# CONDUCTOR AWARENESS OF, KNOWLEDGE OF, AND ATTITUDE TOWARD SOUND INTENSITY LEVELS GENERATED DURING ENSEMBLE-BASED INSTRUCTIONAL ACTIVITIES IN COLLEGE-LEVEL SCHOOLS OF MUSIC

Aaron J. Albin, B.M., M.M.

Dissertation Prepared for the Degree of

DOCTOR OF MUSICAL ARTS

UNIVERSITY OF NORTH TEXAS

August 2012

APPROVED:

David Itkin, Major Professor
Kris Chesky, Committee Member
Clay Couturiaux, Committee Member
Richard Sparks, Chair of the Division of Conducting and Ensembles
John Murphy, Interim Director of Graduate Studies of the College of Music
James C. Scott, Dean of the College of Music
Mark Wardell, Dean of the Toulouse

Albin, Aaron J., Conductor awareness of, knowledge of, and attitude toward sound intensity levels generated during ensemble-based instructional activities in college-level schools of music. Doctor of Musical Arts (Performance), August 2012, 91 pp., 16 illustrations, bibliography, 63 titles.

In 2011, the National Association of Schools of Music (NASM) took an official position to recognize the importance of hearing health and injury prevention as a standard for all member-accredited institutions. This is the largest national acknowledgement promoting hearing health and safety within the music discipline and among students seeking a music degree in the United States. The purpose of the study is to describe what conductors (i.e., instructors) of college-based ensembles know about hearing health and the generation of sound intensity levels. The study aimed to describe the 1) current state of conductors' awareness and knowledge of sound intensity levels, 2) current attitudes of conductors toward learning and sharing knowledge of sound intensity levels, and 3) current teaching practices of conductors in regard to equipment usage (e.g. sound level meter, noise dosimeter, hearing protection devices) relating to sound measurement and exposure.

Findings indicate 80.2% of conductors (*N* = 162, 66% employed by NASM-accredited institutions) agree that sounds generated during ensemble-based instructional activities (EBIAs) in college-level schools of music are capable of harming human hearing, but 24.1% "do not know" if EBIAs they conduct ever exceed sound intensity levels capable of harming human hearing, 54.9% do not know "what services or resources" their home institutions offer/refer to students, 93% are never using a noise dosimeter, 40% have never had an audiology exam, and 70% have never used hearing

protection during an EBIA.  Conductors have a strong openness to change current teaching practices and inform themselves about hearing health, but few are personally informing and educating their students during the EBIA.

The study serves to assist conductors and foster a new dialogue among their students, colleagues, staff, and administrators to revise current curriculum, explore sound measurement technologies, and evaluate current hearing health and safety issues inherent in the practice, performance, and teaching of sound intensity levels generated during EBIAs in college-level schools of music.

ACKNOWLEDGEMENTS

I would like to thank Ms. Julie L. Johnson, Prof. Jack Taylor, and the College Music Society for providing a vehicle for my online survey tool to be administered. Their support of student research and dedication to the field of music education continues to enrich our discipline.

There are many people including Dr. Lynn Eustis, Dr. Jerry McCoy, Prof. Henry Gibbons, and Prof. Paula Homer at the University of North Texas who have spent numerous hours guiding my education and offering support. I would also like to thank Prof. David Itkin, Dr. Kris Chesky, and Dr. Clay Couturiaux for serving on my graduate committee and being a constant council to me.

To Prof. Jennifer Pierce, Dr. Dan Bauer, Dr. Arturo Ortega, and Dr. Debbie Rohwer for their diligent work as editors and advocates for my success; and additionally to Dr. Ryan Riley, Dr. Julie Yu, Dr. Sarah Griffiths, Dr. Jessica McCormack, Dr. Edward Phillips, Prof. Hyunseok Chang, and Ms. Dakota whom have all been true friends providing steadfast advice and encouragement since I arrived in Texas. Besides my Texas family, I also acknowledge Dr. Rebecca Gruber for trusting, validating, and empowering a student when nobody else would.

Finally, my deepest gratitude to and unceasing amazement of my parents, Terry and Laura Albin, who support me with unconditional love, protection, and advocacy as I strive to champion my dreams.

CONTENTS

ACKNOWLEDGEMENTS ..... iii

LIST OF TABLES ..... vi

LIST OF FIGURES ..... vii

ABBREVIATIONS ..... viii

GLOSSARY ..... x

Chapters

1 SIGNIFICANCE AND STATE OF RESEARCH ..... 1

Introduction ..... 1

Noise Legislation ..... 1

The National Association of Schools of Music ..... 5

Noise Exposure of Professional-Based Ensembles ..... 9

Noise Exposure of Educational-Based Ensembles ..... 10

Hearing Protection Devices ..... 11

The Conductor and Ensemble-Based Instructional Activity ..... 12

2 METHOD ..... 20

Participants ..... 20

Measures ..... 21

Specific Aim 1: Conductor Awareness and Knowledge of Sound Intensity Levels ..... 22

Specific Aim 2: Conductor Attitude Toward Sound Intensity Levels ..... 24

Specific Aim 3: Conductor Teaching Practices Regarding the Usage of Equipment Relating to Sound Exposure ..... 25

Pilot Study ..... 26

Procedures ..... 27

Demographics ..... 29

Data Analysis ..... 30

3 RESULTS ..... 31

Demographics ..... 31

Specific Aim 1: Conductor Awareness and Knowledge ..... 32
Specific Aim 2: Conductor Attitude ..... 38
Specific Aim 3: Conductor Teaching Practices ..... 41

4 DISCUSSION ..... 43
Specific Aim 1: Conductor Awareness and Knowledge ..... 43
Specific Aim 2: Conductor Attitude ..... 47
Specific Aim 3: Conductor Teaching Practices ..... 49
Limitations ..... 51

5 CONCLUSION ..... 52

Appendices

A UNT IRB APPROVAL ..... 55

B CMS SURVEY COMMITTEE APPROVAL ..... 59

C CMS RECRUITEMENT LETTER FOR THE ACS ..... 61

D CMS REMINDER LETTER FOR THE ACS ..... 63

E ALBIN CONDUCTOR SURVEY ..... 65

F DEMOGRAPHICS OF THE ACS ..... 78

BIBLIOGRAPHY ..... 86

LIST OF TABLES

Tables

1. Test re-test reliability of each question on the ACS ..... 27

F.1. Demographics ..... 79

F.2. Frequency and composition of EBIAs in college-level schools of music..... 81

F.3. Frequency and composition of ongoing activites outside of college-level schools of music ..... 83

LIST OF FIGURES

Figures

1. Percentage of conductor responses toward sounds being capable of harming human hearing and if their EBIAs ever exceed harmful levels..... 33

2. Frequency and intensity of conductor concern toward four statements regarding hearing health..... 34

3. Percentage of conductors that indicate having NIHL..... 35

4. Percentage of how often conductors receive an audiology exam..... 35

5. Percentage of when conductors last received an audiology exam ..... 37

6. Percentage of known resources conductors' institutions offer or refer to students of EBIAs ..... 38

7. Conductors perceived levels of dependency regarding eight factors that may affect sounds generated during EBIAs ..... 39

8. The frequency conductors indicate students should be informed/educated about sound intensity levels ..... 40

9. Percentage of conductors personally informing/educating students about sounds generated during their EBIAs..... 40

10. Percentage of conductor openness to use sound measurement technology ..... 41

11. Percentage of sound measurement technology usage among conductors ..... 42

12. Percentage of hearing protection usage among conductors ..... 42

ABBREVIATIONS

| | |
|---|---|
| ACS | Albin Conductor Survey |
| ABO | Association of British Orchestras |
| CDC | Centers for Disease Control and Prevention |
| CMS | College Music Society |
| dB | Decibel(s) |
| dBA | Decibel(s), A-weighted |
| EBIA | Ensemble-based instructional activity |
| Ens. | Ensemble |
| EU | European Union |
| HHS | U.S. Department of Health and Human Services |
| HPD | Hearing protection devices |
| HPSM | Health Promotion in Schools of Music |
| HTL | Hearing threshold level |
| Hz | Hertz |
| Instr. | Instrument |
| IRB | Internal Review Board |
| M | Mean |
| Max | Maximum |
| MENC | Music Educators National Conference, As of Sept 1, 2001 recently renamed NAME (National Association for Music Education) |
| Min. | Minimum |
| MTNA | Music Teachers National Association |
| NATA | National Athletics Trainer's Association |

| | |
|---|---|
| NCATE | National Council for Accreditation of Teacher Education |
| NIH | National Institute of Health |
| NIHL | Noise-induced hearing loss |
| NIOSH | National Institute for Occupational Safety and Health |
| Orch. | Orchestra |
| OSHA | Occupational Safety and Health Administration |
| PAMA | Performing Arts Medicine Association |
| PEL | Permissible exposure limit |
| Per. | Period |
| Reh. | Rehearsal |
| REL | Recommended exposure limit |
| SHAPE | Safety and Health in Arts Production and Entertainment |
| SD | Standard deviation |
| SMTE | Society for Music Teacher Education |
| SPL | Sound pressure level |
| TCMM | Texas Center for Music and Medicine (UNT) |
| TWA | Time-weighted average |
| UNT | University of North Texas |
| VAS | Visual analog scale |

# GLOSSARY

Decibel. A dimensionless unit that is logarithmic and used to compare the ratios of acoustical energy (SPL) and electrical energy (voltage). The unit is meant to represent a system to quantify audible perception of loudness.[1]

Dose. The amount of actual exposure relative to the amount of allowable exposure, and for which 100% and above represents exposures that are hazardous.[2]

Exchange rate. An increment of decibels that requires the halving of exposure time, or a decrement of decibels that requires the doubling of exposure time. NIOSH uses a 3dB exchange rate. OSHA uses a 5 dB exchange rate.[3]

Hearing threshold level (HTL). For a specified signal, the amount in decibels by which the hearing threshold for a listener, for one or both ears, exceeds a specified reference equivalent threshold level, measured in dB.[4]

$L_{avg}$. The average sound level measured over a specified length of time. It is important to note if a threshold has been included in a $L_{avg}$ reading because this will significantly alter the resulting level.[5]

$L_{eq}$. This represents the equivalent continuous sound (dB) over a specific time. $L_{eq}$, $t$[6]

$L_{max}$. The highest sampled sound level during a dosimeter's run time with a time constant (fast or slow) applied.[7]

$L_{min}$. The lowest sampled sound level during a dosimeter's run time with a time constant (fast or slow) applied.[8]

$L_{peak}$. This is the highest instantaneous sound detected. Unlike the $L_{max}$, $L_{peak}$ is detected independently of the sound measurement's response time setting (fast or slow).[9]

---

[1] Francis Rumsey and Tim McCormick, *Sound and Recording*, 6th ed. (Oxford: Focal Press, 2009), 17.

[2] Department of Health and Human Services, National Institute of Occupational Safety and Health, *Criteria for a Recommended Standard: Occupational Noise Exposure*, Rev. ed. 1998 (Cincinnati, OH, PB: 98-126), 1-2.

[3] Ibid., xiii.

[4] Ibid.

[5] Quest Technologies, *Noise Dosimetry Glossary of Terms*, http://questtechnologies.com/Assets/Documents/Sound%20Level%20Meter%20Terms.pdf (accessed February 20, 2012).

[6] Ibid.

[7] Ibid.

[8] Ibid.

[9] Ibid.

Response time. The response determines how quickly the sound measurement technology responds to fluctuating noise. Typically, fast = 125 milliseconds and slow = 1 second.[10]

Time-weighted average (TWA). The averaging of different exposure levels during an exposure period. For noise, the REL for the NIOSH indicates, “a TWA not to exceed 85-dBA at a 3-dB exchange rate for any 8 hour period” and the PEL for the OSHA indicates, “a TWA of 90-dBA at a 5-dB exchange rate for an 8 hour period.”[11]

[10] Ibid.

[11] U.S. DHHS, NIOSH, *Criteria for a Recommended Standard*, xv; U.S Department of Labor, Occupational Safety and Health Administration, *Regulations (Standards-CFR: 1910)*, http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=9735 (accessed February 18, 2012).

# CHAPTER 1

# SIGNIFICANCE AND STATE OF RESEARCH

## Introduction

To survey conductor awareness of, knowledge of, and attitude toward sound intensity levels generated during college-based ensemble activities, an understanding of previous, related studies was needed. Investigation began within the roots of hearing health awareness, beginning in Europe where hearing health awareness sparked regulation and government policy and ending in the United States where hearing health awareness is high among the work industry but remains low in the arts and entertainment industry. Due to the lesser-developed status of awareness in arts and entertainment, the literature review turned to the area of musicians, including those in professional and educational settings, so that a basis for understanding and furthering hearing health awareness within music environments could be outlined. The result was to begin the path to hearing health awareness in educational music settings by surveying those in charge of those settings, namely the conductors, about their current positions in regard to sound intensity levels.

## Noise Legislation

The history of government action in response to hearing health awareness and noise legislation in the arts and entertainment industry begins with the European Parliament and the Council of the European Union. In 2003, the European Parliament recognized noise (sound) exposure as a serious concern and began regulating sound levels within the music industry. This organization, comprised of twenty-seven countries, adopted Directive 2003/10/EC and included the music industry as a sector

that must regulate and monitor the sound exposure it produces. The directive modified the earlier 1989 regulation by moving the lower action threshold level down to 80dB and the upper action level to 85dB.[12] Between 2003 and 2005, other countries also addressed the hearing health issue to include the arts and entertainment industry through legislative action and publication. In 2005, the United Kingdom took a stand and adopted the same EU guidelines for the arts and entertainment industry through the Control of Noise at Work Regulation Act.[13] In response to this, the Association of British Orchestras (ABO) published *A Sound Ear* (2005) and *A Sound Ear II* (2008), documents that provided advocacy, awareness, and training to musicians in the United Kingdom.[14,15] Also in 2005, the Safety and Health in Art Production and Entertainment (SHAPE) organization located in Canada published *Noise and Hearing Loss in Musicians*. This document provided awareness, investigated hearing loss in musicians, and recommended protection options for musicians in regard to their hearing health within the contexts of their professions.[16]

The origin of hearing health awareness and noise legislation in the United States exists in the Occupational Safety and Health Administration (OSHA) created under President Nixon by the Department of Labor under the Occupational Safety and Health Act of 1970 (Public Law [91-596]). While the OSHA began hearing health regulations in

[12] European Union, "Directive 2003/10/EC of the European Parliament," http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:042:0038:0044:EN:PDF (accessed July 15, 2011).

[13] U.K. Government, "The Control of Noise at Work Regulations Act of 2005," http://www.legislation.gov.uk/uksi/2005/1643/contents/made (accessed July 1, 2011).

[14] Allison Wright Reid, *A sound Ear (I): Exploring the Issues of Noise Damage in Orchestras* (London: Association of British Orchestras, 2001), 1-20.

[15] Allison Wright Reid and Malcolm Warne Holland, *A Sound Ear II: The Control of Noise at Work Regulations 2005 and Their Impact on Orchestras* (London: Association of British Orchestras, 2008), 1-51.

[16] Cheryl Peters et al., *Noise and Hearing Loss in Musicians* (Vancouver: Safety and Health in Art Production and Entertainment, 2005), 1-39.

1974, it has made several amendments and changes since, with the most recent occurring in 2008. OSHA is a regulatory agency that secures healthful and safe working conditions for workers by setting and enforcing standards and by providing training, outreach, education, and assistance.[17] It receives recommendations for occupational noise exposure from the National Institute for Occupational Safety and Health (NIOSH), a non-regulatory agency under the Centers for Disease Control and Prevention (CDC).[18] The most recent recommendation from NIOSH appeared in 1998 and states, "recommended exposure limit (REL) is 85dBA for a time-weighted average (TWA) of 8 hours" with a 3-dB exchange rate. [19]

Though the NIOSH provides recommendations to the OSHA, it is not a regulatory agency. As a result, in some occupations, the OSHA enforces a less-restrictive rate of a 90dBA permissible exposure limit (PEL) for a TWA of 8 hours with a 5-dB exchange rate, which differs from the NIOSH recommendation.[20] Regardless of these differences, neither the NIOSH recommendation nor the OSHA regulation is currently applied to the arts and entertainment industry. The OSHA has provided reasoning for this decision explaining that, "most musicians and other entertainment establishments are exposed to loud music less than 8 hours a day."[21] However, employers are expected to

[17] U.S. Department of Labor, Occupational Safety and Health Administration, "OSHA's mission," http://www.osha.gov/about.html (accessed February 18, 2012).

[18] U.S. DHHS, NIOSH, *Criteria for a Recommended Standard,* iii.

[19] Ibid.

[20] Ibid.

[21] U.S. Department of Labor, Occupational Safety and Health Administration, Standard Number 1910.95 (May 2, 1985), http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=19093 (accessed February 18, 2012).

appropriately protect their employees from harmful noise levels.[22] Perhaps it is in this area of protecting employees that American education institutions fall short.

College-level schools of music are not routinely training conductors or student musicians about hearing health issues.[23] In effect, how do colleges and schools of music intend to protect their employees from hearing damage? Additionally, while students are not employees, they are exposed to the same noise levels as the employees (the conductors); how can these colleges and schools of music ensure protection for the students? Though the OSHA and the NIOSH are not yet recognizing these needs, some within the field of music are addressing them in various ways.

The lack of awareness and competency within collegiate music education in the context of hearing health has not gone unnoticed among some scholars in the field of music and medicine. Kris Chesky, Ph.D.; William J. Dawson, M.D.; and Ralph Manchester, M.D. formed an initiative called the Health Promotion in Schools of Music (HPSM) project and in 2004 hosted a national conference.[24] This conference was a collective effort between the Texas Center for Music and Medicine (UNT), PAMA, and twenty other professional organizations. The primary goal of HPSM "is to assist schools of music to prevent occupational injuries associated with learning and performing

[22] Ibid.

[23] Ashleigh J. Callahan et al., "Collegiate Musicians' Noise Exposure and Attitudes on Hearing Protection," *Hearing Review* 18, no. 6 (June 2011): 36; Kris Chesky, "Hearing Conservation and Music Education," *Seminars in Hearing* 29, no. 1 (February 2008): 91; Cheryl DeConde Johnson and Deanna K. Meinke, "Noise-Induced Hearing Loss: Implications for School," *Seminars in Hearing* 29, no. 1 (February 2008): 59; Robert L. Folmer, "Hearing-Loss Prevention Practices Should Be Taught in Schools," *Seminars in Hearing* 29, no. 1 (February 2008): 67; Kris Chesky, William J. Dawson, Ralph Manchester, "Health Promotion in Schools of Music: Initial Recommendations for Schools of Music," *Medical Problems of Performing Artists* 21, no. 3 (September 2006): 144.

