stress before and during music performance as well as to learn ways to keep their bodies healthy and their minds focused without distraction and anxiety.

Key References

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All Hands on Keys: Strategies for Teaching Piano Students of Varying Hand Sizes

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Background: As a small-handed pianist, I have spent my entire professional career seeking creative strategies for performing on standard-size keyboards. Since the life-changing moment I started practicing on an ergonomically-scaled piano keyboard (ESPK), I experienced a whole new level of artistic and technical freedom. Research related to the use of ESPKs suggests similar benefits for small-handed pianists, including less pain and injury, greater technical facility and accuracy, and ease of learning. My teaching has benefited tremendously from this insight: I am able to suggest innovative fingerings, ergonomic movements and compensatory gestures for my small-handed students. However, I realized that when teaching students with larger hands, my suggestions often betray my own small-handed bias. Using a DS Standard 5.5 ™ ("7/8") size keyboard, I investigated a diverse range of musical and technical solutions.

Purpose(s)/Aim(s): The purpose/aim of this presentation is to investigate how hand size impacts piano teachers' ability to work with students with different hand sizes than their own. Teachers develop proven strategies for learning repertoire in ways that suits their unique physiology, knowing best that which they have experienced within their own bodies. This presentation will investigate how this bias may influence pedagogical choices.

Approach of Presentation: Video/audio recorded excerpts will demonstrate how hand size impacts artistic and biomechanical choices at the piano, with a focus on pedagogical implications.

Content of Presentation: Through a comparative analysis of video/audio recorded excerpts performed on a DS Standard 5.5 ™ ("7/8") size keyboard and a conventional keyboard, this session will demonstrate effective strategies for teaching students of varying hand sizes and ways to exploit musical and technical choices that maximize artistry and biomechanical ease.

Conclusions and Practical Relevance: This presentation aims to consider how hand size impacts the ability to work with students of varying hand sizes.

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• Sakai, Naotaka (2008).
  • Yoshimura, Eri and Chesky, Kris (2009).

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Cenesthetic Relaxation in Piano Technique

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Background: This biomechanic alternative project addresses the ongoing historic problem of physical damage caused by playing the piano as of 50 years of performing, teaching and researching the phenomenon of piano technique at a national and international level.

Purpose(s)/Aim(s): To demonstrate the viability of relaxation as opposed to no relaxation or/and a relaxation and contraction. Between 65% and 80% of pianists and piano students suffer mild, serious or severe damages, often incurable, having created a public health dilemma recognized by professionals in the medical and pianistic world, regardless of the unlimited number of books and articles written on the issue. Experience has proven that the musical concern and projection, which is the primary and proper purpose for performing, and the ultimate reason for music making causes an inattentiveness of the physical mindfulness required to avoid any kind of physical effort resulting in damage.

Methods: The methodology includes the results of 50 years of specific analysis and critical study of 200 case studies (including EMG analysis) of actual situations of professionals, teachers and students with tension, and the relief experienced by them with the use of the proposed alternatives.

Results: The findings obtained with the use of the alternative proposal for the prevention of pains and strains from playing the piano is summarized in 6 Basic Principles, 12 Natural Resources (specific biomechanical concepts of brain, body, hands and finger management natural for any person), and 8 Movements that can easily be assimilated according to the demands of the repertoire.

Conclusions and Practical Relevance: The proposed systematic relaxation control has been used with students and lectured at educational centers and recognized universities for years. While being surprising successful, it has also created disconcerting questioning amongst the audience: ¿How is it that solving problems while piano playing is so simple without effort or pain? Pianists assume pain as part of the job and teachers do not know what to do and important talents abandon their vocation due to the impossibility of administrating physical difficulties inherent to the instrument. This presentation proposes different ways to avoid these common practices.

Key References: piano, technique, relaxation, hands,

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Vocal Fold Pseudocyst: Behavioral and Surgical Outcomes

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Background: Vocal fold pseudocyst, a phonotraumatic lesion seen most commonly in females and performers, are often conflated with other benign vocal fold lesions due to lack of standardized nomenclature and treatment recommendations. Through study of treatment outcomes, we can provide evidence to support treatment recommendations for this specific lesion.

Purpose(s)/Aim(s): The aims of this study are clarify treatment recommendations of pseudocyst by analyzing behavioral treatment results, predictors of surgical intervention, rates and predictors of recurrence, and degree of patient-perceived functional impairment after both treatment modalities.

Methods: Clinical records of patients with pseudocyst were reviewed for demographic information and VHI-10 score. Videostroboscopic examinations were evaluated for presence of clinical variables, including laterality, reactive lesion, paresis, varix, and hemorrhage. Patients who underwent surgery were prospectively followed for 12 months to establish the rate of lesion recurrence and predictors of recurrence, as determined by a clinical consensus cohort of 10 laryngologists, who blindly reviewed pre- and postoperative examinations. Patients completed the VHI-10 and a condition-specific questionnaire to establish degree of patient-perceived functional limitation after behavioral treatment and, when applicable, after surgery.

Results: Clinical records of 46 patients (41F:5M) with pseudocyst (40 unilateral; 6 bilateral) were reviewed. All underwent behavioral treatment (2-12 sessions; mean of 8 sessions). Seventeen (37%) eventually chose surgical intervention. No demographic or clinical variables were predictive of surgical intervention. Follow-up surveys were completed by 29 (63%) patients and 23 (79%) reported that they were not professionally limited by their voices, despite presence of pseudocyst. In prospective study of 18 surgeries on 17 patients (15F:2M) with pseudocyst, 6 (33%) experienced recurrence, per the clinical consensus cohort, all within 3-6 months. No demographic variables were predictive of lesion recurrence. No clinical variables predicted recurrence, although there was suggestion of paresis as a contributing factor. Postoperative VHI-10 scores decreased and were within normal limits for all patients, including those who experienced recurrence. Four (67%) patients who experienced recurrence returned to normal professional voice use without functional limitation, despite presence of recurrent pseudocyst. Two (33%) of patients who experienced recurrence reported continued functional impairment requiring further treatment.

Conclusions and Practical Relevance: Approximately 2/3 of patients with pseudocyst will return to professional voice demands, given behavioral management alone. The remaining patients are likely to experience continued functional limitation, leading them to seek surgical intervention. Of those who undergo surgical intervention, approximately 1/3 will experience a recurrent pseudocyst swiftly, within 6 months; however, lesion recurrence does not necessarily align with functional limitation. Demographic features and clinical variables are not predictive of decision for surgery or of lesion recurrence; however, the role of glottic insufficiency related to pseudocyst warrants further study.

