Music and Medicine
A Research Model

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Candidate Background

- Fulbright Scholar – USA
- PhD in Music Education – University of North Texas
- Research Assistant – Texas Center for Music and Medicine
- Research Supervisor
- External Examiner
- Editorial Board – MUSICUS
- Peer-reviewer

Primary Research Focus

- Investigating the career expectations of college and professional musicians.
- Medical Problems of Musicians
- Dissertation:
  - Purpose – to investigate the occupational aspirations and expectations of students majoring in jazz
- Current Research Studies:
  - Impact of music on disadvantaged South African youth
  - Occupational expectations of music education majors in Mexico.

Defining Music and Medicine

Sports Medicine ⟷ **Performing Arts Medicine**

(medical problems of athletes)

(medical problems of performing artists)

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Music and Medicine

(medical problems of musicians)

Music and Medicine

Primary Focus:

- **Researching the medical problems of musicians**
- **Developing preventative strategies**
- **Educating individuals about risks and interventions**

Primary Research Areas

- **Musculoskeletal problems** – fingers, hands, wrist, elbow, shoulder, neck, upper back, lower back.
- **Non-musculoskeletal problems** – fatigue, headache, eyestrain, high blood pressure, loss of lip, blackout, dizziness.
- **Mental health** – stage fright, anxiety, depression, drug abuse, alcohol abuse, sleep disturbance.
- **Hearing loss**.

Recent Research Findings

- 76% of professional symphony musicians reported experiencing at least one medical problem severe enough to affect their performance (Fishbein, 1988)
- 87% of college students experienced performance related pain (Pratt, 1992)
- 60% of professional brass musicians reported having one or more musculoskeletal problems (Devroop, 2002)
- High rates headache (46%) , blackout/dizziness (43%) and eyestrain (41%) were associated with higher pitched instruments – Trumpet & Fr. Horn (Devroop & Chesky, 2002)

Recent Research Findings

- 56% of high school students experienced performance related pain (Fry, 1988)
- 52% of professional female clarinet players reported severe pain in the right-hand (Fishbein, 1988)
- 33% of non-classical musicians reported hearing loss (Chesky & Devroop, 2000)
- Peak sound pressure levels in rehearsals were recorded at 139db (Chesky & Henoch, 2000)
- Over 50% of professional musicians admitted to using beta blockers during performance (Chesky & Hipple, 1999)

Case Studies

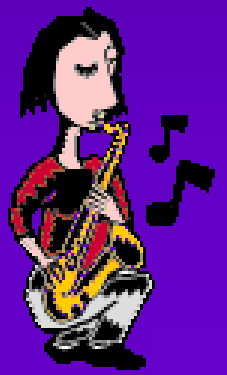
- Cerebral Hematoma in a 16 year old trumpet player.
- Rupture of the Obicularis Oris muscle in brass players
- Sudden Facial Paralysis in a young French Horn player.
- Microperforation of the anterior pharynx.
- Dystonia (similar to computer hard crash)
  - Focal Hand Dystonia - pianists, string players, guitarists, percussionists
  - Embouchure Dystonia – High Brass and double reeds (oboe)
- 80% of musicians diagnosed with overuse syndrome at Mayo Clinic (duration of symptoms range from 1 to 8 years)

Most Commonly Identified Medical Problems - Vocalists

- Overuse of the larynx
- Vocal Nodules and Polyps (excessive force and strain)
- Musculoskeletal stress – displaces the larynx
- Gastroesophageal Reflux Disorder – reflux pools in the vocal folds (inflammation)
- Postnasal Drip – abrupt throat clearing
- results in glottal attack on vocal folds.