[24] Health Promotion in Schools of Music Project, "Health Promotion in Schools of Music (Homepage)," http://unt.edu/hpsm (accessed August 5, 2011).

music."[25] HPSM challenged schools of music and music administrators across the country to implement their health promotion framework, and in 2006 PAMA published *Health Promotion in Schools of Music (HPSM): Initial Recommendations for Schools of Music*.[26] After the PAMA publication, other professional organizations including the Music Educators National Conference: The National Association for Music Education (MENC) and the Music Teachers National Association (MTNA) adopted similar viewpoints and revised their own health promotion position statements.[27] Another effort of HPSM to reform hearing health among musicians at the national level included "a call for NASM-accredited schools to offer coursework that covers occupational health concerns and that music students be routinely informed and educated about hearing "loss prevention as part of ensemble-based instruction."[28]

## The National Association of Schools of Music

The National Association of Schools of Music (NASM) is "the national accrediting agency for music and music-related disciplines and accredits approximately six hundred and thirty-six schools, conservatories, colleges, and universities across the United States."[29] The National Council for Accreditation of Teacher Education (NCATE), the principal national governing body for teacher education in America, defers content standards for music education to the NASM as the learned society and accrediting

[25] Chesky, Dawson, and Manchester, "HPSM," 142.
[26] Ibid.
[27] Music Educator's National Conference (MENC): The National Association for Music Education, "Health in Music Education (Position Statement)," http://www.menc.org/about/view/health-in-music-education-position-statement (accessed August 5, 2011); Music Teachers National Association, "MTNA: Health in Music Teaching," http://www.mtna.org/Portals/1/PDFs/WellnessStatement.pdf (accessed August 5, 2011).
[28] Kris Chesky, "Schools of Music and Conservatories and Hearing Loss Prevention," *International Journal of Audiology* 50 (2011): S34; Kris Chesky, "Hearing Conservation in Schools of Music: The UNT Model," *Hearing Review* (March 2006), http://www.hearingreview.com/issues/articles/2006-03_05.asp (accessed February 18, 2012).
[29] National Association of Schools of Music, "About NASM" from the homepage, http://nasm.arts-accredit.org/index.jsp?page=About+NASM (accessed March 1, 2012).

agency for music and music-related disciplines.[30] Before the summer of 2011, the NASM had no official commentary regarding the routine informing and educating for which HPSM called. Though the NASM handbook requires "growth in artistry, technical skills, collaborative competence and knowledge of repertory through regular ensemble experiences…varied both in size and nature" as a performance standard within institutions granting professional music degrees,[31] no recommendations or regulations applied to "regular ensemble experiences" related to hearing loss, hearing loss prevention, noise-induced hearing loss (NIHL), tinnitus, nor did any mention that music is a sound source capable of harming human hearing.[32] However, in 2011 this changed, and the effects may greatly impact colleges and schools of music in the United States.

July 2011 marked the beginning of collaboration between the NASM and the Performing Arts Medicine Association (PAMA) to create an introduction to hearing health awareness and promotion.[33] A draft document of these efforts were uploaded to the NASM website and available for commentary only.[34] The draft was a "comprehensive overview of hearing health issues for postsecondary schools and departments of music" and meant to be "generic, presentational, and advisory in character."[35] The "Basic Information on Hearing Health" was meant for administrators, faculty, staff, and students of accredited college-level institutions and "in no way serves

[30] Jere L. Forsythe et al., "Opinions of Music Teacher Educators and Preservice Music Students on the National Association of Schools of Music Standards for Teacher Education," *Journal of Music Teacher Education* 16, no. 19 (Spring 2007): 22.

[31] National Association of Schools of Music, "Handbook 2010-11," http://nasm.arts-accredit.org/site/docs/Handbook/NASM_HANDBOOK_2010-11_T.pdf (accessed August 8, 2011), 84.

[32] Chesky, "Schools of Music and Hearing Loss Prevention," S33; Kris Chesky, "Measurement and Prediction of Sound Exposure Levels by University Wind Bands," *Medical Problems of Performing Artists* 25 (2010): 34.

[33] National Association of Schools of Music, "NASM-PAMA Draft Advisories on Hearing Health," http://nasm.arts-accredit.org/index.jsp?page=NASM-PAMA_0_Drafts (accessed August 2, 2011).

[34] Ibid.

[35] Ibid., I-2.

as the basis for the accreditation function of the NASM."[36] Nevertheless, it was a first step toward developing a formal hearing health awareness plan within colleges and schools of music.

An outcome of the ensuing dialogue, of which the NASM-PAMA advisory served as a catalyst, the NASM Board of Directors on Sunday, November 20, 2011, approved an addendum to the NASM Handbook 2010-11.[37] This addendum included the addition of new items to the standards for accreditation and to the guidelines and recommendations portion of this document. Under Standards II. Purposes and Operations, F. Facilities, Equipment, Technology, Health, and Safety, 1. Standards; the following item was added:

> i. It is the obligation of the institution that all students in music programs be fully apprised of health and safety issues, hazards, and procedures inherent in practice, performance, teaching and listening both in general and as applicable to their specific specializations. This includes but is not limited to information regarding hearing, vocal and musculoskeletal health and injury prevention, and the use, proper handling, and operation of potentially dangerous materials, equipment, and technology. Music program policies, protocols, and operations must reflect attention to injury prevention and to the relationships among musicians' health, the fitness and safety of equipment and technology, and the acoustic and other health-related conditions in practice, rehearsal, and performance facilities. Specific methods for addressing these issues are the prerogative of the institution.
>
> NOTE: Health and safety depend in large part on the personal decisions of informed individuals. Institutions have health and safety responsibilities, but fulfillments of these responsibilities can and will not ensure any specific individual's health and safety. Too many factors beyond any institution's control are involved. Individuals have a critically important role and each is personally responsible for avoiding risk and preventing injuries to themselves before, during, and after study or employment at any institution. The NASM standards above and applicable guidelines below, and institutional actions taken under their influence or independently do not alter or cancel any individual's personal

[36] Ibid.

[37] National Association of Schools of Music, "Addendum to the NASM Handbook 2010-11," http://nasm.arts-accredit.org/site/docs/Handbook/NASM_HANDBOOK_2010-11_T.pdf (accessed January 5, 2012), 14.

> responsibility, or in any way shift personal responsibility for the results of any individual's personal decisions or actions in any instance or over time to any institution, or to NASM.[38]

Under the subsequent section, labeled 2. Guidelines and Recommendations, two new items were added:

> d. Normally, institutions or music programs have policies and protocols that maintain strict distinctions between the provision of general musicians' health information in the music program and the specific treatment of individuals by licensed medical professionals.
>
> e. Normally, institutions and music units develop their specific methods for addressing health and safety issues in consultation with qualified professionals in the fields of health and safety and any related areas.[39]

In lieu of this national acknowledgement officially recognizing health and safety promotion by the NASM, and indirectly through earlier efforts by the PAMA, it was prudent to consider research on current sound intensity levels within the educational and professional music settings. Lang, author of *Environmental Impact on Hearing: Is Anyone Listening?*, cites that the National Institutes of Health (NIH) estimates "more than 20 million Americans are exposed on a regular basis to industrial or recreational noise that could result in hearing loss."[40] She went on to include musicians in a list of professions most susceptible to NIHL.[41] Therefore, the question of whether musical ensembles are capable of producing harmful levels of exposure is a necessary part of the discussion. As a result, an investigation of the literature in this area was completed.

---

[38] Ibid.
[39] Ibid,14-15.
[40] Leslie Lang, "Environmental Impact on Hearing: Is Anyone Listening?" *Environmental Health Perspectives* 102, no. 11 (November 1994): 924.
[41] Ibid.

## Noise Exposure of Professional-Based Ensembles

Within professional contexts, the music industry's various specialties (e.g. choir, wind symphony/band, and symphony orchestra, etc.) have documented independent sound studies that warn against the risk of hearing loss, cite the exceedance of recommended exposure levels, and highlight the need for hearing health promotion among musicians playing in ensemble-based activities. Boasson et al. sampled 178 of 258 (69%) of the Dutch Ballet Orchestra (Haarlem, Netherlands) and concluded, "High sound levels during short periods of time lead to temporary threshold shifts that influence the working conditions of musicians in a negative way."[42] McBride et al. measured 63 of the 89 musicians (70%) of the Birmingham Symphony Orchestra (United Kingdom) and discovered half of the rehearsal measurements ($n$ = 5) produced equivalent continuous sound exposure readings above 85dB.[43] Using personal dosimeters, Laitinien *et al* sampled rehearsals (individual and group) and performances ($N$ = 87) of the Finnish National Opera and reported, "apart from the double bass players, all events exceeded the national action level of 85dB."[44] Babin sampled 14 different productions of Broadway musicals in New York City and discovered "thirteen performances (76%) with sound levels above those recommended by NIOSH for a four-hour period…two shows exceeded the OSHA action level for two-hour exposure, and three shows exceeded the OSHA ceiling limit (115 dBA)."[45] Within choral singing, peak

[42] A. Boasson, R.A. Metkemeijer and J.H. Granneman, "Sound Exposure of Musicians in a Pit Orchestra: A One Year Study Survey During Rehearsals and Performances in the Netherlands Ballet Orchestra," *Proceedings of the Institute of Acoustics* 24, no. 4 (2002): 34.

[43] David McBride et al., "Noise and the Classical Musician," *British Medical Journal* 305, no. 6868 (December 1992): 1561-1563.

[44] Heli Laitinen et al., "Sound Exposure Among the Finnish National Opera Personnel," *Applied Occupational and Environmental Hygiene* 18, no. 3 (March 2003): 177-182.

[45] Angela Babin, "Orchestra Pit Sound Level Measurements in Broadway Shows," *Medical Problems of Performing Artists* 14, no. 4 (December 1999): 204.

levels have exceeded 110dBA as evidenced by sampling the Vienna State Opera choir where Steurer et al. concluded that 62 out of 82 members (76%: 30 females, 32 males) had permanent threshold shifts at 250 Hz and above.[46] Steurer also remarked that these threshold shifts "are most likely noise induced with choir singing as [the] noise source."[47] Much like professional music ensembles, educational-based ensembles in college-level schools of music have been found to exhibit similar instances of exceeding recommended threshold levels for noise.

## Noise Exposure of Educational-Based Ensembles

During instructional education-based activities in college-level schools of music, Chesky studied 43 separate events of the University of North Texas (UNT) Symphonic Band and Concert Band during the fall semester of 2007 and reported the "mean dose per event for the entire sample was 109.5% (ranging from 53.8% to 166.9%) of the daily allowable dose as defined by NIOSH."[48] Individuals within UNT jazz ensembles have also been studied with 10 of the 15 participants found to have been exposed to sounds exceeding allowable exposure limits for a three-hour duration.[49] More specifically, the time-varying sound pressure levels ($L_{eq}$) measured in the lead saxophone would present an equivalent continuous sound dose for an eight-hour period in excess of 400%.[50] Based on the findings, music ensembles, both professional-based and educational-based, are capable of producing noise levels that are harmful to human hearing.

---

[46] Martin Steurer et al., "Does Choir Singing Cause Noise-Induced Hearing Loss?" *Audiology* 37 (1998): 38-51.

[47] Ibid., 38-51.

[48] Chesky, "Sound Exposure Levels by Univ. Wind Bands," 30.

[49] Kris Chesky and Miriam A. Henoch, "Sound exposure levels experienced by a college jazz band ensemble: Comparison with OSHA risk criteria," *Medical Problems of Performing Artists* 15 (2000): 17-20.

[50] Ibid., 17-20.

## Hearing Protection Devices

To remedy the issue of excess noise exposure during ensemble-based activities it seems that earplugs might serve as a useful tool for preventing the risk of hearing damage. However, research indicates that hearing protection devices (HPD) are subject to problems and should be considered as a last resort against hazardous noise in an occupational setting.[51] The NIOSH classifies HPDs into 3 categories: 1) earplugs (foam, silicone, fiberglass), 2) ear canal caps (sometimes referred to as semi-inserts), and 3) earmuffs.[52] HPDs are designed for industrial use, with stronger attenuation at higher frequencies and smaller attenuation at lower frequencies; and consequently present limitations when used in a musical setting.[53] To overcome the attenuation problem, "musician earplugs" surfaced in 1985 to provide a custom-molded flat-attenuating (with filter strengths of 9, 15, 25dB) plug designed for hearing sounds across the frequency spectrum unaltered but quieter.[54] Despite the large selection and availability of professional grade earplugs (formable, pre-molded, and custom-molded) and the flat-attenuation musicians' earplugs, professional musicians report using HPDs only seldom.[55] In schools of music, HPDs and flat-attenuating musicians' earplugs

[51]U.S. DHHS, NIOSH, *Criteria for a Recommended Standard,* 63; Kris Chesky *et al.*, "An evaluation of musician earplugs with college music students," *International Journal of Audiology* 48 (2009): 661; Sound Advice, Schools and Colleges: What you need to know, http://soundadvice.info/schoolsandcolleges/schoolsandcolleges-step1.htm (accessed March 5, 2012).

[52] U.S. Department of Health and Human Services, National Institute of Occupational Safety and Health, *Preventing Occupational Hearing Loss: A Practical Guide,* Rev. ed. 1996 (Cincinnati, OH, PB: 96-110), 37.

[53]Heli Koskinen, "Hearing Conservation Among Classical Musicians; Needs, Means, and Attitudes" (DST diss., Alto University School of Science and Technology, 2010), 17.

[54] M. Killion, E. DeVilviss, and J. Stewart, "An Ear plug with uniform 15-dB attenuation," *Hearing Journal* 45, no. 5 (1988): 14-17.

[55] Heli Laitinen, "Factors affecting the use of hearing protectors among classical music players," *Noise and Health* 7, no. 26 (January-March 2005): 21-29; Heli Laitinen and T. Poulsen, "Questionnaire investigation of musicians' use of hearing protectors, self reported hearing disorders, and their experience of their working environment," *International Journal of Audiology* 47, no. 4 (2008): 160-168; M.F Zander, C. Spahn, and B. Richter, "Employment and acceptance of hearing protectors in classical symphony and

reported use is also seldom and not consistent over time.[56] Reasons the majority of musicians are not consistently using earplugs over time ranges from discomfort, cost, and inability to communicate musically (e.g. an inability to hear their own playing or the playing of their colleagues).[57] It is important to note that conductor usage of HPDs is unknown and not specifically addressed in the literature. The infrequent use of HPDs among student musicians and the recommendation that HPDs should be considered as a last resort necessitated examining the literature for alternative means of managing sound intensity levels within education-based ensembles. This compelled the researcher to review the literature to identify how instructors in charge of ensemble-based settings, the conductors, conceptualize noise exposure.

## The Conductor and Ensemble-Based Instructional Activity

Based on the literature, the person managing sound intensity levels is worthy of consideration in the effort to create hearing health-aware colleges and schools of music. In the educational setting conductors have a primary role in controlling and managing the sound levels of education-based ensembles.[58] The research in this area provided

---

opera orchestras," *Noise and Health* 10, no. 38 (2008): 14-26; K.H. Huttunen, V.P. Sivonen, and V.T. Poykko, "Symphony orchestra musicians' use of hearing protection and attenuation of custom-made hearing protectors as measured with two different real-ear attenuation at threshold methods," *Noise and Health* 13, no. 51 (2011): 176-188; Robert Thayer Sataloff and Joseph Sataloff, "Hearing Loss in Musicians," Journal of Occupational Hearing Loss 1, no. 3 (1998): 185-194.

[56]Vanessa Miller, Michael Stewart, and Mark Lehman, "Noise Exposure Levels for Student Musicians," *Medical Problems of Performing Artists* 22, no.4 (December 2007): 160-165; Chesky et al., "An evaluation of musician earplugs," 661; Laitinen, "Hearing protectors among classical music players," 21-29; Koskinen, "Hearing Conservation Among Classical Musicians;" M. C. Zeigler and J. A. Taylor, "The Effects of a Tinnitus Awareness Survey on College Music Majors' Hearing Conservation Behaviors," *Medical Problems of Preforming Artists* 16, no. 4 (2001): 136-143.

[57]Huttunen, Sivonen, and Poykko, "Symphony orchestra musicians' use of custom-made hearing protectors," 176-188; Chesky et al., "An evaluation of musician earplugs," 661; Laitinen, "Hearing protectors among classical music players," 21-29; E Emmerich, L. Rudel, F. Richer, "Is the audiologic status of professional musicians a reflection of the noise exposure in classical orchestral music?" *European Archives of Otorhinolaryngol* 256, no. 7 (July 2008): 753-758.

[58] Chesky, "Schools of Music and Hearing Loss Prevention," S33; Chesky, "Sound Exposure Levels by University Wind Bands," 34; Chesky, "Hearing Conservation and Music Education," 91; Johnson and Meinke, "NIHL: Implications for School," 59; Folmer, "Hearing-Loss Prevention Practices

data sets highlighting the existence of risk; the overexposure to loud sounds for extended periods of time, within the ensemble-based musical community; and the recognition that the conductor is a significant factor contributing to the issue of exceeding recommended threshold levels for noise.[59] A conductor is the leader, and by default the instructor of ensemble-based instructional activities (EBIA) in college-level schools of music.

As the leader of EBIAs, the conductor seeks to guide compositions into a unified musical concept. During this process, the conductor is faced with decisions regarding volume (i.e. dynamics), balance, color, texture, character/mood, and all other artistic choices deemed significant. The consequences of these decisions create specific sound intensity levels, quantifiable using dosimeters, which directly impact the noise exposure levels of every musician in an EBIA. In this situation the student musician does not possess absolute control of the duration of noise exposure or the cumulative exposure level produced over time. The student musician is asked to depend upon an external factor - the conductor (i.e. instructor) - to be informed, educated, responsible, and competent in context of potential noise exposure risks generated during an EBIA. To inform adequately the student musician about hearing health and ultimately manage any potential risk to human hearing during an EBIA, the conductor must adopt awareness of and possess a minimum competency of hearing health promotion and

---

Should Be Taught in Schools," 67; Chesky and Henoch, "Sound exposure by a college jazz band ensemble," 17-20; Sandra Teglas Mace, "A descriptive analysis of university music performance teachers' sound-level exposures during a typical day of teaching, performing, and rehearsing" (paper presented at the *9th International Conference of Music Perception and Cognition*, Univ. of Bologna, Italy, August 22-26, 2006); Sound Advice, "Schools and Colleges," (accessed February 18, 2012).

[59] Ibid.

safety, which includes knowledge of the sound intensity (noise exposure) levels generated during an EBIA.

The topic of conductors and their pedagogical behaviors influencing sound intensity levels surfaced at UNT and the Texas Center for Music and Medicine. In *Schools of Music and Conservatories and Hearing Loss Prevention*, Chesky referenced a study (Chesky and Araujo, 2008) of 15 college of music ensembles with "preliminary results showing 40% (242) of 666 (*N*) individual ensemble-based instructional events within the UNT College of Music have exceeded 100% [allowable] dose."[60] Because dose levels were measured across variable rooms, ensemble types, and over time for individual courses, he suggested "behavioral factors including the pedagogical approach of the instructor" might be a significant factor contributing to these results.[61]

There is a need, therefore, to understand on what knowledge conductors base decisions about music selection and rehearsal technique. Also, there is a need to inquire about conductor attitude toward hearing health in general and their willingness to impart information about hearing health to their students. At this point an examination of literature in other disciplines was needed. The behavioral and social sciences contain theories of behavioral influences that could prove relevant to assessing certain attitudes of a conductor, and investigation of these areas provided a tested framework.