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Physical and Psychological Health Profile of Music Students-a Cohort Study

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Background: Up to 80% of professional musicians suffer from playing-related health problems which start already during university training. Health problems may be both of psychological and physical origin. However, many studies are based on cross-sectional study designs and, hence, present only prevalences instead of incidences. Due to the nature of the study design data from cross sectional studies are inappropriate for assessing incidences and, as consequence, identifying risk factors for playing-related health problems is impossible.

Purpose(s)/Aim(s): To plan a prospective cohort study, in which we will follow music students during their university training and track their psychological and physical health status. The incidence of playing related health problems during their university study will be recorded. Furthermore, we seek to identify risk factors at the beginning of the music study by which playing related health problems may be predicted. Additionally, we compare their health status with those from students of the the same university from other disciplines.

Methods: Detailed measurements of physical and psychological health are undertaken. Therefore, on the one hand we use standardized questionnaires such as SF-36, SCI and KMPAI aiming to measure a person’s perceived health status, stress symptoms, stress coping strategies and performance anxiety. On the other hand we are using a battery of tests in order to assess physical abilities and functions such as coordination, flexibility, motor control and sensitivity to pressure. The data will be compared to a control group from other disciplines that are matched with respect to potential confounders such as age, gender and body composition. Measurements are taken annually. By sending out online questionnaires including few items changes of health status and new episodes of playing related health problems are tracked monthly.

Results: N/A -->study is in pilot and planning phase

Conclusions and Practical Relevance: By identifying risk factors at the beginning of their university training implications are obtained for creating specially tailored prevention and physiotherapeutic intervention programs. Additionally, students are aimed to be classified into a high and low risk profile group with respect to developing playing related health problems to whom preventive measures and physiotherapeutic interventions are administered.
Music Education and Music Therapy. Contact Surfaces and Boundaries

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**Background:** This thesis, which was released at the MDW Vienna in 2010, discusses the similarities and differences between music education and music therapy. For the first time the Austrian Music Therapy Act was used for this comparison and thereby clarity is given for all people employed in these two professional fields.

**Purpose(s)/Aim(s):** Hypothesis: There are slight, but no fundamental differences between music education and music therapy. Research questions: Which common and different aspects can be found in the legal foundations of music education and music therapy? Which role do the music education and music therapy play in the Austrian educational and social system? What similarities and differences can be found in the practice of music education and music therapy?

**Approach of Presentation:** In this presentation, first the position of both occupational areas in the Austrian education system and social education is clarified. The main chapter contains a direct comparison of different dimensions of music education and music therapy practice and its resources for health promotion and health literacy. Therefore the legal texts of the two disciplines in Austria were put next to each other and a direct comparison was made.

**Content of Presentation:**
1.) Definition of music education and music therapy on the basis of legal principles:
   - Music Therapy: The Austrian Music Therapy Act
   - Music Education: School Organisation Act, The Primary School Curriculum and the Curriculum KOMU
   - Similarities and differences
2.) A brief overview of the current education system and social education in Austria: Where are both fields classified?
3.) Comparison of the aspects of music education and music therapy in practice. Similarities and differences of the: short-term objectives, long-term goals, inner attitude of teacher personality and therapist personality, relationship design, environment, equipment and instruments and methods, materials, tools, techniques and interventions.

**Conclusions and Practical Relevance:** Music education and music therapy both aim to use the medium music to help the Austrian students or patients to develop into healthy, self-determined people.

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Notes
Tension Precursors to Focal Dystonia

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Background: Previous literature suggests that musician’s dystonia may originate from unaddressed technical difficulties that create the ground for confusion of cortical finger representation. Muscular tension can present occasionally in an uncontrolled manner and subsequently wrongly interpreted by the cortex as efficient.

Purpose(s)/Aim(s): The purpose of this study is to evaluate muscular tension of piano technique that could resemble dystonic movement. Although it is difficult to foresee any development of established dystonia, early corrective advice could also act as prevention.

Results: We will present five pianists’ case studies, two with established focal dystonia and three without, all with 'dystonic' movements. Their technique is captured with a multimodal method of MIDI, surface electromyography and video filming. A comprehensive chart illustrates their performing tasks and technical inadequacies.

Conclusions and Practical Relevance: If reversal can achieve tension relief and subsequent elimination of the involuntary movement, it may possibly guide us to early therapeutic mechanisms and avoidance of established focal dystonia. The multimodal system can be used not only for the detection of the abnormal motion but also for assisting its elimination through biofeedback. Retrospective studies could follow to look into technical issues that had remained unaddressed in subjects with established focal dystonia. This may help to delay or possibly arrest the devastating and career stopping process.

Key References:
Focal dystonia, prevention, early diagnosis, electromyography, tension, biofeedback

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Examination of the Physical Exertion of College Marching Musicians

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Background: Expended energy cost associated with marching band, to date, have been modestly studied. Empirical results vary in conclusion because of confounders such as marching style, instrument type and performance scenario (practice vs. performance).

Purpose(s)/Aim(s): The purpose of this study is to scientifically evaluate the physiological demands of performing in an elite collegiate marching band. By quantifying the physicality of marching, we can begin to develop guidelines for safe participation and injury prevention recommendations.

Methods: Undergraduate collegiate marching musicians (n = 61) from a southeastern university were recruited for the study. During band practice, heart rate monitors and the accelerometers collected data regarding: 1.) heart rate over time; 2.) number of steps taken; and 3.) instantaneous velocity (acceleration).

Results: The analysis revealed an average group heart rate was 115.75 beats per minute (sd = 3.7); brass instrumentalists having the highest (m = 116.02, sd = 3.8) and percussion the lowest (m = 115.45, sd = 1.2). For average steps taken, the group total was 676.41 (sd = 50); percussion instrumentalists having the highest (m = 987, sd = 235) and woodwind the lowest (m = 719.55, sd = 37.6). Analysis of the between-subjects revealed non-significance (p > .05) when comparing instrument sections (brass, woodwind and percussion). Indicating instrumental section had no statistical significance for how marching affects heart rate. Additional between-subjects also revealed non-significant (p > .05) among section and average MET (m = 1.77).

Conclusions and Practical Relevance: Marching band is not a qualified activity to meet the American College of Sports Medicine (NASM) recommendations for adult cardiorespiratory exercises needs. Given the average MET recorded (m = 1.7), marching is associated with very-light activity levels, akin to merely standing. Therefore, collegiate marching musicians are encouraged to pursue other means of more moderate to vigorous physical activity outside practice and performances to meet NASMs guidelines.

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Effects of Bench Height Variation on Muscle Activation in Pianists

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Background: Pianists, particularly collegiate and professional pianists, often suffer from debilitating playing-related injuries. Poor playing technique, including inefficient ergonomics, has frequently been forwarded as a cause of these injuries, though the literature lacks epidemiological studies to confirm this causation. Arts medicine literature and most piano pedagogy methods suggest that a piano bench height that produces a forearm horizontal to the floor is the preferable bench height.