Most Commonly Identified Medical Problems - Instrumentalists

- Musculotendinous Overuse (repetitive strain, repetitive motion, typically results in tendinitis)
- Nerve Entrapment (nerve compression results in tingling sensation, numbness, pain – carpal tunnel syndrome: median nerve)
- Dystonia
  - Subtle loss of control in fast passages
  - Lack of precision
  - Curling of fingers
  - Fingers "sticking" to keys
  - Involuntary flexion of bowing thumb in strings
  - A tremor may or may not be associated with the spasms



Site/Instrument Specific Medical Problems - Musculoskeletal

- Pianists and guitarists - right hand, left hand, wrists.
- String players - left wrist, neck pain, right shoulder.
- High Brass – embouchure, jaw pain, fingers, upper back
- Low Brass – left hand and wrist (trombone), right fingers, wrist and lower back.
- Saxophone and Clarinet - right wrist, elbow and neck pain.
- Flute - right shoulder, fingers and wrist.
- Bassoon – fingers and wrist both hand.
- Oboe – neck pain, jaw, embouchure.
- Percussionists – wrist

Prevalence rates as high as 42%, Pain Severity above 3 on a scale of 1 to 5

Medical Problems
Non-Musculoskeletal

- Fatigue – trombone (48%), French horn (48%)
- Headache – French horn (55%), trumpet (45%)
- Eyestrain – French horn (46%)
- Stress, Anxiety, and Depression – as high as 50% in some studies
- Drug use – illegal and beta blockers reported in excess of 50% in professional musicians. Widespread drug use in college musicians
- Hearing loss – mostly self reported. Recent studies reveal over exposure according to OSHA standards.

A Research Model

- Establish Prevalence Rates of Medical Problems
- Identify Risk Factors
- Develop Preventative Strategies
- Education

Overview of prevalence data: evidence for biomechanical nature of injury!

Medical Problems of Brass Instrumentalists

- Approximately 60% of brass musicians reported having one or more musculoskeletal problems
- Higher prevalence rates for non-musculoskeletal problems including headache (46%) , blackout/dizziness (43%) and eyestrain (41%) were associated with higher pitched instruments (Trumpet and French Horn)
- Data suggests unique biomechanical demands associated with each brass instrument

Chesky, Devroop, Ford (2002). Medical Problems of Brass Instrumentalists: Prevalence Rates for Trumpet, Trombone, French Horn, and Low Brass.
Medical Problems of Performing Artists, 17: 93 - 98

Focusing on Trumpeters…

- Total group (n=227)
- Mean age = 35.45 yrs.
- Gender = 79% male 21% female
- Average college instruction = 4.27 yrs.
- Average practice per day = 2.59 hrs.
- Exercise per week = 3.46 hrs.

Medical Problems of Trumpeters

- 53% of trumpeters reported one or more musculoskeletal problems!
- Mean pain severity level ranged from 2.56 to 3.00 on a scale of 1 to 5.
  - Fry's Pain Severity Scale (grade 3) – pain while playing, pain persists away from instrument, loss of muscular response and dexterity
- Fatigue (46%) and headache (46%) were the prominent non-musculoskeletal problems.

Identification and investigation of possible risk factors

Biomechanical Factors

Include:

Mouthpiece forces.