Glass and McAtee used the term "risk regulator" as a concept to establish and sustain how certain social influences regulate specific social behaviors.[62] Obesity was

[60] K. Chesky and E. Araujo, "Longitudinal Dosimeter Data from 15 College-based Music Ensembles. Oregon or Bust: The Trail to Better Hearing." 33rd Annual Hearing Conservation Conference, (February 21-23rd, 2008), Portland, Oregon; Chesky, "Sound Exposure Levels by University Wind Bands," 29-34.

[61] Chesky, "Schools of Music and Hearing Loss Prevention," S35.

[62] Thomas A. Glass and Mathew J. McAtee, "Behavioral Science at the Crossroads in Public Health: Extending Horizons, Envisioning the Future," *Social Science and Medicine* 62 (2006): 1650.

used as an example because, as the authors explain, it has "undeniable roots in complex human behavior, with obvious, but as yet unspecified environmental antecedents."[63] That is to say that social cues may contribute or suppress the desire to overeat. Therefore, based on Glass and McAtee's discussion, conductors of EBIAs could theoretically become better risk regulators if their social environment promoted such behavior. The scholarship regarding social influences or specific behaviors of conductors during EBIAs is underdeveloped within the field of music education.[64] Once conductors grasp that they can act as "regulators" of risk, then perhaps they will seek to clarify the perceived behavioral influences associated with hearing health and sound intensity levels generated during EBIAs.[65]

Another discipline that provided theoretical basis for examining conductor practices and attitudes is the field of sports medicine. It serves as an effective model due to its similarities in performance, competition, use of the physical body, and team/ensemble-oriented design. Recently the *Journal of Athletic Training* published an article including current best practices and recommendations regarding the prevention of pediatric overuse injuries. In this article, the National Athletic Trainers' Association (NATA) outlined a position statement and provided "recommendations based on current evidence pertaining to injury surveillance, identification of risk factors for injury, pre-participation physical examinations (PPEs), and proper supervision and education."[66] Such recommendations may have direct parallels in the field of music and therefore require further discussion.

---

[63] Ibid., 1661.
[64] Chesky, "Hearing Conservation and Music Education," 91.
[65] Chesky, "Sound Exposure Levels by University Wind Bands," 29.
[66] Tamara C. Valovich McLeod et al., "National Athletic Trainers' Association Position Statement: Prevention of Pediatric Overuse Injuries," *Journal of Athletic Training* 46, no. 2 (April 2011): 206.

The field of sports medicine has already established decades of research as Anderson and Bacon acknowledged, “In 1975, the American College of Sports Medicine began recommending the integration of change theory in the delivery of health-related and rehabilitation-based programs in which exercise prescription was a major part.”[67] Their explanation of change theory highlighted an aspect pertinent to music, “a critical distinguishing factor in facilitating change in clients is the practitioner’s ability to assess the level of readiness of their client to change.”[68] When placing the music colleges and schools within the sports medicine model, college-level schools of music would serve as the practitioner seeking to change the hearing health practices of the conductor. Therefore, if college-level schools of music intend to facilitate change in the way that Anderson and Bacon suggest, then they will need to “assess the level of readiness” of conductors.[69]

Part of this process of assessing readiness is depicting conductor attitude toward sound intensity levels generated during EBIAs. The attitude of a conductor regarding the sound intensity levels they help to generate during EBIAs has not been researched conclusively in the field of music. Ajzen’s *Theory of Planned Behavior*, in addition, states, “A person’s intention to carry out a behavior is dependent upon their attitudes regarding a specific behavior, subjective norms, and perceived behavioral control.”[70] Presently we do not know the subjective norms that exist for a conductor or how they perceive sound intensity levels during EBIAs. Chesky *et al* surveyed 467 students (280

[67] Marcia K. Anderson and Victoria L. Bacon, “Is Knowledge of Change Theory a Critical Competency in the Training of Health Care Practitioners?” *College Quarterly* 9, no. 4 (Fall 2006), under “Teaching and Learning,” http://www.collegequarterly.ca/2006-vol09-num04-fall/anderson_bacon.html (accessed February 18, 2012).

[68] Ibid.

[69] Ibid.

[70] Icek Ajzen, “The Theory of Planned Behavior,” *Organizational Behavior and Human Decision Processes* 50 (1991): 179-211.

men, 187 women; 49.7% identified themselves as music majors) to show "students majoring in music have a healthier attitude toward sound compared to students not majoring in music…[and]…music majors may be more likely than other students to respond to and benefit from a hearing loss prevention program."[71] Surveying the conductor, both generally and specifically, to determine a positive or negative attitude toward hearing health issues and the factors that influence sound intensity levels generated during EBIAs is a largely unexplored process. Rawool studied auditory life styles and beliefs of 238 college students (40 men, 198 women) with reference to exposure to loud sounds and reported "a critical need for promoting healthy hearing behavior among college students."[72]

Because conductors are the instructors of EBIAs it is necessary to understand their position in regard to hearing health awareness and promotion. In effect, the focus of this research includes a descriptive study of conductors using an online survey tool. Questionnaires present an effective method for research of this kind. Forsythe *et al.* recently used a questionnaire to study "the views of music teacher education faculty and preservice music students concerning the NASM standards for music teacher education"[73] Millican, in addition, used a survey tool to study band and orchestra teachers' rankings of general pedagogical knowledge and skill.[74] To date, however, no known studies have produced a questionnaire to survey conductor awareness of,

[71] Kris Chesky et al., "Attitudes of College Music Students Towards Noise in Youth Culture," *Noise & Health* 11, no. 42 (January-March 2009): 49.

[72] Vishakha W. Rawool and Lyndia A. Colligon-Wayne, "Auditory Lifestyles and Beliefs Related to Hearing Loss Among College Students in the USA," *Noise & Health* 10, no. 38 (January-March 2008): 1.

[73] Forsythe et al., "Opinions on the NASM Music Standards," 22.

[74] J. Si Millican, "Band and Orchestra Teachers' Rankings of General Pedagogical Knowledge and Skill," *Journal of Music Teacher Education* 19, no.1 (August 2009): 68.

knowledge of, and attitude toward hearing health or toward sound exposure levels generated during EBIAs in college-level schools of music.[75]

This information could enable a description of how the new NASM hearing health policy may influence ensemble directors, ensemble-based instructional activities, and the music education community at large. It could also provide a starting point upon which NASM, PAMA, or other national music organization's efforts toward hearing health awareness and promotion among music-related disciplines may build. Although accreditation by NASM is voluntary, Janet Barett, chair of the Society for Music Teacher Education (SMTE), remarked "standards for accreditation shape teacher education programs when they provide useful frameworks for constructing and evaluating the scope, sequence, and coherence of a particular program."[76] With an understanding of conductor awareness, knowledge, and attitude, the framework that Barrett identified could be constructed to support hearing health awareness in college-level schools of music. It could also aid the music education community as it begins to apply NASM's revised standards, guidelines, and recommendations.

The purpose of this research, therefore, is to describe what conductors of college-based ensembles know about sound intensity levels generated in schools of music. Are they aware of the sounds being generated? If so, what do they know? If not, are they willing to learn and share this knowledge with their students? This research sought to answer these questions through an online questionnaire. Specific aims of the study are:

[75] Alberto Behar et al., "Noise Exposure of Music Teachers," *Journal of Occupational and Environmental Hygiene* 1, no. 4 (April 2004): 243-247.

[76] Janet Barrett, "Intersections of Practice, Research, and Policy in Music Teacher Education," *Journal of Music Teacher Education* 20, no. 2 (2011): 3.

1) Describe the current state of conductors' awareness and knowledge of sound intensity levels.

2) Describe the current attitudes of conductors toward learning and toward sharing knowledge of sound intensity levels.

3) Describe the current teaching practices of conductors in regard to their use or lack of use of equipment (i.e. sound level meter, noise dosimeter, personal hearing protection) relating to sound intensity levels.

# CHAPTER 2

## METHOD

The study utilized an online questionnaire to assess conductor awareness of, knowledge of, and attitude toward sound intensity levels generated during EBIAs in college-level schools of music. The questionnaire, a survey tool designed by the researcher, was administered to members of the College Music Society (CMS) through Qualtrics, an internet-based software program.

### Participants

Purposive sampling was used to recruit participants from the CMS directory, which contained a total of 8,478 members, who 1) identify themselves as conductors in college-level schools of music and 2) are employed in the United States.[77] The CMS directory is organized by music specialization categories and corresponding catalog numbers, which members (previous to the study) select upon joining or renewing their CMS membership to self-identify their specialization(s) within the field.[78] Members are permitted to select one or a combination of categories from the list to describe their qualification(s). The researcher and the CMS director of communications selected eleven music specialization categories in which conductors would most likely self-identify. The resulting categories and respective catalog numbers selected were: choral (36), band (37), orchestra (38), opera (39), vocal chamber ensemble (40), instrumental chamber ensemble (41), jazz/stage band (46), jazz ensemble (47), conducting-choral

[77] The College Music Society, "2011 Annual Report of the College Music Society", under Membership, http://live.music.org/index.php?option=com_content&view=article&id=315:membership&catid=59:cms-annual-report-2011&Itemid=306 (accessed May 1, 2012).

[78] The College Music Society, "Homepage," http://music.org (accessed August 30, 2011).

(60), conducting-vocal (60a), conducting-instrumental (60b).[79] The potential research participants were amassed into an electronic mailing list and the Director of Communications purged the list to remove duplicate entries and any members not employed in the United States. The resulting number of recruited potential research participants was 1,507.

## Measures

The researcher-designed online questionnaire titled, Albin Conductor Survey (ACS) was developed using the Internet software program Qualtrics (2011).[80] While the researcher was aware of the pitfalls of designing a new instrument, extensive discussion and research alongside the director of UNT's Texas Center for Music and Medicine (TCMM) determined that the development of a new survey tool was necessary.

The specific aims of the study were consulted to draft objectives for each part of the new survey tool and to aid in question content and design. It was deemed necessary to divide the ACS into six parts with five objectives. The five objectives and the corresponding specific aim used for question content are listed below:

Part I. Describe the conductor's knowledge of and attitude toward sound intensity levels generated during EBIAs. (Specific Aim 1 and 2)

Part II. Describe and rank the conductor's perceived levels of dependency regarding various factors that may affect sound intensity levels generated during EBIAs. (Specific Aim 1)

Part III. Describe the conductor's attitude toward informing and educating both their students and themselves about sound intensity levels generated during EBIAs. (Specific Aim 2)

[79] CMS, *Directory of Music Faculties in College and Universities, U.S. and Canada, 2010-2011*. 32 ed. (Montana: Missoula, 2010), preface.

[80] Qualtrics, Web-Based Survey Software http://qualtrics.com (accessed August 15, 2011).

Part IV. Describe the conductor's personal teaching practices and attitude toward using sound measurement technologies (i.e. sound level meter, noise dosimeter, personal hearing protection) during their EBIAs. (Specific Aim 3)

Part V. Describe the conductor's knowledge of and attitude toward hearing health awareness and promotion during their EBIAs (Specific Aim 1, 2, and 3)

Part VI. Collect demographic data of conductors teaching EBIAs in college-level schools of music. (Demographics)

The ACS tool was created with the supervision of the Director of the TCMM and the Director of Orchestral Studies at UNT. Repeated evaluation of each question ensued over a two-year period where content, clarity, and validity were checked and rechecked. During this time, three researcher-led workshop sessions were also conducted to further confirm and develop question clarity and content.

Current teaching practices were also surveyed, as conductor awareness, knowledge, and attitude ultimately influence teaching practices. Because question content of the ACS was derived from the specific aims of the study, it was also grouped into three broad categories labeled- 1) Specific Aim 1: Conductor awareness and knowledge of sound intensity levels, 2) Specific Aim 2: Conductor attitude toward sound intensity levels, and 3) Specific Aim 3: Conductor teaching practices regarding the usage of equipment relating to sound exposure. These categories provided a measure for describing the current state of conductor awareness, knowledge, attitude, and teaching practice and are explained below.

*Specific Aim 1: Conductor Awareness and Knowledge of Sound Intensity Levels*

Questions were formatted to determine whether conductors are aware that sounds generated during EBIAs in college-level schools of music are capable of exceeding intensity levels harmful to human hearing. They also sought to determine

whether conductors think sounds generated during EBIAs they conduct ever exceed intensity levels harmful to human hearing. Skip logic on the Qualtrics software was used to assess the frequency, on a visual analog scale (VAS), of how often sounds exceeded intensity levels known to be harmful to human hearing. If the participant chose “no” or “I don’t know” to sounds being harmful to human hearing, then the software skipped the frequency question.

A VAS scale was used to determine conductor concern regarding potential harm to the hearing health of conductors (in general), their own hearing health, the hearing health of students during EBIAs, and their own students’ hearing health during EBIAs they conduct. Intensity of the responses was measured using a VAS scale asking conductors to rate their level of concern toward potential harm to the same four categories: the hearing health of conductors, their own hearing health, the hearing health of students during EBIAs, and their own students’ hearing health during EBIAs they conduct.

Awareness of conductors’ current state of hearing health was also surveyed. Inquiries covered the existence of NIHL, frequency of obtaining a hearing exam, and date of their most recent hearing exam. An additional question was formatted to identify what services and resources are offered and available to students of EBIAs in college-level schools of music. Multiple researcher-designed options were allowed to be selected, which included: information about sound intensity levels generated during EBIAs, undergraduate course(s) offering hearing health awareness and promotion among musicians, audiology services (free and fee-based), personal hearing protection (free and fee-based), referral/contact information to local hearing health clinics,

information/community resources about hearing health awareness and promotion, and "I don't know," and "other" options which provided a blank text entry for free response.

To determine conductor knowledge of elements that may contribute to sound intensity levels, questions were formatted to allow participants to rate their level of agreement with eight factors that are presumed to affect sound intensity levels. The eight factors were predetermined by the researcher and included: size of room, acoustics of the room, type of ensemble (e.g. orchestra, choir, band, etc.), total number of students in the ensemble, instructional planning and organization/the way they rehearse the ensemble, selected repertoire, duration of the EBIA, and ensemble's level of ability/classification (e.g. beginner, advanced, etc.). Conductors were asked to rate the level of dependency sound intensity levels have on each factor using a VAS scale ranging from "not dependent at all" to "totally dependent."

*Specific Aim 2: Conductor Attitude Toward Sound Intensity Levels*

Attitude was surveyed through questions designed to describe conductor opinion toward and openness to learning and to sharing hearing health information and the relevance of informing and of educating music students about hearing health. A yes/no question determined whether conductors believe college-level music majors, as part of their curriculum, should be informed and be educated about hearing health during EBIAs. Another question, through the use of a 4-point Likert scale determined the rate at which conductors thought students should be informed and be educated about sound intensity levels generated during EBIAs.

To determine conductor openness to being informed and being educated and to informing and educating both their students and themselves about sounds generated

during EBIAs, yes/no questions were used. A 4-point Likert scale was again utilized to determine the rate at which conductors personally inform and personally educate their students about sound intensity levels. Two additional questions aimed to provide insight into whether conductors were open to "changing teaching practices" or "learning alternative teaching practices" to prevent sounds from exceeding intensity levels that are harmful to human hearing.

*Specific Aim 3: Conductor Teaching Practices Regarding the Usage of Equipment Relating to Sound Exposure*

To characterize the current teaching practices of conductors, survey questions were designed to describe the use or lack of use of sound measurement technology (e.g. sound level meter or noise dosimeter) and personal hearing protection during EBIAs in college-level schools of music.

Yes/no format was used to determine whether conductors are open to using sound measurement technologies and an alternate question used a 3-point Likert scale, of *never*, *occasionally*, and *routinely*, to determine the frequency conductors are currently using sound measurement technology during EBIAs. Two additional questions employed a yes/no answer format to determine whether conductors were willing to use relevant data provided by sound measurement technologies and whether they would allow students to access the data.

The final topic of inquiry regarding characterization of conductor teaching practices addressed the use of hearing protection. A 4-point Likert scale with levels of *never*, *rarely*, *occasionally*, and *routinely*, was used to determine the rate at which conductors use hearing protection during EBIAs. No specific type of hearing protection (e.g. pre-molded, custom, flat-attenuating) was stipulated.

## Pilot Study

To ensure instrument reliability a pilot study was administered on the UNT campus to guarantee clarity of questions, ease of usage by the research participants, manipulation of the Qualtrics software by the researcher, and test re-test reliability. The pilot study was conducted at the College of Music, and participants were those whose profiles resembled that of the survey population. A total of twelve participants ($N$ = 12) were recruited and asked to take the ACS online on two separate occasions for test re-test reliability. The research participants were given five days to take the survey and then asked to re-take the same survey again one week later.

Test retest reliability for each individual question ranged from $r$ = -.171 to $r$ = 1.000 with an average of $r$ = .899 ($p$ < .01). Four of the 40 questions were not reliable at a significance level of at least 0.05 and were considered for revision. Two of the remaining questions were reliable at a significance level of at least 0.05, and 34 questions were reliable at the 0.01 significance level. Each question and its corresponding Pearson correlation is shown in Table 1.

Table 1. Test re-test reliability of each question on the ACS

| Question | Pearson Correlation | Question | Pearson Correlation | Question | Pearson Correlation |
|---|---|---|---|---|---|
| 2 | 1.000** | 8.2 | 0.785** | 12 | -0.091 |
| 3 | 1.000** | 8.3 | 0.891** | 13 | 1.000** |
| 4 | 1.000** | 8.4 | 0.830** | 14.1 | 1.000** |
| 5 | 0.840** | 8.5 | 0.185 | 14.2 | 1.000** |
| 6.1 | 0.970** | 8.6 | 0.868** | 15 | 1.000** |
| 6.2 | 0.789** | 8.7 | 0.649* | 16 | 1.000** |
| 6.3 | 0.837** | 8.8 | 0.861** | 17 | 1.000** |
| 6.4 | 0.680* | 9.1 | 0.813** | 18.1 | 1.000** |
| 7.1 | 0.967** | 9.2 | -0.171 | 18.2 | 1.000** |
| 7.2 | 0.783** | 10.1 | 0.099 | 19.1 | 1.000** |
| 7.3 | 0.785** | 10.2 | 0.916** | 19.2 | 1.000** |
| 7.4 | 0.864** | 11.1 | 0.933** | 20.1 | 1.000** |
| 8.1 | 0.967** | 11.2 | 1.000** | 20.2 | 1.000** |

**. Correlation is significant at the 0.01 level (p<.01) Range: -0.171 – 1.000**

*. Correlation is significant at the 0.05 level (p<.05)

The final ACS contained thirty-nine questions (including demographics) and used a combination of five response formats: yes/no, VAS, drop-down menu, multiple response, and Likert scale. It was formatted in six parts in alignment with the five objectives (plus a demographics part) and the three specific aims of the study. The complete ACS is located in Appendix E.