Purpose(s)/Aim(s): The purpose of this study was to examine the effect of bench height variation, and its resulting effect on forearm position, on pianists’ muscle activation. Specific research questions: [1] Which position of the forearm minimizes muscle activation while playing? [2] Do pianists identify that position as their optimal playing position?

Methods: Twenty pianists (6 males, 14 females, mean age=21.8±3.3 yrs) volunteered. They reported 14.1±4.1 yrs of piano experience and practiced piano for 21.6±18.3 hours per week. The study utilized surface electromyography (sEMG), an inertial measurement unit (IMU), and video capture to quantitatively determine the effects of different bench heights on muscle activation during playing. sEMG data were collected from the right extensor carpi radialis brevis, biceps brachii, triceps brachii, and upper trapezius muscles. These were normalized to the subjects' maximum voluntary contractions. Subjects played each of three piano pieces at each of four bench heights. The IMU was affixed to the right forearm and was used to set the bench heights to attain the desired forearm angle to the horizontal. Subjects also completed a questionnaire pertaining to their experiences with the different bench heights.

Results: There were no significant differences in normalized muscle activation among the bench heights (physically expressed as forearm orientations) or the pieces played. Subjects were not able to accurately perceive differences in bench height.

Conclusions and Practical Relevance: The results suggest that no single bench height minimizes muscle activation across pianists. The lack of identifiable impact of bench height variation on muscle activation as well as the pianists’ inability to correctly identify one bench height's relationship to other bench heights suggest that pianists experience a fundamental disconnect between their perception of their playing and the physicality of their playing. Overall, forearm position relative to horizontal appears to have little impact on piano playing.

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The Role of Occupational Therapy in Performing Arts Medicine

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**Background:** Musicians have the potential for the development of musculoskeletal problems and other health related issues whether they are elite or novice performers. Occupational therapists are concerned with how individuals perform their daily occupations and how existing or potential limitations in physical conditions can impact the occupation of musical performance. In addition, many musicians experience an unrelated injury or other conditions that can then impact musical performance, as well as other daily occupations. In addition to the physical requirements necessary for playing an instrument, there are also cognitive, psychosocial and emotional issues that can impact occupational performance and rehabilitation of the musician.

**Purpose:** The purpose of this poster session to describe the role of the occupational therapy practitioner as a direct care provider, educator, and consultant in the practice areas of rehabilitation, prevention, health and wellness for all levels of performing artists, specifically musicians at the following levels: individuals, groups, and organizations. In addition, an elective course on Performing Arts Medicine for graduate occupational therapy students will be presented as an example of preparing future practitioners about this unique population and specialty area of practice.

**Approach of Presentation:** poster session.

**Content of Presentation:** The following topics will be presented: 1. The role of occupational therapy in the evaluation and treatment of musicians with existing and/or potential for injury, 2. Education of future occupational therapists about Performing Arts Medicine, and 3. Presentation of educational sessions about prevention of injury to college music majors to illustrate the role of OT in prevention, health and wellness

**Conclusions and Practical Relevance:** Occupational therapists are uniquely trained to address the myriad of issues that impact the rehabilitation and educational process for musicians. Improved participation in occupational performance in music as well as all other areas of daily living is the ultimate goal of occupational therapy intervention. It is crucial that health professionals, specifically occupational therapists, be cognizant of the unique needs of the performing artist.
Performing Science Research Lab Vienna: EMG, EDA, LIPR, CAM RESP Studies

Matthias A. Bertsch, PhD, Music University Vienna, Austria

**Background:** As one of the largest music academies in the world, the „University of Music and Performing Arts Vienna“ offers research seminars in performance science. Multiple Bachelor- and Diploma thesis have been conducted over the last two years to investigate individual questions of students.

**Purpose was** to present practical research topics conducted by students within last two years. The discussion of these pilot studies may lead to further studies and specific cooperation in ongoing research projects.

**Methods:** Multiple methods have been used, including EMG, LiPr, RESP, EMA, EDA and camera recordings.

**Results:** Study 1: Surface Electromyography and respiratory studies documenting the variation in breathing patterns of a singer a.) when performed individually in a comfort room and b.) during a concert. Key finding: The abdominal muscle activity levels and the breathing patterns changes without the awareness of the singer. Study 2: Electromagnetic articulography measurements are common in speech analysis, but a new tool for performing analysis. Key finding: Very precise data can be obtained to document the tongue activity while playing wind instruments. Study 3: LiPr is a new prototype measuring lip pressure made by Grosshauser at ETH Zurich and was tested with several trumpet players outside the lab. Key finding: While previous tools have been consisted of complex and hard and software, this new gadget delivers the amount of lip-pressure right to the smartphone and could be used in the classroom. Study 4: While we expect that music students of today have learned the "art of practicing", i.e. how to time playing tasks, do mental training, breaks or corrective exercises like stretching the reality is still often the opposite. Key finding: The analysis of recordings - made by officially mounted camera for vandalism control - shows very little time slots for body exercises and a lot of distraction and breaks using the smartphone.

**Conclusions:** The availability of different measurement tools is necessary to focus on everyday studies on playing techniques. Music performing students do benefit even through small experiments within seminars and often are inspired to get a closer look in new areas for research.

**Key References:** Motion-Emotion-Lab, EMG, Lip Pressure, practising

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Assessing the Relationship between Iliopsoas Tightness and Lumbar Spinal Alignment among Dancers

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Aurianna Lajaunie, BA, Columbia University, New York, USA; Leigh Schanfein, MS, and Marijeanne Liederbach, PhD, PT, ATC, CSCS, Harkness Center for Dance Injuries, NYU Langone Medical Center, New York, USA

Background: Dancers commonly suffer from tight and/or fatigued muscles in the pelvic region due to the specific and repetitive nature of their movement training. Some dancers, particularly ballet dancers, are known to (a) go into posterior pelvic tilt (PPT) and flatten the lumbar spine, or (b) go into anterior pelvic tilt (APT) and increase lumbar lordosis to improve hip range of motion. Both behaviors are associated with changes in sagittal plane lumbar spinal alignment and are speculated to have a relationship with increased incidence of lower back injuries. The iliopsoas muscle group has proximal attachments in the lumbar spine and interior pelvis, yet the relationships between iliopsoas tightness, pelvic tilt, and lumbar spinal alignment have not been independently considered.

Purpose(s)/Aim(s): to examine a mixed-genre cohort of dancers for observation of the relationship between iliopsoas tightness, pelvic tilt, and lumbar spinal alignment to better understand their effect on one another.