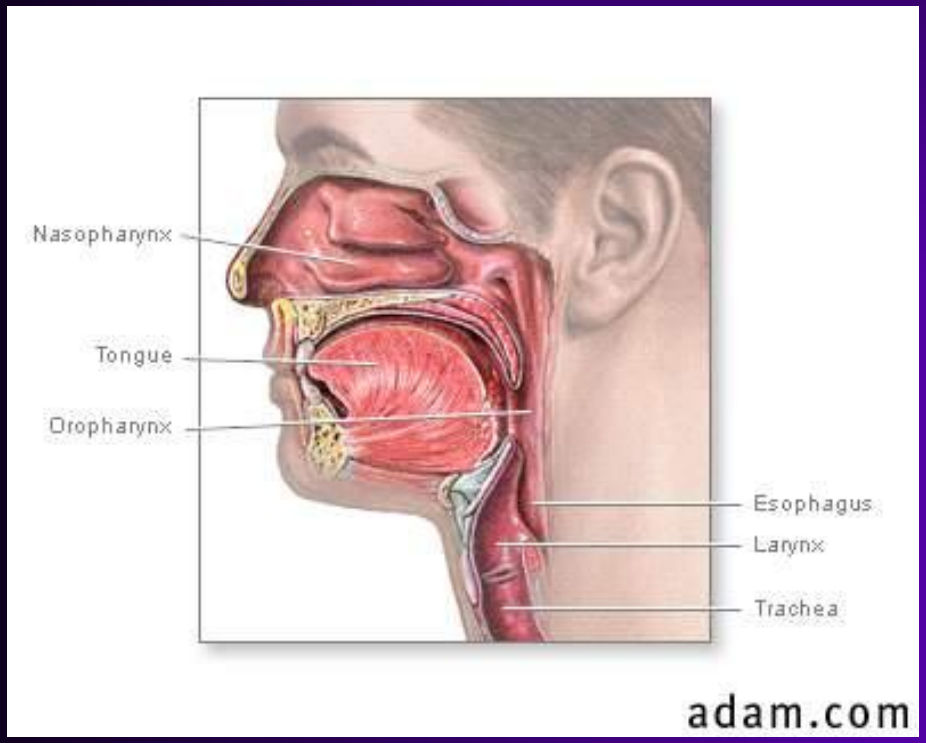
Intra-oral pressures.

Trumpet players may use tremendous mouthpiece force!

Mouthpiece Forces

Injury of the obicularis oris muscle does occur in brass players in the form of herniations, thinning of the muscle, and fibrous scar tissue. (Papsin BC, et al., 1996)

Intra-oral Pressure



Findings From Initial Studies

- Successful quantitative analysis of mouthpiece force and intra-oral pressure.
- Professional trumpet players use substantial amounts of mouthpiece force (11 kg max – 5 kg avg).
- There are substantial differences in levels of force used by different players, but individuals show high levels of consistency.

Comparison of biomechanical forces generated during trumpet performance in contrasting settings

Devroop, K & Chesky, K (2002). Comparison of biomechanical forces generated during trumpet performance in contrasting settings.
Medical Problems of Performing Artists, 17(4): 149 - 154

Subjects

- College trumpeters (n=10)
- Age = 19 years (1.41)
- Gender = 9 males 1 female
- Playing Exp. = 8.60 years (1.35)
- Practice per day = 2.55 hours (1.56)

Apparatus

- **Custom Trumpet Sensor System**
  (measuring mouthpiece forces on three axis-X, Y, Z and trumpet angular position)
- **Bach Stradivarius Trumpet**
  (with trumpet sensor system attached to lead pipe)
- **DATAQ data acquisition system**
- **Pentium based host computer**
- **Video recording equipment**

Data Recording and Analysis

- Measurements taken on 4 channels (3 force axis and trumpet angle)
  - X axis – vertical shear forces (up and down)
  - Y axis – horizontal shear forces (left and right)
  - Z axis – forces applied directly on mouthpiece
  - Trumpet angle
- Data collected and viewed in real time
- Data reviewed and analyzed in WinDaq/Pro software
- Data transferred to SPSS for further analysis