## Procedures

To ensure appropriateness and feasibility of the ACS tool a CMS-designated committee approved the questionnaire (see Appendix B) prior to implementation. The Director of Communications for CMS then formatted an HTML document (see Appendix C) based on the researcher's protocol. An email containing the HTML document was distributed to sampled CMS members on Tuesday, November 15, 2011. The email included a hyperlink directing participants to the ACS online tool and requested their voluntary and anonymous completion of the questionnaire. A reminder email (see Appendix D) was sent two weeks later on Tuesday, November 29, 2011. The ACS tool

remained active for four weeks and final data was collected on Tuesday, December 13, 2011.

To obtain participants' informed consent an electronic version of the IRB-approved informed consent letter appeared at the outset of the online questionnaire. After participants chose to engage the hyperlink, which directed them to the online questionnaire, the consent letter immediately appeared. No portion of the survey could be accessed without the participant's informed consent.

After the informed consent but prior to accessing the main body of the ACS tool, participants were additionally asked to identify themselves as "conductors employed by college-level schools of music." The following definitions were provided alongside this question for clarification of the terminology:

> A "conductor" is any person identified as the ensemble director, instructor, leader, and/or teacher of an ensemble-based instructional activity (EBIA) in a college-level school of music.
>
> An "ensemble-based instructional activity" (EBIA) is any credit-granting performance-oriented course, lab, or ensemble comprised of student musicians receiving instruction from a conductor. Additionally, these EBIAs seek to acquire growth in artistry, technical skills, collaborative competence, and knowledge of repertory through regular ensemble experiences.
>
> A "college-level school of music" is any conservatory, college, or university offering an associate degree, baccalaureate degree, graduate degree, and/or artist certificate/diploma in at least ONE of the following areas: General Music, Sacred Music, Music Education, Music Performance, Music Theory, Music Composition, Musicology, Ethnomusicology, Jazz Studies, or Liberal Arts with a Major in Music.
>
> "Employment" includes any faculty, staff, adjunct, student, teaching fellow/assistant, and/or employee receiving compensation to serve as a conductor.

Another clarification of terminology was necessary for the four questions located in Part IV of the ACS. Here the phrase "sound measurement technologies" was used to

indicate two types of equipment most frequently associated with the measurement of noise exposure. The following definition was provided in the ACS directions proceeding question 14.

Types of sound measurement technology:

1. Sound Level Meter: A sound level meter is an instrument that measures sound pressure level (SPL) in decibels (dB).

2. Noise Dosimeter: A noise dosimeter is a specialized sound level meter intended specifically to measure the noise exposure of a person, integrated over a period of time.

## Demographics

Demographic questions were included, and answer format varied. Background questions were formatted to provide a supplemental description of the sample, including: gender, age, total number of years spent working as a conductor, total number of years spent in academia instructing EBIAs, race, country of origin, state of employment, academic rank, completion of tenure, employment by an NASM-accredited institution, academic training, and what field(s) best describe(s) their formal training.

Another portion of the demographics gave conductors an opportunity to outline the type of ensemble(s) they conduct within a college-level school of music. Conductors were allowed to choose up to five of 19 potential ensemble types to describe their conducting environment(s) ranging from big band/jazz, brass ensemble, baroque orchestra, chamber ensemble (instrumental), chamber ensemble (vocal), choral, early music/period instrument ensemble, electronic music, marching band/pep, musical theatre, new music, opera, percussion ensemble, string ensemble, symphony orchestra, wind symphony/band, vocal jazz ensemble, woodwind ensemble, and other. Conductors also indicated the number of musicians in the ensemble, the number of

rehearsals per week, the duration in minutes of each rehearsal, and the total number of performances given each semester.

The same categories were included for conductors to describe ongoing professional non-EBIA(s) outside of academia where they are employed as the principal conductor, with the exception that rehearsals were based on a monthly scale instead of per week and the performances were calculated per year and not per semester. The conductor was additionally asked to classify the ensemble as a professional-based activity (one where the musicians are paid to participate) or a community-based activity (one where the musicians volunteer their services).

## Data Analysis

The information collected from the ACS tool was exported for data management and analyses into SPSS 20 and Microsoft Excel.[81] Due to the prevalence of nominal and ordinal data, descriptive statistics served as the primary method of measurement. Though the visual analog scale (VAS) is an interval level of measurement, it is best interpreted for purposes of this research through descriptive statistics. The nature of the questionnaire seeks to determine trends as they exist in conductors' awareness of, knowledge of, and attitude toward sound intensity levels generated during EBIAs in college-level schools of music. Means, ranges, and standard deviations provide an accurate picture of conductor characteristics as well as the differences that exist between the perceptions of wind symphony/band, choir, and orchestra conductors.

[81] (SPSS Inc., Chicago, IL. 2008)

# CHAPTER 3

# RESULTS

## Demographics

Of the 1,507 candidates contacted 201 (13%) participants activated the ACS hyperlink and attempted to complete the questionnaire. Of these participants, 37 did not complete the questionnaire in its entirety and were excluded from the final results. Additionally two more did not agree to participate after reading the IRB-informed consent letter and were not permitted to continue. Therefore, the total number of completed surveys reported in the results of the study was *N* = 162 (11%).

As detailed in Chapter 2, the research participants (*N* = 162) were asked to identify themselves as "conductors employed by college-level schools of music" before commencing to the main body of the ACS.[82] Here 155 (95.7%) participants indicated "yes" and 7 (4.3%) selected "no, but I want to participate in this survey."

Demographic data indicate the majority of participants in the study were white/non-Hispanic (93.2%) males (73.5%) with their country of origin being the United States (90.7%). The average participant had 43.38 years of age, 22.14 years of experience working as a conductor, and 16.25 years specifically working in academia as a conductor of an EBIA. Data showed 83.3% selected a doctoral degree as the highest or most relevant attribute of their formal education with 69.1% having a performance degree with a specialization in conducting. The most common participant was assistant professor (30.2%) and full professor (29.6%), without tenure (50.6%), and employment by a NASM-accredited institution (66.0%). While California (6.8%) and Texas (5.6%) contained the highest number of participants in the study, 41 states and

[82] See Appendix E

the federal district Washington D.C. were represented. Data were not received from participants employed in Alaska, Delaware, Louisiana, Maine, Montana, New Jersey, New Mexico, Rhode Island, and Wyoming.

A total of 307 (*N*) individual EBIAs in college-level schools of music were collected. The majority of participants were choral conductors (*n* = 100, 33%). Their average EBIA contained 48.30 students, rehearsed 2.56 times per week for 71.69 minutes, and gave 3.45 performances per semester. The second highest data set was from wind symphony/band conductors (*n* = 56, 18%). Their average EBIA contained 53.29 students, rehearsed 2.23 times per week for 99.02 minutes, and gave 2.27 performances per semester.

For ongoing professional activities a total of 72 (*N*) individual events were collected. The largest data set for ensemble type was the choral ensemble (*n* = 25, 35%). The average choral ensemble contained 51.04 musicians, rehearsed 4.32 times per month for an average of 111 minutes, and completed 19 performances per year. The second largest data set in this category was from the symphony orchestra (*n* = 16, 22%). The average symphony orchestra contained 58.81 musicians, rehearsed 4.13 times per month for 146.88 minutes, and completed 7.31 performances per year.

Detailed demographic data collected is located in Appendix E.

### Specific Aim 1: Conductor Awareness and Knowledge

As seen in Figure 1, data collected shows 80.2% of conductors (participants) believe sounds generated during EBIAs in college-level schools of music are capable of exceeding intensity levels that are harmful to human hearing. The figure also shows that 39.5% of conductors state sounds generated during EBIAs they conduct have

exceeded intensity levels known to be harmful to human hearing at a average frequency of 3.16 on a VAS (0-10), ranging from “never” to “always;” and that 24.1% (*n* = 39) of conductors additionally state they do not know if sounds they conduct have ever exceeded sound intensity levels that are harmful to human hearing.

From the 307 individual EBIAs documented in the demographics, 20% of choral ensemble conductors, 41% of symphony orchestra conductors, and 75% of wind symphony/band conductors indicate “yes,” their EBIAs have exceeded intensity levels known to be harmful to human hearing.

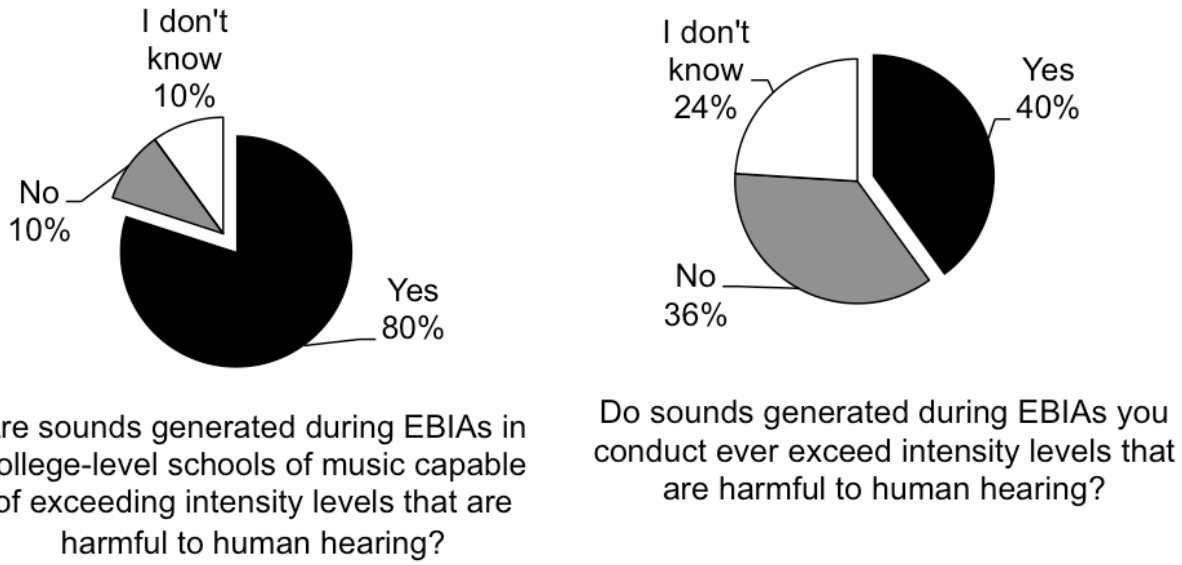



Figure 1. Percentage of conductor responses toward sounds being capable of harming human hearing and if their EBIAs ever exceed harmful levels

Figure 2 shows that the highest reported frequency of concern for conductors was toward potential harm to their own hearing health (M = 5.9), followed by general hearing health of students (M = 5.36), general hearing health of conductors (M = 5.12), and their own students’ hearing health (M = 4.66) based on a VAS (0-10) ranging from “never” to always”. The highest reported intensity of concern for conductors was toward

their own hearing (M = 6.34), followed by general hearing health of students (M = 5.76), general hearing health of conductors (M = 5.51), and their own students' hearing health (M = 5.09) based on a VAS (0-10) ranging from "no concern" to "highest possible concern." The mean frequency and the mean intensity of conductor concern between the hearing health of conductors and the hearing health of students during EBIAs was not significantly different (frequency: paired $t$ = -1.37, $p$ = .17; intensity: paired $t$ = -1.50, $p$ = .14). However, both the mean frequency and the mean intensity of conductor concern between their own hearing health and the hearing health of their students' was significantly different (frequency: paired $t$ = 5.34, ***$p$ = .000; intensity: paired $t$ = 6.21, ***$p$ = .000).

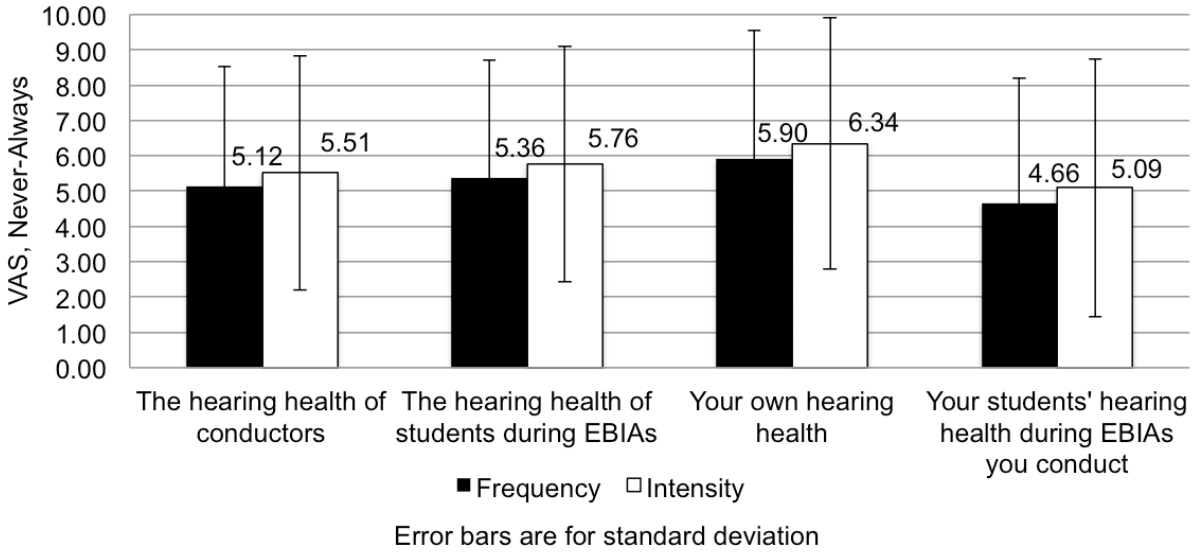



Figure 2. Frequency and intensity of conductor concern toward four statements regarding hearing health

To describe conductor awareness of hearing health, Figure 3 shows 45.7% answered, “I don’t know” to having NIHL.

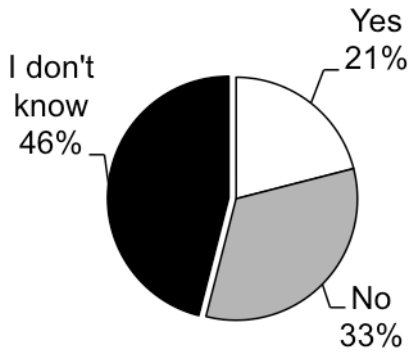



Figure 3. Percentage of conductors that indicate having NIHL

When asked how often they obtain a hearing exam, Figure 4 shows 40.1% replied “never.”

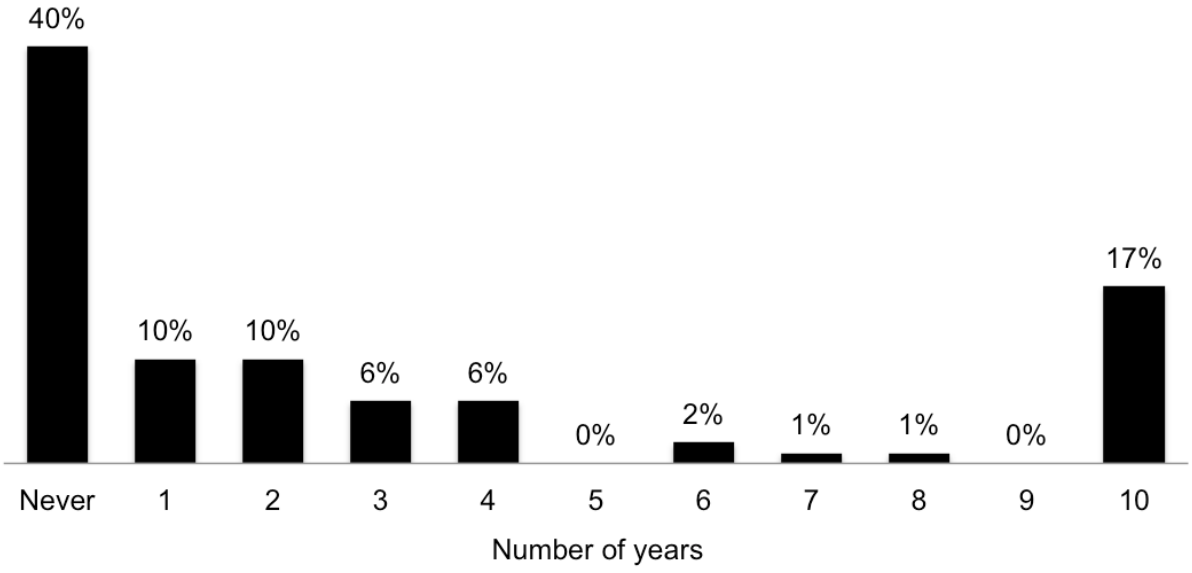



Figure 4. Percentage of how often conductors receive an audiology exam

Figure 5 shows 29.6% claimed their last hearing exam was before the year 2000 (11years prior to the date of the survey).

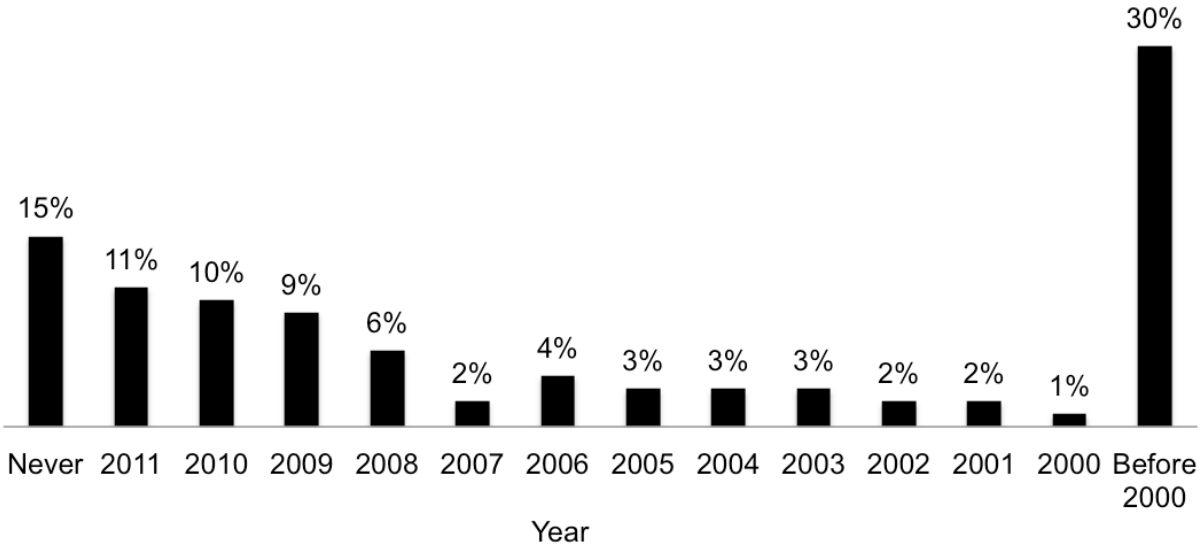



Figure 5. Percentage of when conductors last received an audiology exam

When asked what services and/or resources are available to students of EBIAs in college-level schools of music, Figure 6 shows 54.9% of conductors indicate “I don’t know.” Known services and/or resources offered to students of EBIAs in college-level schools of music, by conductors, were audiology services (14.8%: 9.9% free and 4.9% fee-based), personal hearing protection devices (14.2%: 8.6% free and 5.6% fee-based), referral/contact information to local hearing health clinics (10.5%), information about sound intensity levels generated during EBIAs (8.6%), information/community resources about hearing health awareness and protection (5.6%), other (4.3%) which contained a free response text entry (responses include: “none/none that I know of;” “NONE, chair said I should wear earplugs if concerned about hearing loss in wind symphony reh. (“in a room less than 1500 sq. ft.!;” and “Presentations in School of

Music about hearing health/loss"), and undergraduate course(s) offering hearing health awareness and promotion among musicians (1.9%).