Methods: Data came from 590 participants (22.42±11.5 years; 68 males; 514 females) who completed injury prevention assessments. The majority of participants self-identified as ballet dancers (58%) followed by jazz and modern. A clinician used Thomas Test to determine hip flexor tightness, and visual assessment and palpation while the dancer stood in first position to determine pelvic tilt and sagittal plane spinal alignment.

Results: Tight iliopsoas was positively correlated with lordotic lumbar curve (LC) and negatively correlated with a normal lumbar curve (NC); non-tight iliopsoas was positively correlated with NC and negatively correlated with LC (χ²(2,N=590)=35.554,p<0.001). There were no significant interactions between iliopsoas tightness and pelvic tilt (χ²(2,N=590)=3.457,p=0.178). NC was positively correlated with neutral pelvic position (NP), and negatively correlated with APT; flattened lumbar curve was positively correlated with PPT, and negatively correlated with APT; LC was positively correlated to APT, and negatively correlated to NP (χ²(4,N=590)=69.201,p<0.001).

Conclusions and Practical Relevance: Results suggest iliopsoas tightness has greater influence on lumbar spine alignment than on pelvic tilt. This and previous research also suggest that pelvic tilt and lumbar spinal alignment are correlated regardless of iliopsoas tightness. Further research should examine the effects of psoas length/tightness on spine health.
Assessment of Energy Availability among New York City Dancers

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Susan R. Koff, EdD, New York University, New York, New York, USA

Background: Athletes require adequate energy and nutrients for optimal health and performance. Inadequate energy intake may lead to low energy availability or Relative Energy Deficiency in Sport (RED-S). RED-S occurs when an individual’s dietary intake is insufficient to support the energy expenditure required for health, function, and daily living, once the energy cost of training is taken into account. Aesthetic athletes, including dancers, must further balance energy needs with the demands to achieve an ideal physique.

Purpose(s)/Aim(s): The purpose of this cross-sectional study was to examine self-reported energy intake, physical activity patterns, body composition, and energy availability among adult dancers (n=50 [42 female, 8 male]; age = 24±5 y; body mass index [BMI] = 22.0±2.3 kg/m²; body fat = 22.5±5.6 %).

Methods: Dancers were recruited from pre-professional dance programs, universities, and dance studios. Height, weight, and BMI were determined for each participant. Body composition was measured using bioelectrical impedance assessment. Participants completed 7-day weighed food records, which were analyzed using Food Processor. Participants wore Kenz Lifecorder accelerometers during waking hours for 7-days and noted sleep time on a log. Accelerometer data were downloaded and analyzed by the Kenz Lifecorder Data Analyzer Software. Activity level ranges, expressed in metabolic equivalents (METs), differentiated between no activity (0 METs), sedentary (>0-<1 METs), light (1-3 METs), moderate (4-6 METs) and vigorous (7-9 METs) intensity. Physical inactivity (PIn) was determined by adding together the no activity and sedentary categories, then subtracting sleep time. Physical activity energy expenditure was determined using the accelerometer sensor and energy availability was calculated ([energy intake – physical activity energy expenditure]/kg lean body mass [LBM]). Descriptive statistics were computed using IBM SPSS Statistics.

Results (what data or findings you obtained): Reported total daily energy intake was 1975±518 kcal/d. The average amount of time in each intensity category was determined (sleep 490±42 min/day, PIn 588±73, light 269±64 min/day, moderate 78±29 min/day, and vigorous 9±7 min/day). Mean energy availability was 34.8±10.9 kcal/kg LBM. However, 18(36%) of the participants had an energy availability <30 kcal/kg LBM, a value associated with impaired physiological functioning.

Conclusions and Practical Relevance: More than 1/3 of the dancers exhibited low energy availability. Dancers need education on the negative outcomes of RED-S.

Key References:


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The Female Athlete Triad and Carotenoderma

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Background: The female athlete triad is a common finding in teenagers and young women who engage in intense physical activity. The triad originally was defined as functional hypothalamic amenorrhea, osteoporosis, and low energy availability with or without an underlying eating disorder. It is now accepted that there is a spectrum of the triad and not every patient fits the stereotypical criteria. Instead, patients will often present with subclinical menstrual disorders, low bone density or low trauma fractures, and without signs of overt disordered eating. Health care providers must be educated to detect the subtleties of the triad and the dancers must be better educated about peak bone mass and how to achieve health in their busy day to day lives. Assessing for eating patterns can be challenging and examining the patient's skin for carotenoderma (orange skin pigmentation) and checking a serum carotene level may provide clues to underlying disordered eating.

Purpose(s)/Aim(s): To increase awareness of the female athlete triad among dancers and health care providers with the aim to help them understand the implications of carotenoderma from overeating carotene rich vegetables which can also be associated with the female athlete triad.

Methods: A detailed case report and retrospective case study of dancers with the female athlete triad and carotenoderma will illustrate the challenges of the diagnosis and how best to approach patients with this condition.

Results: Dancers may often present with amenorrhea and fracture, but not acknowledge an underlying eating disorder. We will begin the presentation with a case study describing a 20-year-old woman who is a performing arts major and developed a metatarsal stress fracture while dancing. She has amenorrhea and denies any history of an eating disorder. Further questioning reveals that she eats a bag of sweets potatoes every week and has squash every day. On exam, she weighs 126 pounds with a height of 5’5’. Her BMI is 20.97 kg/m². She has an orange hue to her palms. Her carotene level is 590mcg/dL (normal range 60-200). We will further discuss findings of elevated carotene levels in a group of dancers and the implications for understanding and defining the female athlete triad.

Conclusions and Practical Relevance: Many dancers are not formally diagnosed with the female athlete triad until they have a career changing fracture. It is important to acknowledge that while a dancer may appear to have a weight in the acceptable BMI range, she may have restrictive eating patterns that lead her to eat an overabundance of carotene rich vegetables. These eating patterns can be associated with amenorrhea, low bone mass, and fracture.
Encouraging Dancers to Strengthen Upper Body Using Non-Weight Bearing Exercises

Nicole Hagen, BFA in Dance Performance, Chapman University, Orange, California, USA

**Background:** “Today, to meet the choreographic demands of many professional modern dance companies and college major programs, training must prepare dancers to meet the physical requirements necessary to accomplish artistic intent” (Vetter & Dorgo, 2009). It is clear that this generation of modern and contemporary dance choreographers have been expanding their movement vocabulary, expecting dancers to execute movement that requires increased strength and endurance in the upper body. However, most dancers technique classes do not provide adequate strengthening exercises that are targeting the upper body, putting dancers at a higher risk of upper body injuries. In order to reduce the risk of injury, dancers must spend time intelligently strengthening and conditioning their bodies, especially the upper extremities, outside of technique class to keep up with the demands of choreography.

