Epidemiology of Saxophonists' Occupational Health Problems

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Introduction

Saxophone is a widely popular instrument seen in virtually all genres of music around the world. However, saxophonists represent an understudied and under-represented population in the performing arts health research literature. Except for one study in 1999 that compared health concerns across genre[1], health concerns of saxophonists are often analyzed and reported together with other orchestral musicians who perform woodwind instruments.[2] Furthermore, surveys typically exclude musculoskeletal areas of concern, specifically the orofacial area, acknowledged by saxophone pedagogues and performers.[3] While the literature suggests that biopsychosocial factors are interrelated, another limitation is that performance anxiety is often measured using scales that assess only negative symptoms and experiences. This perspective is challenging to the music disciplines because research and anecdotal evidence supports the idea that stress is critical to success and that performance anxiety can facilitate performance for some musicians.[4,5] Together, these limitations warrant additional research focused on this understudied population of musicians.

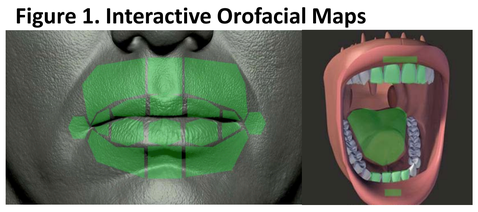
The purpose of this study is to:

1) **Develop and deploy a saxophone-specific epidemiologic survey based on biopsychosocial principals in order to characterize occupational health concerns experienced by saxophonists.**
2) **Report the musculoskeletal and non-musculoskeletal occupational health problems of saxophonists.**
3) **Explore the influence of orofacial pain on saxophonists, particularly at the inside of the bottom lip.**
4) **Explore how music performance anxiety affects the performance of saxophonists.**

Method

A saxophone-specific epidemiologic survey was created and distributed online using Qualtrics software. In addition to assessing demographics, levels of engagement, and occupational identity, this novel survey included body, hand, and facial maps to assess prevalence, intensity, frequency, and influence of pain for 171 musculoskeletal sites. Shown in **Figure 1** below, novel facial maps were developed for the orofacial region specifically for this survey. Mental health concerns were assessed using a series of unidimensional and bidirectional VAS scales. The survey also assessed how performance anxiety influences music performance along the somatic/cognitive and musical/non-musical categories developed by Meidell.[6]

Figure 1. Interactive Orofacial Maps



Results

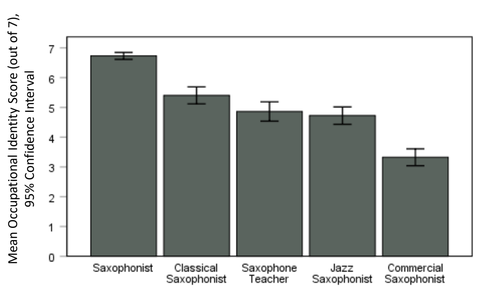
As shown in **Table 1**, the average age of this group of saxophonists **(N=203)** was slightly more than 34 years. On average, subjects report playing saxophone for over 21 years. The most common academic degrees reported were Master's degree in saxophone performance (21.18%), Bachelor's degree in saxophone performance (18.23%), and doctorate in saxophone performance (16.75%). The next most reported degree was a Bachelor's in music education (14.29%). Nearly half (47.29%) reported no music degree. Subjects report an average of 1.57 (±0.88) playing sessions per day, 8.20 (±5.47) sessions per week, and an average duration 77.97 (±42.22) minutes per session. They also report taking 1.39 (±1.68) breaks per session for an average duration of 6.53 (±11.75) minutes. Subjects reported stopping practice due to mental fatigue (43.87% ± 27.44) at a higher rate than physical fatigue (38.33% ± 26.82). Subjects reported playing an average of 29.62 (±30.13) performances per year.