Testing Conditions

Condition One

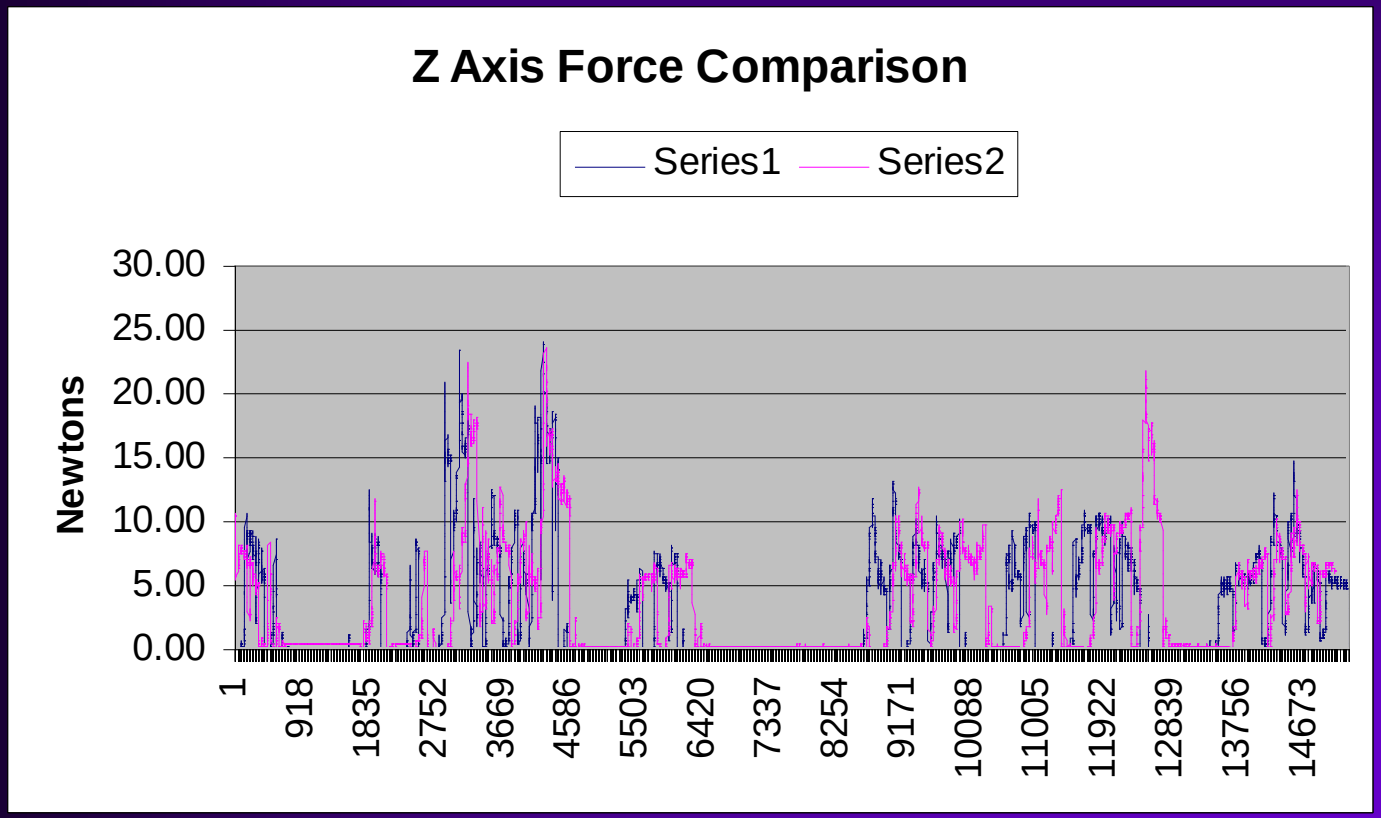
- Rehearsal performance venue
- Big band jazz ensemble
- Subjects measured while rehearsing with 18 other students

Condition Two

- Experimental setup in research lab
- Individual measurement sessions

Results

Comparative Axial Forces for a Single Subject



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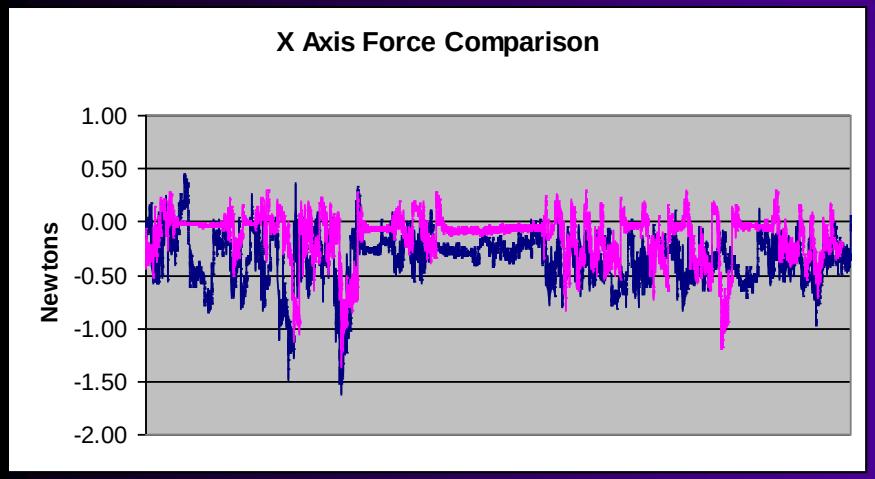