**Purpose(s)/Aim(s):** The purpose of this study was to identify effective supplemental non-weight bearing upper body strengthening and conditioning exercises and its effects on a dancer’s technical aesthetic competence.

**Methods:** Through an analysis of common upper body exercises and movement requirements of contemporary dance technique a series of supplemental exercises were chosen to facilitate one collegiate dancer’s technique. Strength was tracked quantitatively through a pre and post-test in addition to photo analysis of a modern dance straight leg inversion to examine aesthetic differences before and after the study was completed.

**Results:** After any type of training regime changes in muscular strength and endurance are expected. A qualitative analysis of the pre-test and post-test aesthetics of the straight leg inversion resulted in significant improvements in the competence in the dancer.

**Conclusions and Practical Relevance:** Through improvement of strength, technical aesthetics in modern and contemporary training improved and provided greater muscular balance. These improvements in technical ability will help dancers meet the choreographic demands in today’s dance world.

**Key References:**


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Spondylolisthesis: A Dancer's Perspective on the Effectiveness of Conservative and Surgical Treatment Modalities

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**Background:** Spondylolisthesis is a spinal deformity in which a vertebrae slides forward onto the bone below it. This slippage causes instability in the spine and thus limits spinal mobility and causes pain and discomfort. This traumatic injury restricts movement and participation in dance, detrimental to the training patterns of a performing artist. Treatment methods must be sought out to rehabilitate the body back to training and performing condition.

**Purpose(s)/Aim(s):** The purpose of this presentation is to investigate a case study of a dancer with spondylolisthesis. The researcher will synthesize the effectiveness of conservative and surgical treatment methods for spondylolisthesis and lower back pain through empirical evidence and anecdotal evidence by the case study participant. The information presented will assist performing artists as they attempt injury rehabilitation; as well as educators, teachers, and parents as they consider how to best serve the needs of the injured performing artist.

**Methods:** A retrospective case study of a young adult female dancer with spondylolisthesis and the effectiveness of conservative and surgical treatment methods to lessen symptoms.

**Results:** The case study participant found the greatest amount of success through surgical intervention involving a spinal decompression and spinal fusion procedure. A combination of both conservative and surgical treatment modalities proved the most success in terms of functionality and reduced pain.

**Conclusions and Practical Relevance:** Educators, instructors, and parents must be aware of proper care for students suffering from spondylolisthesis to appropriately accommodate and address their specific needs. Performing artists should be conscious to evaluate and treat injuries; as they may develop further if neglected, and may require multiple treatment methods to obtain optimal results. A general awareness of the psychological struggles associated with physical pain and diagnosis is essential to the treatment of the holistic body.

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The Physical and Psychological Effects of Massage Therapy on Dancers

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Background: It is common to see dancers on foam rollers, balls, and other massage equipment trying to release tension and pain in their bodies. Professional athletes consistently use massage therapy as part of their pre and post performance protocols. Dancers tend to learn from each other’s techniques to use or go to see a professional massage therapist for their general treatment needs. The literature is limited on the exact techniques most effective for dancers. It is important that dancers are educated in proper techniques and the limitations of massage for increased performance.

Purpose(s)/Aim(s): to demonstrate the physical and psychological benefits and limitations of massage for dancers based on the current scientific literature available.

Methods: Through an extensive review of literature, an evaluation of the benefits and limitations of massage is presented. The examination of massage therapy is conducted through various biases, including massage therapy, sports medicine, physiological studies, anecdotal reports, and social media.

Results: An evaluation of the claims of proponents of massage therapy will be presented along with the physiological limitations of the technique. Appropriate protocols for dancers are presented, including foam roller and ball use, as well as working with a certified massage therapist. For a dancer to successfully use massage technique for pain relief or performance, they must understand when and where the technique is most successful.

Conclusions and Practical Relevance: Current research shows specific times and techniques to appropriately use massage and when it has clear benefits. There are also myths regarding the supposed benefits of massage. From this information, a plan can be put together for dancers to guide them to utilize massage to its full potential.

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How Dancers Deal with Pain: Coping Mechanisms and Tolerance

Gina Hesp, BA, Chapman University, Orange, California, USA

**Background:** In order to be a professional dancer you must endure an immense amount of training and countless hours of preparation. It is a very competitive art form, which doesn't allow much time for rest. The pressure leading up to a performance, and the physical demands put on the dancers can be grueling. Dancers tend to ignore the pain during training because they fear not being able to perform.

**Purpose(s)/Aim(s):** The purpose of this study is investigate the pain tolerance differences between dancers and non-dancers. It is also of interest to look at the research surrounding the coping mechanisms related to pain tolerance, and how this relates to the accumulated injuries they experience.

**Methods:** The coping mechanisms which dancers use include both psychological and physiological aspects, which allows them to endure the high amount of pain and muscle exhaustion they experience. These mechanisms are brought on from the cultural upbringing in a dancer’s training. Overtime this can create various acute or even chronic injuries and affect a dancer’s longevity.

**Results:** Various types of research have even found dancers to have a higher pain tolerance compared to the average physically active person. This could be due to the highly competitive nature of this art form, which causes dancers to learn certain coping mechanisms. These coping mechanisms allow them to ignore the pain they are feeling.

**Conclusions and Practical Relevance:** A better understanding of the coping mechanisms could help treatment planning, which could lower the amount of acute and chronic injuries seen in dancers today.

**Key References:**


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Notes
**Houston Methodist Hospital's Center For Performing Arts Medicine: Current Clinical Care Approaches to Injuries and Medical Conditions of the Student and Professional Artist**

Todd Frazier, Dr Richard Fish, Dr Kevin Varner, Dr Eric Haufrect, Dr Robert Jackson, Dr C Richard Stasney

Houston Methodist Hospital's Center for Performing Arts Medicine, Houston, Texas, USA

Specialists Include: Orthopedics, ENT, Ophthalmology, Internal Medicine, Obstetrics/Gynecology.

**Background:** Founded in 1996 by Dr. Richard Stasney, Houston Methodist Hospital's Center for Performing Arts Medicine (CPAM) supports the health of Houston’s arts community, the third largest home to working artists in the nation, and artists visiting from around the globe. The healthcare service is accessible through a dedicated CPAM Patient Line 713-394-6088 where a CPAM Nurse Liaison coordinates expedited patient access to a roster of over 100 CPAM physicians distinguished by their skills in issues related to the performing arts and human performance. In 2014 CPAM treated 650 artist patients.

**Purpose(s)/Aim(s):** The purpose/aim of this presentation is to emphasize CPAM physician experience and perspectives on the most current trends and treatments in the field, drawing upon research and clinical experience, and to highlight how performing arts medicine is integrated into physician practices and an academic medical institution through the structure of CPAM.