Table 1. Demographics

Variables	Total	Male	Female
Sex N (%)	203 (100%)	158 (77.80%)	45 (22.20%)
Age (yrs) mean ± SD	34.03 ± 16.91	35.52 ± 17.50	28.80 ± 13.57
Handedness N (%)			
Right	165 (81.3%)	127 (76.97%)	38 (23.03%)
Left	25 (12.3%)	21 (84.00%)	4 (16.00%)
Ambidextrous	13 (6.4%)	10 (76.92%)	3 (23.08%)
Height (inches) (mean ± SD)	69.56 ± 3.63	70.84 ± 2.71	65.07 ± 2.78
Weight (lbs) (mean ± SD)	178.36 ± 42.63	187.35 ± 40.99	146.76 ± 32.15
Exercise (hrs. per week) (mean ± SD)			
Cardiovascular	6.15 ± 20.57	3.61 ± 6.30	15.06 ± 41.20
Resistance	3.46 ± 13.72	2.49 ± 6.93	6.84 ± 26.03
Flexibility	1.29 ± 3.22	0.99 ± 2.17	2.34 ± 5.43
Engagement (mean ± SD)			
Playing saxophone (yrs.)	21.52 ± 15.57	22.78 ± 16.30	17.09 ± 11.79
Formal study saxophone (yrs.)	11.16 ± 11.37	11.12 ± 11.37	11.28 ± 11.49
Playing instrument (hrs. per week)	18.72 ± 11.99	19.93 ± 12.29	14.47 ± 9.85
Soprano	1.75 ± 3.22	1.93 ± 3.53	1.09 ± 1.59
Alto	10.41 ± 8.95	10.38 ± 9.18	10.53 ± 8.20
Tenor	4.01 ± 6.66	4.48 ± 7.11	2.38 ± 4.43
Baritone	2.12 ± 5.83	2.47 ± 6.52	0.87 ± 1.50
Number of performances (past year)	29.62 ± 36.25	32.56 ± 37.37	19.40 ± 30.27

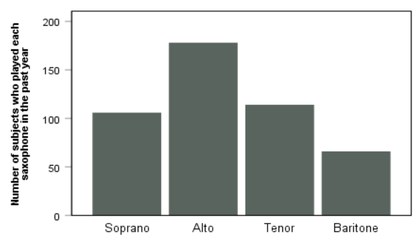
Shown in **Figure 2**, subjects strongly identified as saxophonists, less as classical saxophonists, slightly less as saxophone teachers, slightly less as jazz saxophonists, and much less as commercial saxophonists. Subjects also scored high on the total and sub scales of the Musician Identity Measurement Scale (MIMS).

Figure 2. Occupational Identity



As shown in **Figure 2**, the most played saxophone was the alto, then the tenor, closely followed by the soprano. Less than half of the subjects played the baritone in the past year. Average playing time per week was much higher on the alto (10.41 ± 8.95) than the next closest, tenor (4.01 ± 6.66). Playing two saxophones was reported by the highest number of subjects (36.95%), followed by three (26.60%), one (23.64%), and four (12.81%).