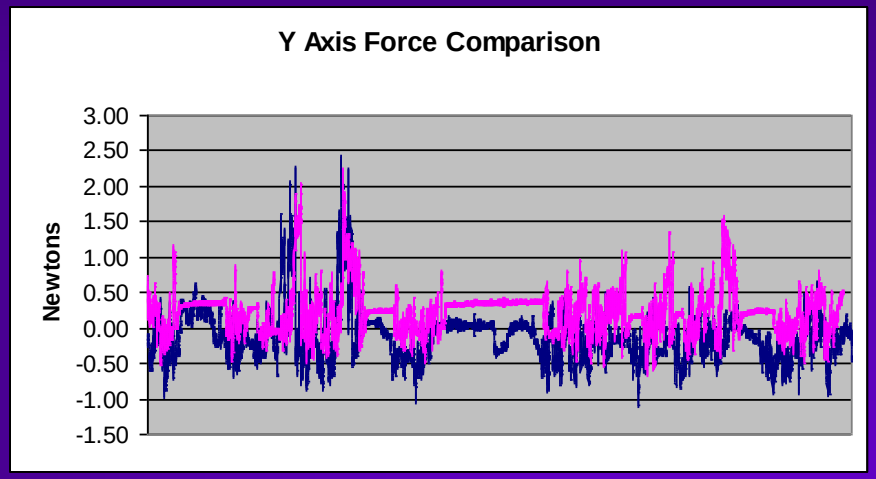

Results

Mean force and trumpet angle across conditions for subjects grouped together

	Mean	N	Standard Deviation	Standard Error Mean
X Axis				
Condition 1	-.10	10	.65	.20
Condition 2	-.08	10	.67	.21
Y Axis				
Condition 1	.65	10	.75	.23
Condition 2	.82	10	.61	.19
Z Axis				
Condition 1	7.46	10	3.47	1.09
Condition 2	7.43	10	2.40	.76
Trumpet Angle (deg)				
Condition 1	-35.13	10	4.73	1.49
Condition 2	-35.56	10	6.67	2.11

Results

Differences in mean force, trumpet angle and force variance between both conditions for subjects grouped together

	Mean Difference	Std. Deviation	Std. Error Mean	t	df	Sig.
X Axis Condition 1 - Condition 2	-1.40	.43	.13	-.10	9	.92
Y Axis Condition 1 - Condition 2	-.17	.41	.13	-.13	9	.22
Z Axis Condition 1 – Condition 2	3.20	2.68	.84	.03	9	.97
Trumpet Angle Condition 1 – Condition 2	.43	5.82	1.84	.23	9	.81
X Force Variance Condition 1 – Condition 2	-.29	2.37	.75	-.38	9	.70
Y Force Variance Condition 1 – Condition 2	-.86	4.79	1.51	-.57	9	.58
Z Force Variance Condition 1 – Condition 2	-2.88	138.17	43.69	-.06	9	.94
Z Force Maximum Condition 1 – Condition 2	3.35	7.88	2.49	1.34	9	.21

Conclusions

This study highlights the possibility that the results researchers obtain in the laboratory setting may be reflective of what is going on in the real-world.

Implications for Music Research in South Africa

- Definite need for quantitative research in music
- Need to more interdisciplinary research in music
- Need to collaborative research within institutions
- Need for closer collaboration between industry and academia
- We need more mentoring of young researchers and students
- We need to identify areas of research pertinent to our country and follow through with studies

Thank you!
Questions?