**Approach of Presentation:** This program is designed to be an integrated series of oral presentations/powerpoints delivered by key CPAM physicians (5 talks 15-20 minutes each).

**Content of Presentation:**
- Dr. Richard Fish: Eye Disease in Visual and Performing Artists- Historic Examples and Current Solutions.
- Dr. Eric Haufrect: Current Approaches/Solutions to Hormonal Challenges in Female Performers.
- Dr. Kevin Varner: The Unique and Comprehensive health care relationship between Houston Methodist Hospital and the Houston Ballet.
- Dr. Robert Jackson: Health Trends and Lessons Learned from a 10 year general health retrospective of the Houston Ballet.
- Dr. C. Richard Stasney: Wellness and Clinical Care of the Professional Voice.

**Conclusions and Practical Relevance:** Attendees should be able to articulate current wellness and clinical approaches in performing arts medicine from the physician perspective. Attendees will also be able to apply lessons and coordination structure from a successful performing arts medicine center to their own institutions.
A Comparison of How Dancers Generate Angular Impulse to Initiate Pirouette and Pique Turns of Increased Rotational Demands

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Jill L McNitt-Gray, PhD, University of Southern California, Los Angeles, California, USA

Background: Dancers must regulate reaction forces (RF) relative to the center of mass (CM) in order to generate angular impulse (AI) needed to initiate pique and pirouette turns of increased rotation. Differences in translation objectives and stance configuration during the initiation of these turns are expected to alter AI generation strategies between turn types as rotational demand increases. The large CM translation during pique turns is not desired during a pirouette. Pique turns are initiated with support from a single support leg ("push leg" (PL)) with limited double-support as the turn phase support leg ("turn leg" (TL)) makes initial ground contact. Conversely, pirouette turns are initiated with double-support with the PL posterior to the TL.

Purpose(s)/Aim(s): to compare how skilled dancers generate AI during the initiation of single and double pirouette and pique turns.

Methods: Dancers (n=10) performed single and double pique and pirouette turns with each foot supported by a forceplate (Kistler, 1200Hz). Each leg's RF and AI generation were quantified and compared between turn types using probability-based statistical methods.

Results: With increased rotational demands, net AI increased during the initiation of both turn types, however, the role of each leg to generate AI was different. During the pique turn, the PL generated the majority of the AI for both single and double turns, but as rotational demand increased, the increase in AI generated by the TL tended to exceed the increase in AI generated by the push leg (despite the relatively short duration of TL ground contact). During single and double pirouette turns, the relative contribution of each leg to net AI depended on initial stance configuration (dancers who generated more AI with the PL than with the TL positioned their CM closer to the TL). During pirouettes of increased rotation, the RF magnitude at each leg tended to increase. Conversely, during piques of increased rotation, the RF was redirected to increase AI. Subject-specific RF regulation mechanisms were identified.

Conclusions and Practical Relevance: Knowledge about how individual dancers coordinated the generation of angular impulse between both legs during pique and pirouette turns of increased rotational demands can help design training tools to improve performance.

Key References:
Professional and Student Dancers' Interest in Nutritional Counseling

Rachel Fine, MS, RD, CSSD, CDN, To The Pointe Nutrition, New York, USA
Leigh Schanfein, MS, Harkness Center for Dance Injuries, NYU Langone Medical Center, New York, USA

**Background:** Adequate nutrition is essential to the development and maintenance of optimal athletic performance. Athletes who participate in body-conscious sports, including dance, may be at higher risk for nutrition-related consequences as they attempt to maintain a lean physique. Approximately 10-12% of dancers are reported to be below ideal body weight. Evidence suggests that having a Registered Dietitian Nutritionist (RDN) within athletic institutions may result in better-informed athletes and better decision-making with regard to food choices, resulting in improved performance and reduced injury risk. However, many institutions supporting dance do not have RDNs onsite or a method of referral. Therefore, we hypothesized that both professional and student dancers will express interest in nutritional counseling.

**Purpose(s)/Aim(s):** to examine if self-reported professional-level and student-level dancers express interest in nutritional counseling and if interest differs between groups.

**Methods:** 654 dancers who self-presented to an orthopedic dance clinic or were contracted to receive onsite care participated. Subjects included 355 (54.3%) professional (30.34±10.0 years), and 299 (45.7%) student (18.29±4.3 years) dancers.

**Results:** 259 (39.6%) dancers reported interest in nutritional counseling, and 395 (60.4%) reported no interest. Among student dancers, 106 (35.5%) reported interest in nutritional counseling and 193 (64.5%) reported no interest. Among professional dancers, 153 (43.1%) reported interest in nutritional counseling and 202 (46.9%) reported no interest. A Pearson's chi-square test revealed that professional dancers were more likely to report interest in nutritional counseling than student dancers ($\chi^2 (1, N=654) =3.968, p=0.046$). While we found an age by group correlation, a subsequent post hoc analysis revealed no correlation between age and interest ($p=0.241$).

**Conclusions and Practical Relevance:** Not all dancers were interested in nutritional counseling. Professionals expressed interest more often than students, suggesting an effect of professional performance demands. Although various dance companies and schools report offering some type of nutrition-related education program for students, this not standard and typically does not involve an onsite RDN who can provide personalized nutritional counseling. Future research is necessary to identify factors affecting interest, knowledge, and awareness of nutrition-related interventions for injury prevention, and how the dancer's professional status alters this.
Implications of Popular Dieting Practices in Dancers

Shannon Sterne, MS, MA, RDN, Case Western Reserve University, Cleveland Hts, Ohio, USA

Background: Vegetarian, raw, gluten free and low-carb diets are hailed in the popular media for their health benefits, and research validates many of their common claims. Such diets have become increasingly popular and are widely accepted as alternative lifestyle choices. However, these diets can be highly restrictive introducing great potential for nutritional inadequacies. Dancers and other aesthetic athletes are at increased risk of nutritional inadequacies which might be exacerbated by the adoption of restrictive diets, and such diets may potentially mask serious eating and psychological disorders.

Purpose(s)/Aim(s): The purpose/aim of this study was to identify nutritional inadequacies in popular diets and to demonstrate the potential for associations between such restrictive diets with psychological and disordered eating patterns in dancers.

Approach to Presentation: An overview of popular claims, published research, and potential adverse effects pertaining to popular restrictive diets, and the associations between these diets and eating and psychological disorders common in dancers.