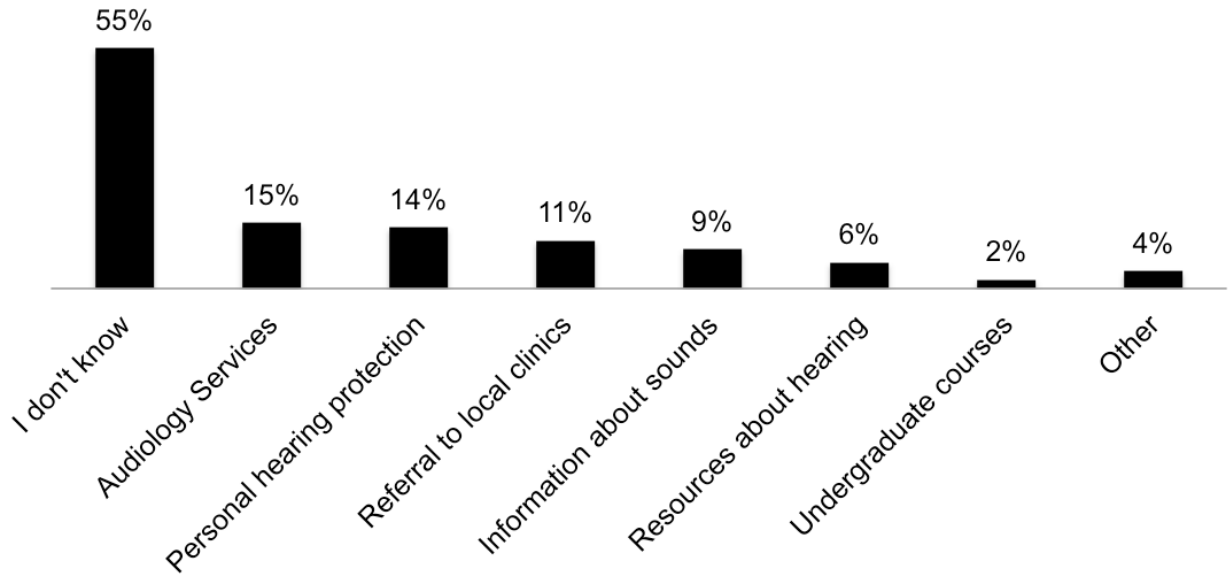



Figure 6. Percentage of known resources conductors' institutions offer or refer to students of EBIAs

As seen in Figure 7, when told sound intensity levels generated during EBIAs in college-level schools of music are dependent on various factors, the highest factor indicated by conductors was "type of ensemble" (M = 8.42); followed by "acoustics of the room" (M = 7.72), "total number of students in the ensemble" (M = 7.35), "size of the room" (M = 7.26), "selected repertoire" (M = 6.47), "duration of EBIA" (M = 5.72), "instructional planning and organization/way the ensemble rehearses" (M = 5.00), and "the ensemble's level of ability/classification" (M = 4.79) based on a VAS (1-10) ranging from "not dependent at all" to "totally dependent." All factors had range responses of 0 to 10 except "type of ensemble" which had a minimum response of 3.6 instead of 0.

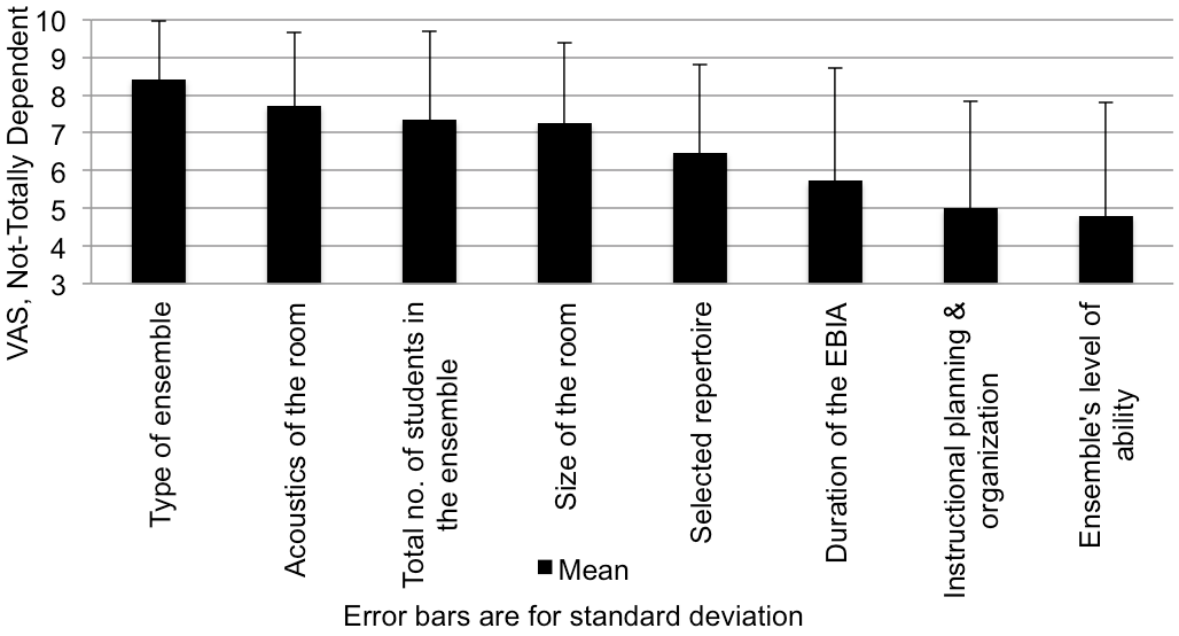



Figure 7. Conductors perceived levels of dependency regarding eight factors that may affect sounds generated during EBIAs

Figure 7 highlights the two highest-ranking factors were “type of ensemble” and “Acoustics of the room.” The two lowest-ranking factors were “ensemble’s level of ability/classification” and “instructional planning and organization/way the ensemble rehearses.”

Specific Aim 2: Conductor Attitude

Conductors believe music majors, as part of their curriculum, should be informed (100%) and be educated (95.7%) about hearing health. Figure 8 shows that during EBIAs in college-level schools of music, the majority of conductors indicate students should be informed, “when sounds are known to harmful” (50%), and be educated, “routinely, regardless if sounds are known to be harmful” (48%).

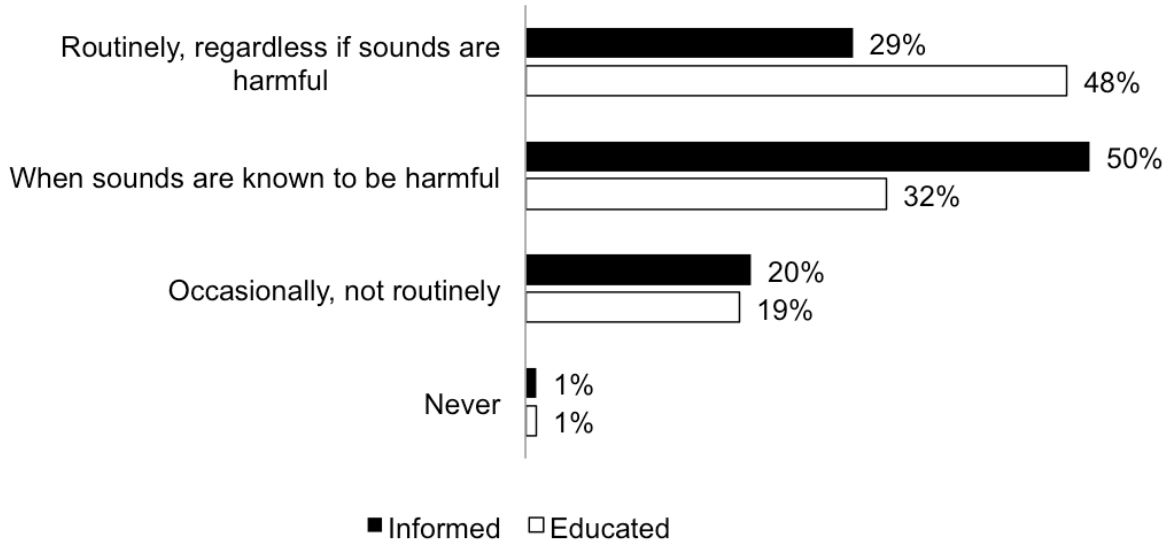



Figure 8. The frequency conductors indicate students should be informed/educated about sound intensity levels

Data indicate conductors are open to being informed (100%) and to being educated (96.9%) about hearing health and also open to “informing” (93.2%) and to “educating” (92%) themselves about sound intensity levels generated during their EBIAs. Additionally, conductors are personally open to informing (97.5%) and to educating (90.1%) their students about hearing health during their EBIAs. Currently as seen in Figure 9, the majority of conductors indicate personally informing (45.7%) and personally educating (39.5%) “occasionally but not routinely” their students about sound intensity levels generated during EBIAs.

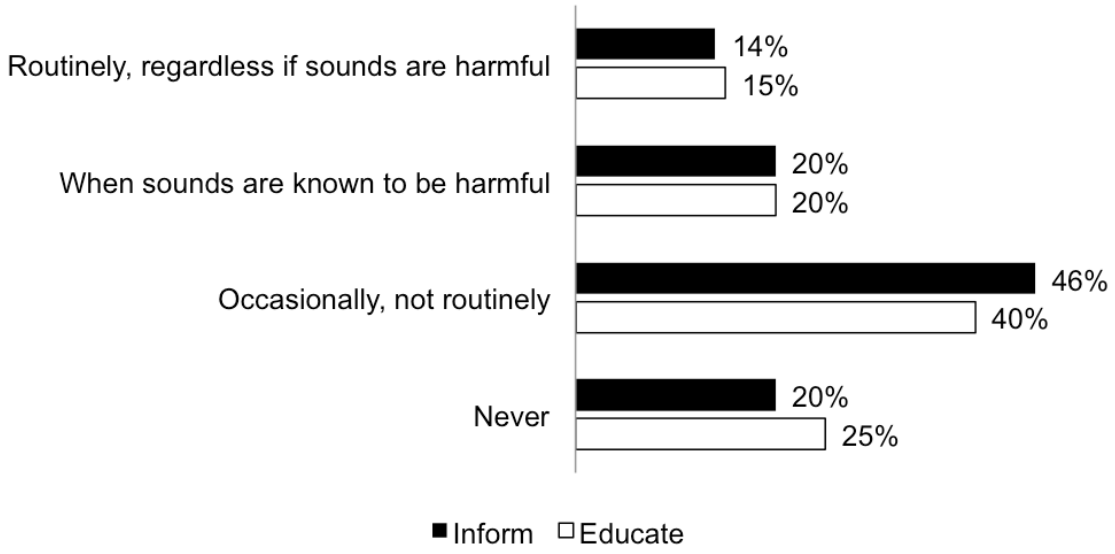



Figure 9. Percentage of conductors personally informing/educating students about sounds generated during their EBIAs

When asked if open to changing their teaching practices if sounds prove to exceed intensity levels known to be harmful to human hearing 95.1% of conductors selected “yes” and 98.8% selected “yes” to also being open to learning alternative teaching practices that prevent sounds from exceeding intensity levels that are harmful to human hearing.

Specific Aim 3: Conductor Teaching Practices

In Figure 10, data indicate 91.4% of conductors are open to using sound measurement technologies to measure sound intensity levels generated during their EBIAs.

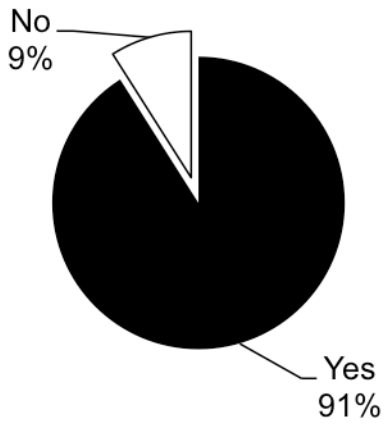
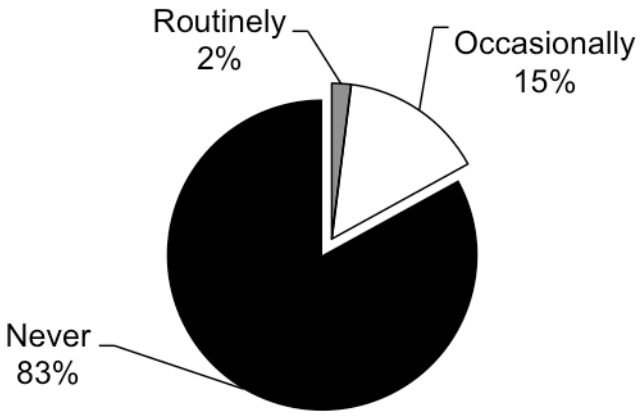



Figure 10. Percentage of conductor openness to use sound measurement technology

As seen in Figure 11, however, 83.3% of conductors indicate “never” using a sound level meter and 93.2% indicate “never” using a noise dosimeter to measure sound intensity levels generated during their EBIAs.




Sound level meter

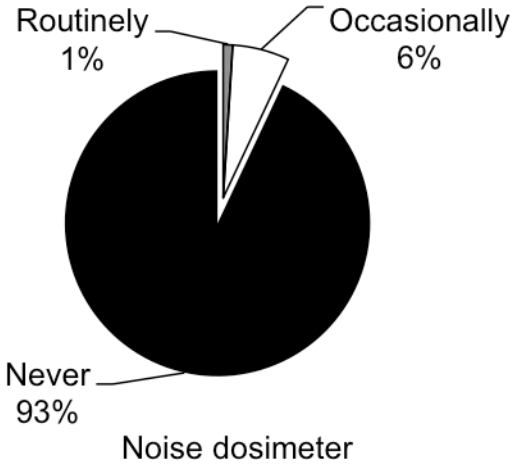



Figure 11. Percentage of sound measurement technology usage among conductors

Data indicate if sound measurement technologies were used to provide relevant data, 97.5% of conductors would use the information and 95.7% of conductors would allow students to access data of sound intensity levels generated during their EBIAs.

Data in Figure 12 denote 70.4% of conductors indicate “never” using hearing protection during EBIAs they conduct.

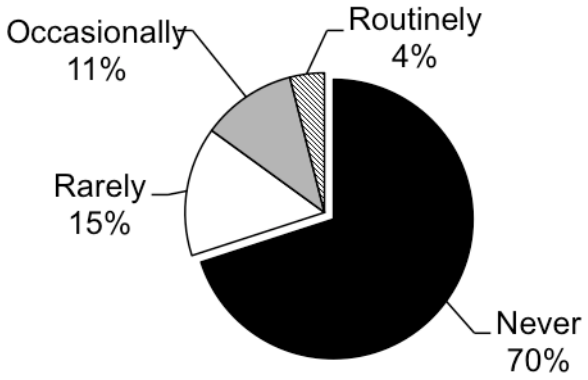



Figure 12. Percentage of hearing protection usage among conductors

# CHAPTER 4

# DISCUSSION

The purpose of this research is to describe conductor awareness of, knowledge of, and attitude toward sound intensity levels generated during ensemble-based instructional activities (EBIAs) in college-level schools of music. The study specifically achieved the 1) development and pilot test of a researcher-designed online questionnaire, 2) electronic distribution of the survey tool through the College Music Society, and 3) characterization of the data using descriptive statistics. Discussion of the results are grouped according to the three specific aims of the study and describe the current state of conductors in college-level schools of music regarding the sound intensity levels generated during their EBIAs.

## Specific Aim 1: Conductor Awareness and Knowledge

Previous research suggests that sounds generated during professional performances and rehearsals are above those recommended by governing bodies in European countries, the United Kingdom, Canada, and the United States.[83] In agreement with these findings, the majority of conductors surveyed recognize that sounds generated during EBIAs in college-level schools of music are capable of exceeding intensity levels that are harmful to human hearing. However, conductors of the most prevalent ensembles (wind symphony/band, choral, and symphony orchestra) were divided. The majority of wind symphony/band conductors indicated that intensity levels are exceeding recommendations, but over half of choral and symphony orchestra

[83] Babin, "Sound Level Measurements in Broadway Shows," 204; Chesky, "Sound Exposure Levels by University Wind Bands," 29; Chesky and Henoch, "Sound exposure by a college jazz band ensemble," 17-20; Laitinen et al., "Sound Exposure Among the Finnish National Opera Personnel," 177-182; McBride et al., "Noise and the Classical Musician," 1561-1563; Steurer et al., "Does Choir Singing Cause NIHL?," 38-51.

conductors did not indicate that their EBIAs exceeded intensity levels known to be harmful to human hearing. The belief that their EBIAs are not reaching harmful levels is inconsistent with previous findings[84] and suggests that perhaps conductors are unaware of their EBIAs' intensity levels. Furthermore, the questionnaire offered the option of "I don't know" as a response to whether sounds generated during EBIAs are harmful. There were some conductors who responded with "I don't know," which definitively indicates a portion of the sample lacks knowledge of or awareness toward sounds generated during their EBIAs.

This deficiency may be a lack of access to or usage of sound measurement tools that would properly evaluate sounds generated during EBIAs in order to determine if in fact sounds are exceeding levels capable of harming human hearing. On a basic level, however, the collected "I don't know" data confirms a lack of awareness, and a potential lack of comprehensive knowledge, regarding what threshold level is specifically being generated during EBIAs and an unclear scientific conception of what threshold level is required to produce sounds that may be harmful to the human ear. The fact that conductors are unaware and in some cases willing to offer confirmation that they do not know about sound intensity levels of their own EBIAs also opposes the ideas presented in European and Canadian hearing and sound awareness documents.[85] These along with the standards suggested by American agencies including the OSHA and the NIOSH do recommend safe intensity levels.[86] However, as the OSHA regulations and the NIOSH recommendations do not extend to the arts and entertainment industry, it

[84] Boasson, Metkemeijer and Granneman, "Sound Exposure of Musicians in a Pit Orchestra," 34.
[85] Reid, *A Sound Ear I,* 1-20; Reid and Holland, *A Sound Ear II,* 1-51; Peters et al., *Noise and Hearing Loss in Musicians*, 1-39.
[86] U.S. Department of Labor, OSHA "Mission statement," online; U.S. DHHS, NIOSH, *Criteria for a Recommended Standard,* iii.

was expected that conductors surveyed are not aware of intensity levels within their EBIAs. Despite the efforts of other countries to promote hearing safety and awareness within the arts and entertainment arenas, it is still waiting for support in America, a fact that is indicated through conductor responses.