Figure 3. Saxophone Type



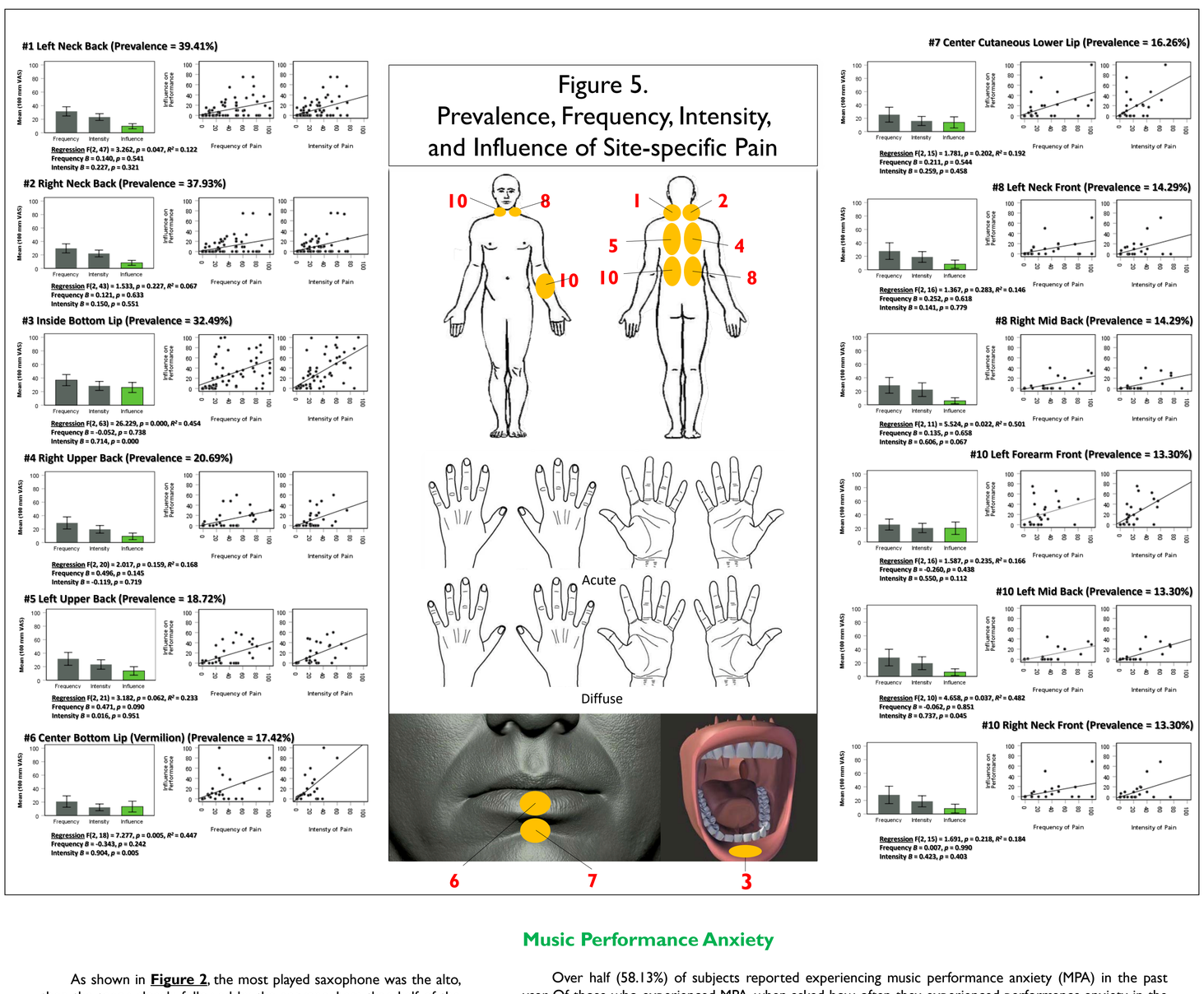
Non-Musculoskeletal Health Problems

Table 2 shows the percentages of subjects reporting various mild and severe non-musculoskeletal problems sorted by severe. Depression was the most severe problem reported, with 17% of subjects reporting severe depression. The total reported percentage of 48.27%, however, is less than headache (58.12%) and fatigue (61.09%). Several problems stand out with a high percentage of mild cases but very few severe cases; most notably eye strain (42.86% mild, 2.96% severe) and noise induced hearing loss (26.60% mild, 0.99% severe).

Table 2. Non-Musculoskeletal Problems

Health Concern	Mild	Severe
Depression	**30.54%**	**17.73%**
Headache	**47.78%**	**10.34%**
Acute Anxiety	**37.93%**	**9.36%**
Fatigue	**52.22%**	**8.87%**
Stage Fright	**34.98%**	**7.88%**
Tinnitus	**27.59%**	**5.91%**
Respiratory Allergies	**26.11%**	**5.42%**
TMJ Syndrome	**12.32%**	**4.43%**
Sleep Disturbances	**32.51%**	**3.94%**
ADD	**9.85%**	**3.94%**
Earaches	**30.05%**	**3.45%**
Mouth Lesions	**15.27%**	**3.45%**
Eye Strain	**42.86%**	**2.96%**
Weight Problems	**22.66%**	**1.97%**
Asthma	**19.21%**	**1.97%**
High Blood Pressure	**16.26%**	**1.97%**
ADHD	**8.87%**	**1.97%**
Acquired Dental Malocclusion	**8.37%**	**1.48%**
Noise Induced Hearing Loss	**26.60%**	**0.99%**
Temporary Hearing Loss	**10.84%**	**0.99%**
Heart Condition	**4.93%**	**0.99%**
Blackouts/Dizziness	**20.69%**	**0.49%**
Ulcer	**9.85%**	**0.49%**