Content of Presentation: The risks and benefits of popular diet plans have been published in the literature. Nutrition professionals typically regard such diets with caution as the elimination of one or more food groups introduces high potential for nutritional inadequacies which may offset any potential benefits. Nutritional knowledge, meal planning, access to foods, and meal preparation skills are required to ensure the adequacy of any meal plan particularly diets plans that are highly restrictive. Young dancers are largely dependent upon their parents for access to foods, and dancers of all ages are challenged with shopping and meal preparation due to busy schedules. Supplementation with specific nutrients may be needed to ensure optimal performance. Female adolescents and young adults appear to be particularly drawn to vegetarian diets for personal health, weight management, ethical and environmental concerns, whereas paleo diets resonate with males hoping to build muscle mass. Relationships between restrictive eating behaviors, depression, body image disturbances and unhealthful weight control behaviors are well established in the general population and in dancers specifically.

Conclusions and Practical Relevance: Parents, teachers, dancers and clinicians should be aware of the possibility of disordered eating patterns and unwarranted weight loss that may accompany adherence to popular diet plans. Individual assessment of dietary adequacy by qualified nutrition professionals is essential.
Injury Prevention Videos Featuring a Teen Dance Company; a Collaborative Effort

Kendall Alway, BFA, DPT, Associate Director ODC Healthy Dancers’ Clinic, San Francisco, California, USA
Kimi Okada, Director ODC School, San Francisco, California, USA

Background: Many online instructive dance videos appealing to adolescents are produced without input from experienced performing arts medicine professionals. Some online videos found in our search promote dangerous techniques and behaviors. The goal of this project was to create a series of short videos focused on raising awareness of injury prevention in an adolescent dancer population using a safe, scientifically informed perspective and generating positive teen peer influence for healthy dance performance and behaviors.

Purpose: The producers of these videos aim to add to the pool of expert advice on injury prevention in a “teen friendly” student context. This presentation will be helpful both for those who may be interested in producing their own similar videos or for those who wish to use these videos as a teaching tool for their students and patients.

Approach of Presentation: Explanation of the process is alternated with showing the videos.

Content of Presentation: There are three dance injury prevention videos to share, each are between 2 and three minutes in length. The process of working with the school, members of a teen dance company, determination of content, direction and production concerns are outlined.

Conclusions and Practical Relevance: It is hoped that in creating educational videos on dance injury prevention for teens, the content of the videos will positively impact the health of adolescent dancers by teaching them about common technique errors, exercises, and positive health habits. Further, the videos could be used by dance instructors and other performing arts medicine professionals to promote healthy dance habits in their schools, and/or inspire independent production of other dance injury prevention projects.

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Notes
Injuries in Context: Impact of Touring and Performance Schedules on 1-Year Injury Rates in a Modern Dance Company

Lily Wood BS, ADAM Center; Alvin Ailey, New York, New York, USA
Shaw Bronner PT, PhD, OCS, ADAM Center; Alvin Ailey, New York, New York, USA

Background: This study augments recent analysis of injury rates over 15-yrs in a professional modern dance company. Their time-loss injuries (TL-inj) averaged 0.16 inj/1000-hrs dance exposure. Medical attention injuries (MAI) without time loss or injury report and complaints were not analyzed.

Purpose(s)/Aim(s): Our objective was to examine the relationship between touring, performance, and rehearsal schedule and injury in this company over 1-yr in greater detail.

Methods: Prospective data for this company (30 dancers, 15 males) were recorded over 1-yr, tracking new work-related musculoskeletal injuries (WMSI), TL-inj, complaints, diagnoses, and exposure hours. Injury data was excluded from analysis if sustained outside of working hours. The year was divided up into 6-segments alternating with breaks of ≥6 days. Injuries during each segment were converted into injuries/1000-hrs exposure to allow comparisons of the effects of performance, rehearsal, and travel. We conducted a quasi-Poisson analysis to determine differences in injury rates due to segment, co-varied with travel days.

Results: 20 WMSI were sustained by company members in 1-yr: 0.44 inj/1000-hrs exposure. WMSI were 6-times more likely to occur in Segment 6 compared to other segments (p=0.031), with 1.0 inj/1000-hrs. The highest rate of TL-inj and traumatic injuries also occurred in Segment 6 (0.57 inj/1000-hrs), reflecting a concentrated period of learning new choreography, 2-wk New York season and one-wk travel/performance abroad without break. The greatest number of overuse injuries, 0.57/1000 hr exposure were in Segment 2 during an international tour with raked stages. Although covariance with travel days was not significant, there was a correlation between WMSI and travel days (r=0.53). There was a trauma:overuse ratio of 80:20 TL-inj over the year. Complaints/1000-hrs were fairly evenly distributed across segments as on-site PT hours were also consistent. The majority of WMSI and TL-inj were muscle-tendon diagnoses, affecting the Lower Leg-Achilles and Cervical body regions.

Conclusions and Practical Relevance: While tracking complaints permits understanding of stressors to specific body regions and utilization of PT resources, WMSI and TL-inj are the most important to track for injury surveillance. Future studies will focus on the effect of travel on longer international tours.

Key References:


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Body and Instrument, Duet or Duel?

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Background: Previous research from six Danish Symphony Orchestra, including 441 musicians has demonstrated that, 97% of the women and 83% of the men experienced symptoms in at least one of nine anatomical regions: neck, upper and lower back, shoulders, elbows, hands and wrists. 86% of the women and 67% of the men experienced symptoms for more than seven days and 63% of the women and 49% of the men experienced symptoms for more than 30 days. Playing in an orchestra is compared with being a top athlete. Research has demonstrated that 12% of professional musicians have reported to give up their career permanently because of playing related muscle skeletal diseases. Some typical muscle skeletal diseases among musicians are: myalgia, tendinitis and dystonia ("musician cramp"). Music physiology was developed in 1971 by the physical therapist Lulle Lærum at the Grieg Academy, University of Bergen, Norway. The course is based on evidence-based practice, and topics included are physical therapy, health, safety and environment and Performing Arts Medicine. The aim with the course is to prevent muscle skeletal diseases among musicians.

Purpose(s)/Aim(s): The purpose/aim of this presentation is to give an overview of the course in Music physiology that aims to prevent playing related muscle skeletal diseases in musicians.

Approach of Presentation: I will present the content of Music Physiology including practical approach.

Content of Presentation: I will give an introduction to Music physiology. Examples of themes are: Why do musicians get strain injuries? How can musicians prevent playing related muscle skeletal diseases? Muscular activity when playing, rehearsal routines, initial positions: sitting and standing, relaxation techniques and exercises for musicians.

Conclusions and Practical Relevance: Music physiology contributes in learning musicians how their body and instruments can be in a duet and not in a duel, and our students have given positive evaluation of the course.