Despite conductors' lack of knowledge regarding sound intensity levels, the survey results indicate that conductors are concerned about potential harm to their "own hearing health" and less about the "hearing health of their students during EBIAs they conduct." This trend was consistent when looking at intensity level as well. While a conductor's higher concern and stronger intensity for his or her own hearing health over the hearing health of students is meaningful, evaluating the possible factors contributing to this data set is beyond the scope of the study. Furthermore, it is a finding that is not supported in prior research, due to the researcher aiming to describe sound intensity levels rather than considering conductor perspective of hearing health.

It is interesting, however, to note that almost half of conductors indicated, "I don't know" when asked if they have NIHL. In addition to the lack of knowledge to conclusively confirm or deny NIHL, one-third of conductors indicate their last hearing exam was "before 2000" and when asked how often they obtain a hearing exam the highest responses were "every 10 years" and "never." This data suggest large portions of conductors are not receiving regular audiometric testing and are potentially unaware of their own hearing health status.

The study also indicates that conductors are unaware of how to assist students with their hearing health status because over half of conductors surveyed indicate, "I don't know" when asked what "services and/or resources their institutions offer or refer

to students of EBIAs." This suggests conductors may possess a negative attitude toward seeking out information that would facilitate a deeper understanding of hearing health. It also suggests that students of EBIAs in college-level schools of music may not be receiving basic hearing health information as called for by the HPSM, the PAMA, and the NASM.[87] Future research should aim to understand what services and/or resources are available to students of EBIAs about hearing health and how these services and resources get communicated and distributed to conductors of EBIAs in college-level schools of music. Such research will also fill the void for both conductors and students to be informed and be educated about what services and resources are offered by their institutions and seek to reduce the "I don't know" statistic.

Of the eight variables presented in the ACS, conductors indicated "type of ensemble" as the factor that has the greatest influence on sound intensity levels generated during EBIAs they conduct. All of the conductors surveyed believe this factor has an influence greater than zero and stronger than the other seven, which all individually contained at least one entry of zero. As a result, it is clear that they view type of ensemble as a highly influential factor in determining sound intensity levels. This at first seems logical as perhaps a choir is viewed as less capable of producing harmful intensity levels while a jazz big band would seem more capable. However, this is not aligned with previous research findings, which indicate that choirs and concert

[87] Chesky, Dawson, and Manchester, "HPSM," 144; NASM, "NASM-PAMA Draft Advisories," online; NASM, "Addendum to NASM Handbook," online.

bands along with symphony orchestras have recorded intensity levels above the recommended thresholds.[88]

Of particular interest to the researcher was that conductors ranked "instructional planning and organization/way the ensemble rehearses" second to the bottom in regard to its ability to affect sound intensity levels. Future research is needed to understand why instructional planning and organization is ranking low among college-level conductors. Because these conductors serve as educators during EBIAs in college-level schools of music, they should also be modeling the current best practices of the field. Developing new methods of rehearsing that positively alter sound intensity levels generated during EBIAs needs exploration.

The eight factors mentioned and perhaps others need further study to understand how they interact with each other and at what level of dependency. Appreciating these relationships deeper will help conductors plan and organize their rehearsals differently and consequently aid conductors to better manage and manipulate sound intensity levels generated during their EBIAs.

Specific Aim 2: Conductor Attitude

Conductors conclusively believe that music majors, as part of their curriculum should be informed and be educated about hearing health. The survey shows that half of conductors believe students should be informed, "when sounds are known to be harmful" and the majority of conductors believe students should be educated, "routinely, regardless if sounds are known to be harmful." Conductors also have a compellingly positive attitude toward being informed and being educated about hearing health and

[88] McBride et al., "Noise and the Classical Musician," 1561-1563; Chesky, "Sound Exposure Levels by University Wind Bands," 29; Chesky and Henoch, "Sound exposure by a college jazz band ensemble," 17-20; Steurer et al., "Does Choir Singing Cause NIHL?," 38-51.

are overwhelmingly open to informing and to educating themselves about sound intensity levels generated during their own EBIAs.

In addition, conductors are open to informing and to educating their students about hearing health during their EBIAs. However, the majority of conductors fall short when they indicate they are only personally informing and personally educating their students about sound intensity levels "occasionally, but not routinely." Again this confirms that conductors rank informing and educating students higher than they rank their personal commitment to inform and to educate their students themselves. Nevertheless, a positive attitude toward the role of someone to inform and to educate students about sound intensity levels is present because just a small portion of conductors indicated students should "never" be informed or be educated.

A definitive number of conductors indicate they are open to changing their teaching practices if sounds prove to exceed intensity levels known to be harmful to human hearing and an even greater number indicate they are open to learning alternative teaching practices that prevent sounds from exceeding intensity levels that are harmful to human hearing. Overall, conductors display a positive attitude toward learning and sharing knowledge of sound intensity levels generated during EBIAs.

Since a majority of conductors are open to "learn alternative teaching practices" and "change current teaching practices," it is noteworthy that only about half of surveyed conductors, as mentioned above, are currently informing and even less are currently educating their students about sound intensity levels generated during their EBIAs. While not distinctly within the scope of the study, the reason conductors have a strong openness to change but only an "occasional" sense of personal responsibility, or

potentially negative attitude toward personally informing and educating their students, may suggest that conductors feel 1) a lack of resources and or knowledge currently available to inform and to educate properly themselves and their students, or 2) a possible assumption this information is being disseminated to their students by other instructors and/or means outside of the EBIA. This eludes the reasons European countries, the United Kingdom, and Canada as well as the OSHA and the NIOSH organizations in the United States have found hearing safety recommendations to be an important part of their regulatory system. As a result, future research may need to include: 1) What resources need to be created to ensure conductors are informed and are educated about sound intensity levels generated during EBIAs they conduct in college-level schools of music, 2) Methods to increase personal responsibility and positively promote conductors to inform and to educate their students personally about sound intensity levels generated during EBIAs and 3) How to modify curriculum in the future to match the current conductor belief system that students should be informed when sounds are “known to be harmful” and educated “routinely, regardless when sounds are known to be harmful.” This type of future research would provide competency, support, and guidance to conductors and the students of EBIAs in college-level schools of music.

### Specific Aim 3: Conductor Teaching Practices

A large majority of conductors are open to using sound measurement technologies to measure sound intensity levels generated during EBIAs they conduct. Unfortunately, the same numbers of conductors are currently “never” using a sound level meter or a noise dosimeter to measure sound intensity levels generated during

their EBIAs. Conductors, however, do indicate they would use relevant information provided by sound measurement technologies and furthermore would allow students to access data of sound intensity levels generated during their EBIAs.

Future research is required to understand why a vast number of conductors are open to using sound measurement technologies and the relevant data they provide, but most are never implementing them during their EBIAs. More research is also needed to understand and highlight the benefits of utilizing such technology. The use of sound measurement technology is hugely unexplored and a tool for conductors that may lead to increased knowledge of, awareness of, and attitude toward sound intensity levels generated during their EBIAs. It may also be the best way to evaluate conclusively any health-related conditions in practice, rehearsal, and performance facilities in college-level schools of music. Perhaps applying the models in place as found in other countries within the European Union, the United Kingdom, Canada, and the occupational safety agencies in the United States would assist schools of music in preparing to provide such information. This type of scholarship is imperative for NASM-accredited institutions, by which over half of conductors in the study are employed, when they begin interpreting the recently amended standards to the Handbook regarding hearing health and safety discussed in Chapter 1.

A large majority of conductors also indicate they “never” use personal hearing protection during their EBIAs. Conductors appear to have a negative attitude toward their own hearing health or perhaps see their own hearing health as a risk not important enough to require the use of personal hearing protection devices. To reiterate, nearly half of conductors surveyed do not know if they have NIHL, a large majority of them

never use hearing protection during EBIAs they conduct, almost one-third have not had a hearing exam in the last 11 years, and almost half have never had a hearing exam in their entire careers as conductors.

## Limitations

The study had limitations regarding its recruitment method and response rate. Because the ACS was sent only to sampled members of the CMS, it is not possible to calculate how many qualified conductors were entirely unaware of the study and therefore, were unable to participate. Consequently the results are only generalizable to conductors who are sampled members of the CMS. Additionally, the low response rate may be in part because the CMS restrictions allowed for only the initial electronic recruitment letter and one electronic reminder letter. If multiple electronic reminder letters were permitted, a higher response rate may have occurred. This coupled with participant anonymity prevented sampling of non-respondents and is a notable limitation as characterization of non-respondents was impossible.

Besides descriptive statistics no causal data were collected. This includes any questions regarding influential factors that specify why certain responses were indicated or the nature of how various belief systems formulate conductor awareness of, knowledge of, and attitude toward sound intensity levels generated during EBIAs in college-level schools of music. Any attempt to analyze data beyond the realm of descriptive statistics was not sought by the researcher and considered beyond the scope of the study.

# CHAPTER 5

# CONCLUSION

Prior to this study, no known large-scale descriptive studies examining conductor knowledge of, awareness of, and attitude toward sound intensity levels generated during ensemble-based instructional activities in college-level schools of music have been published. Vastly unexplored, this research facilitated the debut of a unique pilot study and researcher-developed online questionnaire administered to conductors of EBIAs in college-level schools of music. Characterizations of the descriptive data are intended to articulate current trends, spark dialogue among conductors, and highlight the need for continued study among conductors regarding sound intensity levels generated during EBIAs in college-level schools of music.

The findings of this study indicate 80.2% of conductors agree with the preponderance of prior research, which suggests sounds are capable of harming human hearing and exceeding threshold exposure limits.[89] Understanding current trends in sound legislation, globally and domestically, may serve to assist conductors as they begin a new dialogue among their students, colleagues, staff, and administrators to revise current curriculum, explore sound measurement technologies, and evaluate

[89] Reid, *Sound Ear I,* 1-20; Reid, *"Sound Ear II,* 1-51; Peters et al., *Noise and Hearing Loss in Musicians,* 1-39; Chesky, "Schools of Music and Hearing Loss Prevention," S32-S37; Lang, "Environmental Impact on Hearing," 924; Boasson, Metkemeijer, and Granneman, "Sound Exposure of Musicians in a Pit Orchestra," 33-34; McBride et al., "Noise and the Classical Musician," 1561-1563; Laitinen et al., "Sound Exposure Among the Finnish National Opera Personnel," 177-182; Babin, "Sound Level Measurements in Broadway Shows," 204-209; Chesky, "Sound Exposure Level by University Wind Bands," 29-34; Chesky and Henoch, "Sound Exposure by a College Jazz Band Ensemble," 17-20; Steurer et al., "Does Choir Singing Cause NIHL?," 38-51; Chesky and Araujo, "Dosimeter Data from 15 College Music Ensembles," Conference (2008).

current hearing health and safety issues inherent in the practice, performance, and teaching of sounds generated during EBIAs.[90]

As previously stated in Chapter 1, in 2011 NASM took an official position to recognize the importance of hearing health and injury prevention as a standard for all member-accredited institutions. This is one of the first national acknowledgements promoting hearing health and safety within the music discipline and among students seeking a music degree in the United States. Of the conductors who participated in the ACS 66% are employed by NASM-accredited institutions. The ACS reveals 24.1% "do not know" if EBIAs they conduct ever exceed sound intensity levels capable of harming human hearing and 54.9% do not know "what services and/or resources" their home institutions offer to students of EBIAs. It also suggests conductors have a strong openness to inform and to educate themselves about hearing health, but feel less responsibility or posses a negative attitude toward informing and toward educating their students personally during EBIAs they conduct.

While the current study is unable to indicate how attitude shapes awareness of and knowledge of sounds generated during EBIAs, it does generalize that conductors are unprepared and potentially unable to implement the current NASM health and safety standard for hearing health into their curricula. If the new NASM standard for hearing health and safety is to be achieved, conductors need to obtain a greater competency

[90] NASM, "Handbook and Addendum," 1-200; Barrett, "Practice, Research, and Policy in Music Education," 1-5; Forsythe, Kinney, and Braun, "Opinions on NASM Music Standards," 19-33; Millican, "Band and Orchestra Rankings of Knowledge and Skill," 68-79; EU, "Directive 2003/10/EC," online; UK Government, "Control of Noise at Work Regulations Act," online; U.S. DHHS, NIOSH, *Criteria for a Recommended Standard*," 98-126; U.S. Dept. of Labor, "OSHA, Occupational Noise Exposure," CFR 1910, online; Chesky, Dawson, and Mancheter, "HPSM," 142-144; MENC, "Health in Music Education," online; MTNA, "Health in Music Teaching," online; Chesky, "Schools of Music and Hearing Loss Prevention," S32-S37; Rawool and Colligon-Wayne, "Auditory Beliefs Related to Hearing Loss Among College Students," 1-10.

level and additionally make a deeper investment toward informing and educating both themselves and their students about sounds generated during EBIAs. This may include seeking additional knowledge, learning alternative teaching practices, engaging in conversation to revise outdated curriculum, routinely advocating for hearing health, actively promoting a positive attitude toward sounds generated during their EBIAs, understanding the resources and/or services their institutions may provide to students about hearing health, and aggressively utilizing sound measurement technologies as a means to understand sound intensity levels generated during their EBIAs in college-level schools of music.

Such examinations of any of these topics may cultivate a cultural shift toward hearing health promotion and establish a new level of competency for conductors and student musicians. Since conductors are the educators of EBIAs it is essential to discover the classroom environment being endorsed, including but not limited to the attitude of the conductor toward hearing health and promotion, before we can expect student musicians to promote hearing health and safety behaviors independently. Recognizing conductor knowledge of, awareness of, and attitude toward sound intensity levels will formulate how best to articulate, at an instructional level, future integration of hearing health and to promote the long-term development of understanding sound intensity levels generated during EBIAs in college-level schools of music.

# APPENDIX A

# UNT IRB APPROVAL

UNT
UNIVERSITY OF
NORTH TEXAS
Discover the power of ideas.

OFFICE OF THE VICE PRESIDENT FOR RESEARCH AND ECONOMIC DEVELOPMENT
Research Services

October 18, 2011

Dr. David Itkin
Department of Orchestral Studies
University of North Texas
RE: Human Subjects Application No. 11-473

Dear Dr. Itkin:

In accordance with 45 CFR Part 46 Section 46.101, your study titled "Conductor Awareness of, Knowledge of, and Attitude toward Sound Intensity Levels Generated during Ensemble Based Instructional Activities in Schools of Music?" has been determined to qualify for an exemption from further review by the UNT Institutional Review Board (IRB).

Enclosed is the consent document with stamped IRB approval. Please copy and **use this form only** for your study subjects.

No changes may be made to your study's procedures or forms without prior written approval from the UNT IRB. Please contact Jordan Harmon, Research Compliance Analyst, ext. 3940, if you wish to make any such changes. Any changes to your procedures or forms after 3 years will require completion of a new IRB application.

We wish you success with your study.

Sincerely,

Brad Heroda for PLK

Patricia L. Kaminski, Ph.D.
Associate Professor
Chair, Institutional Review Board

PK:jh

1155 Union Circle #305250 | Denton, Texas 76203-5017 | TEL 940.565.3940 | FAX 940.565.4277
TTY 940.369.8652 | http://research.unt.edu

University of North Texas (UNT) Institutional Review Board
Informed Consent Form

**Title of Study:** Conductor awareness of, knowledge of, and attitude toward sound intensity levels generated during ensemble-based instructional activities in schools of music

**Supervising Investigator**: David Itkin, Director of Orchestral Studies
**Co-Investigator**: Kris Chesky, Director of the Texas Center of Music & Medicine
**Student Investigator**: Aaron Albin, DMA Candidate
**Department:** UNT College of Music (Denton, TX)

You have been invited to participate in a research study that surveys CMS conductors. Statistical characterizations of the collected data will be part of doctoral dissertation research compiled by Aaron Albin, a graduate student at the University of North Texas College of Music.

**Purpose of the Study**: The purpose of this research is to survey conductor awareness of, knowledge of, and attitude toward sound intensity levels generated during ensemble-based instructional activities in schools of music.

**Procedure**: You will answer a six-part questionnaire. Parts I-V present 31 statements/questions regarding your awareness of, knowledge of, and attitude towards sound intensity levels generated during ensemble-based instructional activities. Part VI presents 19 demographic questions regarding your formal training, experience, employment, and type of ensemble(s) you conduct and instruct. This questionnaire takes about 20 minutes to complete.

There are no foreseeable risks involved in this study. If any question causes emotional discomfort you may discontinue participation at any time during the administration of the questionnaire. This study is not expected to be of any direct benefit to you, but it may contribute new research to the fields of music education, music and medicine, and conducting ensembles. In addition, it may prompt awareness of sound intensity levels generated during ensemble-based instructional activities in schools of music. Participation is voluntary, and you are free to refuse to participate in the study or withdraw your consent at anytime.

**Confidentiality of Research Records**: You will not provide your name or institution of employment, but you will be asked demographic information regarding the location (i.e. state) and academic rank of your position. The confidentiality of your individual information will be maintained in publications or presentations regarding the study.

The research study has been reviewed and approved by the UNT Institutional Review Board (IRB) and the College Music Society (CMS). The UNT IRB may be contacted at (940) 565-3940 with any questions regarding the rights of research subjects. CMS may be contacted via its website http://music.org.

A hard copy of the data will be stored with the UNT College of Music: Department of Orchestral Studies located in room 137 of the Murchison Performing Arts Center. David Itkin, Supervising Investigator and Director or Orchestral Studies may be contacted at [redacted]. A summary of the results will be available from Aaron Albin, Student Investigator following this study. The research will be compiled into a dissertation and available via Electronic Dissertation & Theses from the University of North Texas Library. If you have questions about the study, you may contact Aaron Albin, at [redacted] or [redacted]

**Research Participant's Rights**:

Selecting "Yes" will constitute an electronic signature and indicate that you have read or have had read to you all of the above and that you confirm all of the following:

- You may contact Aaron Albin to ask question(s) regarding the study. You understand the possible benefits and the potential risks and/or discomforts of the study.
- You understand that you do not have to take part in this study, and your refusal to participate or decision to withdraw will involve no penalty or loss of rights or benefits. The study personnel may choose to stop your participation at any time.
- You understand why the study is being conducted and how it will be performed.
- You understand your rights as a research participant, and you voluntarily consent to participate in this study.
- An electronic copy of this form is available upon request by contacting Aaron Albin [redacted]

___ Yes, I agree to participate in the study.

___ No, I do not agree to participate in the study.

[The participant must select "yes" to gain access to the online questionnaire.]