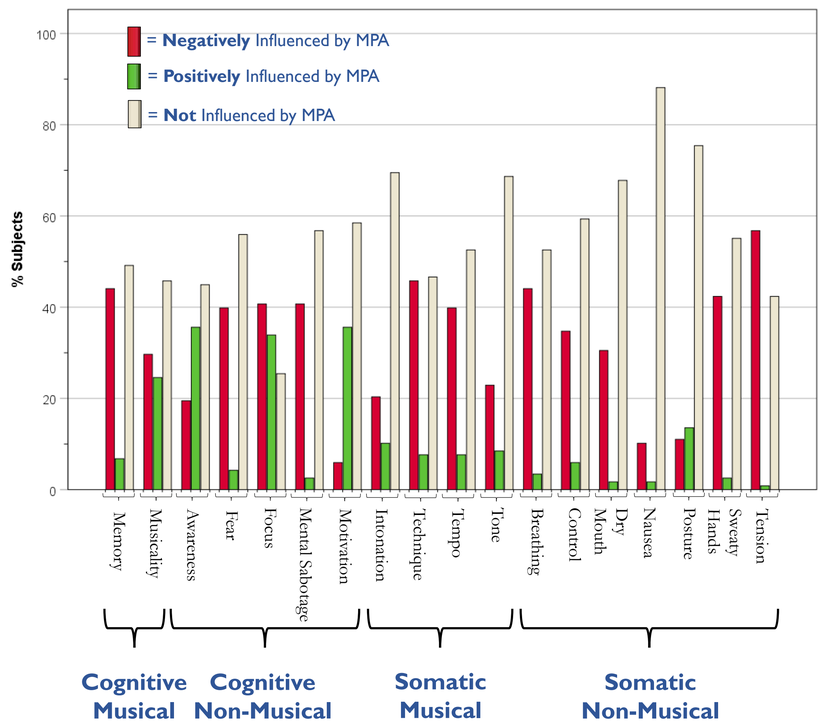
Figure 5.
Prevalence, Frequency, Intensity, and Influence of Site-specific Pain



Music Performance Anxiety

Over half (58.13%) of subjects reported experiencing music performance anxiety (MPA) in the past year. Of those who experienced MPA, when asked how often they experienced performance anxiety in the past year on a 100 point scale from never to always, the mean response was 38.95 (±29.26). The mean intensity of performance anxiety over the past year was 31.90 (±24.79). The mean influence of MPA on performance was -6.93 (±19.31) on a bidirectional scale of -50 (strong negative influence) to 50 (strong positive influence). Over half (57.63%) reported negative influence, while under a quarter (23.73%) reported positive influence and the remainder reported no influence. Subjects were presented with 18 aspects of music performance commonly affected by music performance anxiety, shown in **Figure 4**, and were directed to indicate if each aspect was positively, negatively, or not affected by their performance anxiety. Results were varied; some were overwhelmingly influenced negatively, while others were overwhelmingly influenced positively, and others had no clear consensus. Subjects reported "tension" as an aspect of music performance mostly influenced negatively (56.78%) by performance anxiety and almost none (0.85%) reported positive influence. Conversely, few (5.96%) subjects reported negative influence on "motivation" while over a third (35.59%) reported positive influence. Subjects reported "focus" as highly influenced by performance anxiety both negatively (40.68%) and positively (33.90%).

Figure 4. How MPA influences music performance



Musculoskeletal Problems

The overall prevalence of musculoskeletal pain, calculated as the total population reporting one or more site-specific problem over the past year, was **86.7%**. **Figure 5** shows the top 12 musculoskeletal sites ordered by prevalence. Linear regression analyses were calculated to predict the influence of site-specific pain on musical performance based on the frequency and intensity of pain as independent factors. Intensity of pain was found to be a statistically significant predictor of influence for the inside bottom lip, center bottom lip (vermilion), and left mid back. The most frequently selected number of saxophone related pain sites was 1 (18.23%), followed by 2 (11.33%), and 3 (7.39%).

Although the inside of the bottom lip was not the most prevalent location where saxophonists experience pain it had the **greatest overall impact on playing**. It was the third ranked prevalence site (32.49%) and the site with the highest mean frequency (36.85 ± 33.31), intensity (28.36 ± 26.92), and influence on playing (26.05 ± 30.27). The descriptive quality of pain at this site most often reported were tender (33.33%), sharp (18.18%), aching (16.67%), and stinging (15.15%).