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The Closed Piano Lid: Maximizing the Brain & Muscle Memory

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Background: For years, students and teachers have relied on limited types of memory to learn their repertoire. Most rely on rote memory (playing over and over again); some rely on aural, visual or tactile memory. Rarely, do we incorporate all types of memory to maximize the efficiency and confidence in our playing. The latest research by Daniel Levitin shows that music engages all areas of the brain. Numerous research on professional athletes demonstrates that visualization techniques greatly enhance their performance. Therefore, we as teachers need to understand how our brain processes music to improve practice strategies in our students. Once we engage all of the brain's memory and sensory components, including the visualisation approach, we can create a more efficient learning process and maximize the performance outcome.

Purpose(s)/Aim(s): The purpose/aim of this presentation is to use the closed piano lid to maximize the brain and muscle memory to produce accurate, confident, and efficient playing of repertoire.

Approach of Presentation: I will use a Power Point presentation, based on experimentation conducted in lessons with my college students, as well as live volunteer demonstrations in the course of the presentation, to illustrate the power of learning repertoire on a closed piano lid, instead of always "playing" it on the instrument.

Content of Presentation: The presentation will address how the closed piano lid engages the brain's visualization, spatial memory, finger/arm muscle memory, internal hearing (aural visualization), and imagination to improve the learning process of a piece, without having to play it over and over again on the piano. Engaging all of the above senses, helps to create a more efficient approach to practicing, as well as minimize the physical risks of injuries resulting from overplaying the instrument. Additionally, it makes the student more aware of his/her gestures, hence improving tone quality once the student uses the actual keyboard.

Conclusions and Practical Relevance: Developing a more effective learning process for our students, which reduces potential injuries associated with hours of mindless rote practicing on the instrument. Additionally, this approach develops heightened awareness of other musical aspects which aids the student in growing as a musician.

Key References:


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Dancers Perceptions of Anatomy and its Relation to Movement

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Background: Dancers, dance teachers, and medical professionals are now recognizing the importance of level of knowledge of anatomy for allowing dancers to use their bodies most effectively and safely. And understanding how the muscles work in a dance movement, what constraints are imposed by muscles and bones, and how a young dance student can expand the range of motion permitted by these constraints is clearly a valuable tool for a dance teacher. Currently, there is a lack of literature available that discusses the dancers’ knowledge of anatomy and its relation to how they move. There are no measurement tools to assess the dancers’ knowledge of anatomy. It is possible that a dancers’ knowledge of anatomy may affect the way they move, and perhaps the frequency and/or type of injury they may incur. Although an experienced dancer may have accumulated more injuries over the course of his/her career, the frequency of injuries are sparser than the less experienced dancers. This is our hypothesis that knowledge of anatomy and awareness of body movements may be confounding factors.

Purpose(s)/Aim(s): To assess dancers’ perceptions of anatomy and how anatomical structure is related to function, including production of specific dance movements. If there is a correlation between knowledge of anatomy and movement or injury, then enhancing dancers’ knowledge of anatomy may help them move better and/or prevent frequent injuries.

Methods: Dancers from the New York City Metropolitan area were invited to participate in the survey. Dancers who consent to completing the survey will answer 11 multiple choice anatomy questions. They will also submit demographic information included injury history and answer questions relating to their perception of their knowledge of anatomy. The results of both sets of questions will then be compared and analyzed.

Results: Data collected, currently pending review and analysis by statistician.

Conclusions and Practical Relevance: Pending analysis by statistician, and researchers. The goal is to use the information to help determine the importance of anatomy in dance education, and to help identify the appropriate party to teach anatomy to dancers.
Prevalence of Playing-related Musculoskeletal Pain among College-level Musicians before and after an Informative Lecture

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Background: Playing-related musculoskeletal pain is prevalent among musicians and has the potential to adversely impact their performance careers. The National Association of Schools of Music (NASM) set new standards in 2013 requiring accredited schools to provide health and safety information to students. As movement specialists, physical therapists are uniquely qualified to provide this type of education.

Purpose: The purpose of this study was to determine the effect of a single informative lecture on the prevalence of playing-related pain among music students in a college-level music program.

Methods: Forty-six subjects ages 18-55 completed surveys 2 weeks before and 2 months after an informative lecture. Surveys included the Standardized Nordic Questionnaire (SNQ), Musculoskeletal Pain questionnaire for Musicians (MPQM), and demographics. The SNQ identifies location of symptoms while the MPQM grades frequency, duration, intensity, and related disability. Optional lecture attendance was used as a grouping variable; 11 subjects attended. The 50-minute lecture included prevalence and impact, risk factors, posture and biomechanics, accessing healthcare, personal responsibility (prevention is key), followed by a question and answer period.

Results: The overall prevalence of playing-related pain ranged 49-54% depending on body part and did not change significantly pre- to post-test. About half of those who reported pain indicated that it affected music performance. Pre-test prevalence of symptoms was higher--significantly for upper back pain (p=.002)--among those who attended the lecture. Among them the prevalence of upper and lower back pain decreased significantly pre-to post-test (p=.046). There were no significant changes among those who did not attend the lecture.

Conclusions and Practical Relevance: Prevalence of playing-related musculoskeletal pain in this collegiate group was similar to that found in other studies. An optional informative lecture was not enough to address the overall problem. However, the prevalence of upper and lower back pain decreased among symptomatic students who chose to attend the lecture. These findings suggest that education provided by physical therapists may be an effective way to address playing-related pain in college-level musicians.

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"Spreading the Word" in Arts Medicine via the Internet

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Jan Dunn, MS, 4dancers – Dance Wellness, Princeville, Hawaii, USA
Catherine Tully, BA, 4dancers

**Background:** The authors of this presentation have many years experience both in dance medicine and in using the internet to disseminate information. These combined experiences have shown how the internet can be utilized to further the spread of dance medicine and science (aka "Dance Wellness) material to a much larger audience than was previously possible.

**Purpose(s)/Aim(s):** The purpose of this presentation is to illustrate that the successful use of the internet in the dance medicine field can and should be applied to the wider arts medicine area, bringing in the music, theatre, and visual arts populations.

**Approach of Presentation:** This will be a 3 person panel, with each presenter providing a particular segment

**Content of Presentation:** One presenter, who has the most experience with the internet, will start with the background of how / why her site was started, and how she brings in other aspects of Social Media to further disseminate information. Presenter Two, who is the resident dance medicine specialist on the site, will provide information on how she began the Dance Wellness column, and the impact that has had on the dance community worldwide (the Dance Wellness segment is now the most popular portion of the overall site). Presenter Three will take the information provided by the previous two presenters, and discuss how this concept can be applied to the wider field of Arts Medicine.

**Conclusions and Practical Relevance:** The internet is now a major factor in how information is spread and shared worldwide. PAMA and Arts Medicine can have a much broader impact by utilizing this tool to accomplish the goals of reaching more performing artists in all areas.
Notes
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