APPROVED BY THE UNT IRB
DATE: 10-18-11

# APPENDIX B

# CMS SURVEY COMMITTEE APPROVAL

Resent-From: [redacted]
From: Jack Taylor [redacted]
Subject: Survey
Date: November 14, 2011 8:49:13 AM CST
Resent-To: [redacted]
To: [redacted]

Dear Aaron:

You have constructed an excellent survey. Congratulations!

We have just a few comments:

Part IV 1): This sentence is a little awkward. We suggest something like this: "A sound level level meter is an instrument that measures sound pressure level (SPL) in decibels (dB).

The following recommendations can considerably increase survey return rates:

1. We strongly suggest that in your cover letter you mention that responses to the survey are private, i.e., anonymous - meaning that their names and individual data will not be released to others.

2. Also, your survey abruptly ends. We suggest that at the end of the survey you thank them for their participation, and that you tell them when and where they can obtain a summary of the results.

3. We don't know what your University requires, but if possible, you should reduce the amount of information you're planning to send to the respondents. The cover letter, the survey, and a one-page summary of the dissertation proposal are sufficient.

The Committee wishes you the best of luck (but we know it isn't really luck!) in your dissertation research and doctoral program.

Jack Taylor, Chairman
CMS Survey Committee

--
Jack Taylor, Professor Emeritus
College of Music
Florida State University
[redacted]

APPENDIX C

CMS RECRUITMENT LETTER FOR THE ACS

THE COLLEGE MUSIC SOCIETY

## Conducting Survey

Dear CMS Conductor:

You are invited to participate in a research study that surveys CMS conductors. Statistical characterizations of the collected data will be part of doctoral dissertation research compiled by Aaron Albin, a graduate student at the University of North Texas College of Music (Denton, TX).

The purpose of this research is to survey conductor awareness of, knowledge of and attitude toward sound intensity levels generated during ensemble-based instructional activities in schools of music. The survey is an online questionnaire in six parts, and participation will take approximately 20 minutes. There is no anticipated risk in completing the survey, responses are anonymous, and the confidentiality of your individual information will be maintained in any presentations or publications regarding the study.

Please click on the following link to participate: Conductor Questionnaire

Or you may also copy and paste the following address:
http://untbusiness.qualtrics.com/SE/?SID=SV_e2rxPzkIG8A4mR6

You may email Aaron Albin [redacted] to ask any additional question(s) or to receive an electronic copy of the informed consent letter.

Thank you,

Aaron Albin
[redacted]

APPENDIX D

CMS REMINDER LETTER FOR THE ACS

THE COLLEGE MUSIC SOCIETY

## Conducting Survey

Dear CMS Conductor:

Recently, you received an e-mail message requesting your participation in a research study conducted by Aaron Albin, a doctoral student at the University of North Texas. The purpose of this research is to survey conductor awareness of, knowledge of and attitude toward sound intensity levels generated during ensemble-based instructional activities in schools of music. If you have already completed this survey, thank you!

This message has been delivered to all members registered as conductors on the CMS conductor listserv, as no personal data is retained for reasons of confidentiality and responses are anonymous. Please consider taking a moment to participate if you have not had an opportunity. Every participant is important, and your efforts will make this research stronger.

Please click on the following link to participate: Conductor Questionnaire

Or you may also copy and paste the following address:
http://untbusiness.qualtrics.com/SE/?SID=SV_e2rxPzkIG8A4mR6

You may email Aaron Albin [redacted] to ask any additional question(s) or to receive an electronic copy of the informed consent letter.

Thank you,

Aaron Albin
[redacted]

# APPENDIX E

# ALBIN CONDUCTOR SURVEY

University of North Texas (UNT) Institutional Review Board
Informed Consent Letter

**Title of Study**: Conductor awareness of, knowledge of, and attitude toward sound intensity levels generated during ensemble-based instructional activities in schools of music

**Supervising Investigator**: David Itkin, Director of Orchestral Studies
**Co-Investigator**: Kris Chesky, Director of the Texas Center of Music & Medicine
**Student Investigator**: Aaron Albin, DMA Candidate
**Department:** UNT College of Music (Denton, TX)

You have been invited to participate in a research study that surveys CMS conductors. Statistical characterizations of the collected data will be part of doctoral dissertation research compiled by Aaron Albin, a graduate student at the University of North Texas College of Music.

**Purpose of the Study**: The purpose of this research is to survey conductor awareness of, knowledge of, and attitude toward sound intensity levels generated during ensemble-based instructional activities in schools of music.

**Procedure**: You will answer a six-part questionnaire. Parts I-V present 31 statements/questions regarding your awareness of, knowledge of, and attitude toward sound intensity levels generated during ensemble-based instructional activities. Part VI presents 19 demographic questions regarding your formal training, experience, employment, and type of ensemble(s) you conduct and instruct. This questionnaire takes about 20 minutes to complete.

There are no foreseeable risks involved in this study. If any question causes emotional discomfort you may discontinue participation at any time during the administration of the questionnaire. This study is not expected to be of any direct benefit to you, but it may contribute new research to the fields of music education, music and medicine, and conducting ensembles. In addition, it may prompt awareness of sound intensity levels generated during ensemble-based instructional activities in schools of music. Participation is voluntary, and you are free to refuse to participate in the study or withdraw your consent at anytime.

**Confidentiality of Research Records**: You will not provide your name or institution of employment, but you will be asked demographic information regarding the location (i.e. state) and academic rank of your position. The confidentiality of your individual information will be maintained in publications or presentations regarding the study.

The research study has been reviewed and approved by the UNT Institutional Review Board (IRB) and the College Music Society (CMS). The UNT IRB may be contacted at (940) 565-3940 with any questions regarding the rights of research participants. CMS may be contacted via its website http://music.org.

A hard copy of the data will be stored with the UNT College of Music: Department of Orchestral Studies located in room 137 of the Murchison Performing Arts Center. David Itkin, Supervising Investigator and Director of Orchestral Studies may be contacted at [redacted]. A summary of the results will be available from Aaron Albin, Student Investigator following this study. The research will be compiled into a dissertation and available via Electronic Dissertation & Theses from the University of North Texas Library. If you have questions about the study, you may contact Aaron Albin, at [redacted] or [redacted]

**Research Participant's Rights**:
Selecting "Yes" will constitute an electronic signature and indicate that you have read or have had read to you all of the above and that you confirm all of the following:

- You may contact Aaron Albin to ask question(s) regarding the study. You understand the possible benefits and the potential risks and/or discomforts of the study.

- You understand that you do not have to take part in this study, and your refusal to participate or decision to withdraw will involve no penalty or loss of rights or benefits. The study personnel may choose to stop your participation at any time.

- You understand why the study is being conducted and how it will be performed.

- You understand your rights as a research participant, and you voluntarily consent to participate in this study.

- An electronic copy of this form is available upon request by contacting Aaron Albin [redacted]

Q1)
___ Yes, I agree to participate in the study.

___ No, I do not agree to participate in the study.

This Questionnaire is for Conductors Employed
by College-Level Schools of Music

Definition of Terms:

A “conductor” is any person identified as the ensemble director, instructor, leader, and/or teacher of an ensemble-based instructional activity (EBIA) within a college-level school of music.

An “ensemble-based instructional activity” (EBIA) is any credit-granting performance-oriented course, lab, or ensemble comprised of student musicians receiving instruction from a conductor. Additionally, these EBIAs seek to acquire growth in artistry, technical skills, collaborative competence and knowledge of repertory through regular ensemble experiences.

A “college-level school of music” is any conservatory, college, or university offering an associate degree, baccalaureate degree, graduate degree, and/or artist certificate/diploma in at least ONE of the following areas: General Music, Sacred Music, Music Education, Music Performance, Music Theory, Music Composition, Musicology, Ethnomusicology, Jazz Studies, or Liberal Arts with a Major in Music.

“Employment” includes any faculty, staff, adjunct, student, teaching fellow/assistant, and/or employee receiving compensation to serve as a conductor.

Q2) Do you conduct EBIAs in a college-level school of music?

___ Yes

___ No, but I want to participate in the survey

Part I. Answer by clicking next to your response

Q3) Are sounds generated during EBIA in college-level schools of music capable of exceeding intensity levels that are harmful to human hearing?

___ Yes ___ No ___ I Don't Know

Q4) Do sounds generated during EBIA you conduct ever exceed intensity levels that are harmful to human hearing?

___ Yes ___ No ___ I Don't Know

Q5) How often do sounds generated during EBIA you conduct exceed intensity levels known to be harmful to human hearing? [*Question contained skip logic]

Never |_____| Always

Substitute the phrase on the left into the following question and move the slider left or right to indicate your responses in relations to the two extremes.

Q6) How often are you concerned about potential harm to:

Q6.1) The Hearing Health of Conductors

Never |_____| Always

Q6.2) Your Own Hearing Health

Never |_____| Always

Q6.3) The Hearing Health of Students during EBIA

Never |_____| Always

Q6.4) Your Students' Hearing Health during EBIA You Conduct

Never |_____| Always

Q7) Rate your level of concern toward potential harm to:

Q7.1) The Hearing Health of Conductors

Never |_____| Always

Q7.2) Your Own Hearing Health

Never |_____| Always

Q7.3) The Hearing Health of Students during EBIA

Never |_____| Always

Q7.4) Your Students' Hearing Health during EBIA You Conduct

Never |_____| Always

Part II. Sound intensity levels generated during EBIA in college-level schools of music may be dependent on various factors. Rate the level of dependency regarding each of the following factors.

Statement:
Sound intensity levels generated during EBIA in college-level schools of music are dependent on the:

Q8.1) Size of the Room

Not Dependent at All |_____| Totally Dependent

Q8.2) Acoustics of the Room

Not Dependent at All |_____| Totally Dependent

Q8.3) Type of Ensemble (e.g. Orchestra, Band, Choir, etc.)

Not Dependent at All |_____| Totally Dependent

Q8.4) Total Number of Students in the Ensemble

Not Dependent at All |_____| Totally Dependent

Q8.5) Instructional Planning and Organization (Way the Ensemble Rehearses)

Not Dependent at All |_____| Totally Dependent

Q8.6) Selected Repertoire

Not Dependent at All |_____| Totally Dependent

Q8.7) Duration of EBIA

Not Dependent at All |_____| Totally Dependent

Q8.8) Ensemble's level of Ability/Classification (e.g. beginner, advanced, etc.)

Not Dependent at All |_____| Totally Dependent

Part III. Respond by substituting the word on the left into the following question and then mark your response.

Q9) Generally, how often should students be _____ about sound intensity levels generated during EBIA in college-level school of music?

| | | | | |
|---|---|---|---|---|
| Q9.1) Informed: | __Never | __Occasionally but not routinely | __When sounds are known to be harmful | __Routinely, regardless if sound are known to be harmful |
| Q9.2) Educated: | __Never | __Occasionally but not routinely | __When sounds are known to be harmful | __Routinely, regardless if sound are known to be harmful |

Q10) Do you *personally* _____ *your* students about sound intensity levels generated during EBIA *you* conduct?

| | | | | |
|---|---|---|---|---|
| Q10.1) Inform: | __Never | __Occasionally but not routinely | __When sounds are known to be harmful | __Routinely, regardless if sound are known to be harmful |
| Q10.2) Educate: | __Never | __Occasionally but not routinely | __When sounds are known to be harmful | __Routinely, regardless if sound are known to be harmful |

Q11) Are you open to _____ yourself about sound intensity levels generated during EBIA you instruct?

| | | | | |
|---|---|---|---|---|
| Q11.1) Informing: | __Never | __Occasionally but not routinely | __When sounds are known to be harmful | __Routinely, regardless if sound are known to be harmful |

| | | | | |
|---|---|---|---|---|
| Q11.2) Educating: | __Never | __Occasionally but not routinely | __When sounds are known to be harmful | __Routinely, regardless if sound are known to be harmful |

Q12) Would you be open to changing your teaching practices if sounds prove to exceed intensity levels that are harmful to human hearing?

___ Yes ___ No

Q13) Would you be open to learning alternative teaching practices that prevent sounds from exceeding intensity levels known to be harmful to human hearing?

___ Yes ___ No

Part IV. Respond to the following questions about sound measurement technologies.

Types of Sound Measurement Technologies

1) **Sound Level Meter**: A sound level meter is an instrument that measures sound pressure level (SPL) in decibels (dB).
2) **Noise Dosimeter**: A noise dosimeter is a specialized sound level meter intended specifically to measure the noise exposure of a person, integrated over a period of time.

Q14) Are sound measurement technologies being used to measure sound intensity levels generated during EBIA *you* conduct?

Q14.1) Sound Level Meter: __ Never __ Occasionally __ Routinely

Q14.2) Noise Dosimeter: __ Never __ Occasionally __ Routinely

Q15) Are you open to using sound measurement technologies to measure sound intensity levels generated during EBIA you conduct?

___ Yes ___ No

Q16) If sound measurement technologies were used to provide you with relevant data, would you use this information?

___ Yes ___ No

Q17) Would you allow students to access data of sound intensity levels generated from EBIA you conduct?

___ Yes ___ No

Part V. Answer by clicking next to your response.

Q18) Generally, should music majors, as part of their curriculum be _____ about hearing health?

Q18.1) Informed: __ Yes __ No

Q18.2) Educated: __ Yes __ No

Q19) Are you open to being _____ about hearing health?

Q19.1) Informed: __ Yes __ No

Q19.2) Educated: __ Yes __ No

Q20) Personally, are you open to _____ your students about hearing health during EBIA *you* conduct?

Q20.1) Informing: __ Yes __ No

Q20.2) Educating: __ Yes __ No

Part VI. Demographics

*Personal Information*

Q21) Age:_____ [Drop-down menu] Q22) Are you (select): Male / Female

Q23) Race (select):
White, Non-Hispanic / Hispanic, Latino / Black, African-American / Asian, Asian-American / Native Am. Indian / Other

Q24) Country of Origin:_____ [Drop-down menu]

*Employment as Ensemble-Based Instructor*

Q25) In what state are you employed:_____ [Drop-down menu]

Q26) Rank (select):
Adjunct / Lecturer / Assistant Professor / Associate Professor / Full Professor / Student, Teaching Fellow / Other

Q27) Do you have tenure: ___Yes ___No

Q28) Are you employed by a NASM-accredited institution: ___Yes ___No

*Employment as a Conductor*

Q29) List all the ensemble-based instructional activities you currently conduct as the *primary* instructor for your college-level school of music.*

| | Type of Ensemble | No. of Musicians in Ensemble | No. of Rehearsals (per week) | Duration of each Rehearsal (min.) | Total No. of Performances during a semester |
|---|---|---|---|---|---|
| 1. | | | | | |
| 2. | | | | | |
| 3. | | | | | |
| 4. | | | | | |
| 5. | | | | | |

*. Columns online contained a drop-down response menu.

Q30) List any ongoing professional ensembles you currently conduct as the *principal* conductor:*

| | Type of Ensemble | No. of Musicians in Ensemble | Ave. No. of Reh. per Month | Duration of each Reh. (min.) | Total No. of Perf. during a Year | Professional-based Ens.: Musicians are paid for services** | Community-based Ens.: Musicians volunteer for services** |
|---|---|---|---|---|---|---|---|
| 1. | | | | | | | |
| 2. | | | | | | | |
| 3. | | | | | | | |
| 4. | | | | | | | |
| 5. | | | | | | | |

*. Columns online contained a drop-down response menu.

**. Columns online contained a drop-down “Yes/No” response menu.

*Education/Academic Training*

Q31) What is the highest or most relevant formal education you have completed (select):

None / Bachelor's Degree / Master's Degree / Doctoral Degree / Artist Certificate, Diploma / Other

Q32) What field(s) best describe(s) your formal education (select all that apply):

Music Education / Performance: Conducting / Performance: Non-Conducting / Musicology / Music Theory

Music Composition / Ethnomusicology / Jazz Studies / Other

*Background Information*

Q33) Total number of years spent working as a conductor: _____ [Drop-down menu]

Q34) Number of years spent in academia instructing ensemble-based instructional activities:_____ [Drop-down menu]

Q35) When was the last time (year) you had your hearing tested? [Drop-down menu]

Q36) How often do you have your hearing tested? [Drop-down menu]

Q37) Do *you* have Noise-Induced Hearing Loss (NIHL)?

___ Yes ___ No ___ I Don't Know

Q38) How often do you use hearing protection during EBIA you conduct?

__ Never __ Rarely __ Occasionally __ Routinely

Q39) What services and/or resources does *your* institution offer and/or refer to students of ensemble-based instructional activities? (Mark all that apply)

___ Information about sound intensity levels generated during EBIA

___ Audiology Services: ___ Free ___ Fee-Based

___ Personal Hearing Protection: ___ Free ___ Fee-Based

___ Undergraduate course(s) offering hearing health awareness and promotion among musicians

___ Referral/Contact information to local hearing health clinics (off-campus)

___ Information/Community resources about hearing health awareness and promotion (off-campus)

___ I don't know

___ Other (Specify): _____ [Free response text entry]

*Thank You* for taking the survey!

Your responses have been recorded.

The research will be compiled into a dissertation and available via Electronic Dissertation & Theses from the University of North Texas Library (Denton, TX). A summary of the results will be available from Aaron Albin, Student Investigator, following this study. If you have questions about the study, you may contact Aaron Albin, at [redacted] or [redacted].