Most of the other locations on and around the lower lip are also highly problematic—including the other two lip sites shown in Figure 5. The lower lip is one of the areas of the face involved in the formation of the embouchure, the lips around the mouthpiece and reed which control the energy transfer of the saxophonist's air from their body to the instrument. The lower lip rests on the bottom teeth and saxophonists "bite" into the lower lip to varying degrees depending on many factors ranging from the type of music they play, to the equipment they use, to how they practice, to how they were taught to form an embouchure. A common solution to this problem in pedagogical literature is to use a "tooth guard" to serve as a cushion that creates smoother contact between the bottom teeth and lower lip.[3,7] Almost half (43.84%) of the subjects reported using a tooth guard more than once in the past year. **Table 3** compares the pain prevalence, frequency of pain, intensity of pain, and influence of pain on playing for those who did or did not use a tooth guard. A chi-square test was done to compare the statistical significance of prevalence rates. Statistical significance was found for the center cutaneous lower lip. An independent samples t-test was used to determine the statistical significance of the differences in frequency, intensity, and influence. Statistical significance was found for influence of pain on playing at the inside bottom lip and for intensity of pain and influence of pain on playing at the center bottom lip (vermilion).

Table 3. Use of Tooth Guard

	Inside bottom lip	Center bottom lip (vermilion)	Center cutaneous lower lip
Overall Prevalence	66 (32.49%)	35 (17.24%)	33 (16.26%)
Prevalence with a tooth guard n=89	30 (33.71%)	14 (15.73%)	8 (8.89%)
Prevalence without a tooth guard n=114	36 (31.58%)	21 (18.42%)	25 (21.93%)
Significance*	X^2=0.103, p=0.748	X^2=0.254, p=0.615	X^2=6.148, p=0.013
Overall Frequency	36.85 ± 33.31	19.71 ± 24.39	25.42 ± 31.64
Frequency with a tooth guard n=89	38.90 ± 33.84	27.67 ± 27.87	21.13 ± 33.02
Frequency without a tooth guard n=114	35.14 ± 33.24	15.90 ± 21.95	26.80 ± 31.75
Significance*	t=0.454, p=0.651	t=1.416, p=0.166	t=-0.436, p=0.666
Overall Intensity	28.36 ± 26.92	11.66 ± 14.76	15.91 ± 19.19
Intensity with a tooth guard n=89	33.80 ± 27.39	18.80 ± 16.73	20.38 ± 23.77
Intensity without a tooth guard n=114	23.83 ± 26.05	7.48 ± 11.57	14.48 ± 17.82
Significance*	t=1.512, p=0.135	t=2.396, p=0.022	t=0.751, p=0.458
Overall Influence	26.05 ± 30.27	13.69 ± 24.02	13.76 ± 23.66
Influence with a tooth guard n=89	34.40 ± 35.74	27.33 ± 31.78	24.75 ± 39.73
Influence without a tooth guard n=114	19.08 ± 23.09	3.29 ± 5.46	10.24 ± 15.27
Significance*	t=2.100, p=0.040	t=3.416, p=0.002	t=1.542, p=0.133

Conclusion

This is the first known saxophone-specific epidemiologic study to assess potential musculoskeletal problems in the lip and mouth areas. Supporting concerns expressed by saxophone pedagogues and players, the inside of the bottom lip was identified as one of the most critical areas of concern due to the high prevalence, frequency, and intensity of pain in this area. More than any other musculoskeletal site, pain in this area was reported as having the strongest negative influence on the ability to perform the saxophone. **Further research in this area should include assessment of the influence of pain on playing as prevalence alone does not correlate with high influence on performance.** Additional research is needed to better understand the etiology of this problem and the effectiveness of prevention and treatment strategies. Another important finding suggests the need for researchers to consider and adopt multidimensional theories of performance anxiety. **There are aspects of music performance that can be facilitated by music performance anxiety. R**esearch should adopt multidimensional models in order to better understand and develop pedagogical approaches designed to maximize the facilitative potential of this phenomenon. **Performing arts health researchers need to interact with the population being studied in order to develop the right questions to ask to yield applied insights.**

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Michael Davis is a saxophonist who began his saxophone career at the University of Iowa. He graduated with a Bachelor of Music in Performance with high distinction under the direction of Dr. Kenneth Tse. After graduation, Michael participated in the Iowa Saxophonists' Workshop Ensemble east Asia tour in July 2016. The ensemble performed multiple times in Hong Kong for the Hong Kong International Saxophone Symposium and in Chengdu, China, at the Sichuan Conservatory of Music. Michael went on to study saxophone with Dr. Eric Nestler at the University of North Texas (UNT) where he completed his Master's of Music in saxophone performance with a related field in music theory in 2017. Currently, Michael is a DMA student and saxophone teaching fellow at UNT. He is doing his related field in performing arts health, conducting research on saxophone related occupational health problems.

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