# APPENDIX F

# DEMOGRAPHICS OF THE ACS

Table F.1. Demographics

| Question | Variable | Freq., % |
|---|---|---|
| Gender | Male | 119 (73.5%) |
| | Female | 43 (26.5%) |
| Race | White/Non-Hispanic | 151 (93.2%) |
| | Hispanic/Latino | 3 (1.9%) |
| | Black/African-American | 2 (1.2%) |
| | Asian/Asian-American | 4 (2.5%) |
| | Other | 2 (1.2%) |
| Country of origin | Argentina | 1 (.6%) |
| | Canada | 5 (3.1%) |
| | Cuba | 1 (.6%) |
| | Germany | 4 (2.5%) |
| | Haiti | 1 (.6%) |
| | Japan | 1 (.6%) |
| | South Korea | 1 (.6%) |
| | United Kingdom | 1 (.6%) |
| | United States | 147 (90.7%) |
| State of employment | Alabama | 1 (.6%) |
| | Arizona | 4 (2.5%) |
| | Arkansas | 3 (1.9%) |
| | California | 11 (6.8%) |
| | Colorado | 2 (1.2%) |
| | Connecticut | 1 (.6%) |
| | District of Columbia | 1 (.6%) |
| | Florida | 4 (2.5%) |
| | Georgia | 6 (3.7%) |
| | Hawaii | 1 (.6%) |
| | Idaho | 1 (.6%) |
| | Illinois | 9 (5.6%) |
| | Indiana | 4 (2.5%) |
| | Iowa | 3 (1.9%) |
| | Kansas | 4 (2.5%) |
| | Kentucky | 3 (1.9%) |
| | Maryland | 2 (1.2%) |
| | Massachusetts | 3 (1.9%) |
| | Michigan | 1 (.6%) |
| | Minnesota | 1 (.6%) |
| | Mississippi | 2 (1.2%) |
| | Missouri | 6 (3.7%) |
| | Nebraska | 5 (3.1%) |
| | Nevada | 1 (.6%) |
| | New Hampshire | 1 (.6%) |
| | New York | 6 (3.7%) |
| | North Carolina | 3 (1.9%) |
| | North Dakota | 3 (1.9%) |

| | | |
|---|---|---|
| | Ohio | 5 (3.1%) |
| | Oklahoma | 5 (3.1%) |
| | Oregon | 7 (4.3%) |
| | Pennsylvania | 8 (4.9%) |
| | South Carolina | 8 (4.9%) |
| | South Dakota | 2 (1.2%) |
| | Tennessee | 7 (4.3%) |
| | Texas | 9 (5.6%) |
| | Utah | 1 (.6%) |
| | Vermont | 2 (1.2%) |
| | Virginia | 1 (.6%) |
| | Washington | 5 (3.1%) |
| | West Virginia | 3 (1.9%) |
| | Wisconsin | 4 (2.5%) |
| | I do not live in the continental U.S. | 3 (1.9%) |
| Rank | Assistant Professor | 49 (30.2%) |
| | Full Professor | 48 (29.6%) |
| | Associate Professor | 42 (25.9%) |
| | Lecturer | 12 (7.4%) |
| | Other | 7 (4.3%) |
| | Adjunct | 4 (2.5%) |
| What is the highest or most relevant formal education you have completed? | Doctoral Degree | 135 (83.3%) |
| | Master's Degree | 25 (15.4%) |
| | Artist Certificate/Diploma | 1 (.6%) |
| | None | 1 (.6%) |
| | Bachelor's Degree | - |
| What field(s) best describe(s) your formal education? | Performance: Conducting | 112 (69.1%) |
| | Music Education | 80 (49.4%) |
| | Performance: Non-Conducting | 50 (30.9%) |
| | Musicology | 17 (10.5%) |
| | Music Theory | 14 (8.6%) |
| | Jazz Studies | 9 (5.6%) |
| | Music Composition | 7 (4.3%) |
| | Other | 4 (2.5%) |
| Do you have tenure? | Yes | 80 (49.4%) |
| | No | 82 (50.6%) |
| Are you employed by an NASM-accredited institution? | Yes | 107 (66.%) |
| | No | 55 (34%) |

Table F.2. Frequency and composition of EBIAs in college-level schools of music

| | | No. of musicians in the ens. | | | | No. of rehearsals per week | | | |
|---|---|---|---|---|---|---|---|---|---|
| Ens. type | *N*=307 | M | SD | Min. | Max. | M | SD | Min. | Max |
| Big Band/Jazz | 15 (5%) | 18.60 | 3.42 | 8 | 22 | 1.73 | 0.59 | 1 | 3 |
| Brass Ens. | - | - | - | - | - | - | - | - | - |
| Baroque Orch. | 2 (1%) | 26 | 5.66 | 22 | 30 | 1.50 | 0.71 | 1 | 2 |
| Chamber Ens. Instr. | 17 (6%) | 12.35 | 7.35 | 4 | 24 | 1.35 | 0.61 | 1 | 3 |
| Chamber Ens. Vocal | 28 (9%) | 16.25 | 6.88 | 5 | 30 | 2.11 | .99 | 1 | 4 |
| Choral | 100 (33%) | 48.30 | 24.43 | 13 | 151 | 2.56 | 1.04 | 1 | 5 |
| Early Music/Per. Instr. Ens. | 3 (1%) | 9 | 3.61 | 5 | 12 | 2 | 0 | 2 | 2 |
| Electronic Music | - | - | - | - | - | - | - | - | - |
| Marching Band/Pep | 22 (7%) | 86.91 | 50.91 | 8 | 151 | 2.27 | 1.03 | 1 | 4 |
| Musical Theatre | 3 (1%) | 21.67 | 11.55 | 15 | 35 | 2.67 | 1.53 | 1 | 4 |
| New Music | 2 (1%) | 12.50 | 9.19 | 6 | 19 | 1 | 0 | 1 | 1 |
| Opera | 8 (3%) | 31.25 | 26.17 | 4 | 80 | 2.25 | 1.16 | 0 | 4 |
| Percussion Ens. | 3 (1%) | 10 | 4.58 | 6 | 15 | 2.33 | .58 | 2 | 3 |
| String Ens. | 8 (3%) | 19.13 | 9.34 | 10 | 38 | 1.75 | .46 | 1 | 2 |
| Symphony Orch. | 27 (9%) | 60.52 | 18.05 | 28 | 95 | 1.85 | .77 | 1 | 3 |
| Wind Symphony/Band | 56 (18%) | 53.29 | 15.31 | 20 | 80 | 2.23 | .76 | 1 | 4 |
| Vocal Jazz Ens. | 5 (2%) | 15.40 | 8.53 | 8 | 30 | 2.60 | .55 | 2 | 3 |
| Woodwind Ens. | 3 (1%) | 19 | 20.07 | 5 | 42 | 2 | 1 | 1 | 3 |
| Other | 5 (2%) | 13.20 | 15.01 | 6 | 40 | 2 | 0 | 2 | 2 |

Table F.2. *continued*

| | Duration of each reh. (min.) | | | | Total no. of perf. per semester | | | |
|---|---|---|---|---|---|---|---|---|
| Ens. type | M | SD | Min. | Max. | M | SD | Min. | Max |
| Big Band/Jazz | 84 | 31.01 | 45 | 150 | 2.33 | 1.40 | 1 | 6 |
| Brass Ens. | - | - | - | - | - | - | - | - |
| Baroque Orch. | 46 | 62.23 | 2 | 90 | 2.5 | .71 | 2 | 3 |
| Chamber Ens. Instr. | 78 | 33.68 | 1 | 135 | 1.29 | .59 | 1 | 3 |
| Chamber Ens. Vocal | 70.71 | 27.04 | 30 | 150 | 4.11 | 3.15 | 1 | 17 |
| Choral | 71.69 | 23.03 | 35 | 150 | 3.45 | 2.50 | 0 | 15 |
| Early Music/Per. Instr. Ens. | 73.33 | 20.82 | 50 | 90 | 1.33 | .58 | 1 | 2 |
| Electronic Music | - | - | - | - | - | - | - | - |
| Marching Band/Pep | 100.68 | 50.91 | 30 | 150 | 14.55 | 8.56 | 3 | 36 |
| Musical Theatre | 118.33 | 2.89 | 115 | 120 | 5.33 | 1.15 | 4 | 6 |
| New Music | 80 | 14.14 | 70 | 90 | 1 | 0 | 1 | 1 |
| Opera | 110.63 | 20.78 | 90 | 150 | 2.13 | 1.36 | 1 | 4 |
| Percussion Ens. | 61.67 | 12.58 | 50 | 75 | 1 | 0 | 1 | 1 |
| String Ens. | 70.13 | 35.07 | 1 | 120 | 1.50 | .53 | 1 | 2 |
| Symphony Orch. | 103.74 | 46.77 | 1 | 150 | 3.70 | 5.34 | 1 | 30 |
| Wind Symphony/Band | 99.02 | 29.41 | 50 | 210 | 2.27 | .98 | 1 | 6 |
| Vocal Jazz Ens. | 63.40 | 15.42 | 50 | 80 | 8.40 | 5.55 | 2 | 16 |
| Woodwind Ens. | 100 | 34.64 | 60 | 120 | 2.33 | 1.53 | 1 | 4 |
| Other | 90 | 34.64 | 60 | 150 | 2.20 | .45 | 2 | 3 |

Table F.3. Frequency and composition of ongoing activities outside of college-level schools of music

| | | | | No. of Musicians in the ens. | | | |
|---|---|---|---|---|---|---|---|
| Ens. type | *N*=72 | Professional-based ens. (Paid) | Community-based ens. (Volunteer) | M | SD | Min. | Max. |
| Big Band/Jazz | 1 (1%) | 1 | - | 10 | - | 10 | 10 |
| Brass Ens. | 2 (3%) | - | 2 | 23.50 | 2.12 | 22 | 25 |
| Baroque Orchestra | 2 (3%) | 1 | 1 | 37.50 | 3.54 | 35 | 40 |
| Chamber Ens. Instr. | 3 (4%) | 3 | - | 8.67 | 8.14 | 3 | 18 |
| Chamber Ens. Vocal | 6 (8%) | 4* | 3* | 21.83 | 13.06 | 7 | 40 |
| Choral | 25 (35%) | 3* | 23* | 51.04 | 34.55 | 16 | 151 |
| Early Music/Per. Instr. Ens. | 2 (3%) | 2 | - | 6 | 2.83 | 4 | 8 |
| Electronic Music | - | - | - | - | - | - | - |
| Marching Band/Pep | 1 (1%) | 0+ | 0+ | 30 | - | 30 | 30 |
| Musical Theatre | 1 (1%) | 1 | - | 20 | - | 20 | 20 |
| New Music | 2 (3%) | 2 | - | 14 | 5.66 | 10 | 18 |
| Opera | 2 (3%) | 2 | - | 62.50 | 3.54 | 60 | 65 |
| Percussion Ens. | - | - | - | - | - | - | - |
| String Ensemble | - | - | - | - | - | - | - |
| Symphony Orchestra | 16 (22%) | 11** | 7** | 58.81 | 13.44 | 30 | 75 |
| Wind Symphony/Band | 7 (10%) | - | 6+ | 49.43 | 18.81 | 26 | 80 |
| Vocal Jazz Ens. | - | - | - | - | - | - | - |
| Woodwind Ens. | - | - | - | - | - | - | - |
| Other | 2 (3%) | 2 | - | 34.50 | 41.72 | 5 | 64 |

*. One participant selected “yes” for both professional and community-based ensemble type
**. Two participants selected “yes” for both professional and community-based ensemble type
+. One participant selected “no” for both professional and community-based ensemble type

Table F.3. *continued*

| | No. of reh. per month | | | | Duration of reh. in min. | | | |
|---|---|---|---|---|---|---|---|---|
| Ens. type | M | SD | Min. | Max. | M | SD | Min | Max. |
| Big Band/Jazz | 1 | - | 1 | 1 | 150 | - | 150 | 150 |
| Brass Ens. | 3 | 1.41 | 2 | 22 | 120 | 0 | 120 | 22 |
| Baroque Orch. | 4 | 1.41 | 3 | 5 | 165 | 21.21 | 150 | 180 |
| Chamber Ens. Instr. | 1.67 | 1.15 | 1 | 3 | 100 | 34.64 | 60 | 120 |
| Chamber Ens. Vocal | 2.83 | .98 | 2 | 4 | 118.33 | 52.69 | 50 | 180 |
| Choral | 4.32 | 2.01 | 1 | 13 | 111 | 36 | 45 | 180 |
| Early Music/Per. Instr. Ens. | 1.50 | .71 | 1 | 2 | 115.50 | 135.06 | 20 | 211 |
| Electronic Music | - | - | - | - | - | - | - | - |
| Marching Band/Pep | 1 | - | 1 | 1 | 50 | - | 50 | 50 |
| Musical Theatre | 1 | - | 1 | 1 | 180 | - | 180 | 180 |
| New Music | 2.50 | 3.54 | 0 | 5 | 105 | 21.21 | 90 | 120 |
| Opera | 8 | 5.66 | 4 | 12 | 135 | 21.21 | 120 | 150 |
| Percussion Ens. | - | - | - | - | - | - | - | - |
| String Ensemble | - | - | - | - | - | - | - | - |
| Symphony Orchestra | 4.13 | 1.36 | 1 | 8 | 146.88 | 20.89 | 120 | 180 |
| Wind Symphony/Band | 4.29 | 2.75 | 1 | 10 | 122.14 | 25.14 | 90 | 150 |
| Vocal Jazz Ens. | - | - | - | - | - | - | - | - |
| Woodwind Ens. | - | - | - | - | - | - | - | - |
| Other | 3 | 1.41 | 2 | 4 | 150 | 42.43 | 120 | 180 |

Table F.3. *continued*

| | No. of performances per year | | | |
|---|---|---|---|---|
| Ens. type | M | SD | Min. | Max. |
| Big Band/Jazz | 10 | - | 10 | 10 |
| Brass Ens. | 7 | 1.41 | 6 | 22 |
| Baroque Orch. | 4.50 | 2.12 | 3 | 6 |
| Chamber Ens. Instr. | 6.67 | 3.06 | 4 | 10 |
| Chamber Ens. Vocal | 8.17 | 6.08 | 4 | 20 |
| Choral | 19.04 | 20.45 | 2 | 51 |
| Early Music/Per. Instr. Ens. | 8 | 5.66 | 4 | 12 |
| Electronic Music | - | - | - | - |
| Marching Band/Pep | 20 | - | 20 | 20 |
| Musical Theatre | 6 | - | 6 | 6 |
| New Music | 2 | - | 2 | 2 |
| Opera | 4.50 | 2.12 | 3 | 6 |
| Percussion Ens. | - | - | - | - |
| String Ensemble | - | - | - | - |
| Symphony Orchestra | 7.31 | 3.40 | 2 | 14 |
| Wind Symphony/Band | 5.57 | 1.62 | 3 | 8 |
| Vocal Jazz Ens. | - | - | - | - |
| Woodwind Ens. | - | - | - | - |
| Other | 27 | 33.94 | 3 | 51 |

BIBLIOGRAPHY

Ajzen, Icek. “The Theory of Planned Behavior.” *Organizational Behavior and Human Decision Processes* 50 (1991): 179-211.

Anderson, Marcia K., and Victoria L. Bacon. “Is Knowledge of Change Theory a Critical Competency in the Training of Health Care Practitioners?” *College Quarterly* 9, no. 4 (Fall 2006) http://www.collegequarterly.ca/2006-vol09-num04-fall/anderson_bacon.html (accessed February 18, 2012).

Babin, Angela. “Orchestra Pit Sound Level Measurements in Broadway Shows.” *Medical Problems of Performing Artists* 14, no. 4 (December 1999): 204-209.

Barrett, Janet. “Intersections of Practice, Research, and Policy in Music Teacher Education.” *Journal of Music Teacher Education* 20, no. 2 (2011): 1-5.

Behar, Alberto, Ewen MacDonald, Jason Lee, Jie Cui, and Willy Wong. “Noise Exposure of Music Teachers.” *Journal of Occupational and Environmental Hygiene* 1, no. 4 (April 2004): 243-247.

Boasson, A., R.A. Metkemeijer, and J.H. Granneman. “Sound Exposure of Musicians in a Pit Orchestra: A One Year Study Survey During Rehearsals and Performances in the Netherlands Ballet Orchestra.” *Proceedings of the Institute of Acoustics* 24, no. 4 (2002): 33-34.

Callahan, Ashleigh J., Norman J. Lass, Lindsey B. Foster, Jessica E. Poe, Erin L. Steinberg, and Kathleen A. Duffe. “Collegiate Musicians’ Noise Exposure and Attitudes on Hearing Protection.” *Hearing Review* 18, no. 6 (June 2011): 36-44.

Chesky, Kris, Marla Par, Eri Yoshimura, and Scott Landford. “An evaluation of musician earplugs with college music students.” *International Journal of Audiology* 48 (2009): 661.

_____, Marla Pair, Scott Lanford, and Eri Yoshimura. “Attitudes of college music students towards noise in youth culture.” *Noise & Health* 11, no. 42 (Jan.-Mar. 2009): 49-53.

_____. W. Dawson, and R. Manchester. “Health Promotion in Schools of Music: Initial Recommendations for Schools of Music.” *Medical Problems of Performing Artists* 21, no. 3 (Sept. 2006): 142-144.

_____. “Hearing Conservation and Music Education.” *Seminars in Hearing* 29, no. 1 (February 2008): 90-93.

_____. “Hearing Conservation in Schools of Music: The UNT Model,” *Hearing Review* (March 2006). http://www.hearingreview.com/issues/articles/2006-03_05.asp (accessed February 18, 2012).

_____. and E . Araujo. “Longitudinal Dosimeter Data from 15 College-based Music Ensembles. Oregon or Bust: The Trail to Better Hearing.” 33rd Annual Hearing Conservation Conference, (February 21-23rd, 2008). Portland, OR.

_____. “Measurement and Prediction of Sound Exposure Levels by University Wind Bands.” *Medical Problems of Performing Artists* 25 (2010): 29-34.

_____. “Schools of Music and Conservatories and Hearing Loss Prevention.” *International Journal of Audiology* 50 (2011): S32-37.

_____. and M. Henoch. “Sound exposure levels experienced by a college jazz band ensemble: Comparison with OSHA risk criteria.” *Medical problems of performing artists* 15 (2000): 17-20.

Chung, Jeannie H., Catherine M. Des Roches, John Meunier, and Roland D. Eavey. “Evaluation of Noise-Induced Hearing Loss in Young People Using a Web-Based Survey Technique.” *Pediatrics* 115, no. 4 (April 2005): 861-867.

The College Music Society. “2011 Annual Report of the College Music Society.” under Membership. http://live.music.org/index.php?option=com_content&view=article&id=315:membership&catid=59:cms-annual-report-2011&Itemid=306 (accessed May 1, 2012).

_____. *Directory of Music Faculties in College and Universities, U.S. and Canada, 2010-2011*. 32 ed. Montana: Missoula, 2010.

_____. “Homepage.” http://music.org (accessed August 30, 2011).

Emmerich, E., L. Rudel, F. Richer. “Is the audiologic status of professional musicians a reflection of the noise exposure in classical orchestral music?” *European Archives of Otorhinolaryngol* 256, no. 7 (July 2008): 753-758.

European Union. “Directive 2003/10/EC of the European Parliament.” http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:042:0038:0044:EN:PDF (accessed July 15, 2011).

Folmer, Robert L. “Hearing-Loss Prevention Practices Should Be Taught in Schools.” *Seminars in Hearing* 29, no. 1 (February 2008): 67-80.

Forsythe, Jere L., Daryl W. Kinney, and Elizabeth L. Braun. “Opinions of Music Teacher Educators and Preservice Music Students on the National Association of Schools of Music Standards for Teacher Education.” *Journal of Music Teacher Education* 16, no. 19 (Spring 2007): 19-33.

Glass, Thomas A., and Matthew J. McAtee. “Behavioral Science at the Crossroads in Public Health: Extending Horizons, Envisioning the Future.” *Social Science and Medicine* 62 (Month 2006): 1650-1671.

Health Promotion in Schools of Music project. “Health Promotion in Schools of Music (Homepage).” http://unt.edu/hpsm (accessed August 5, 2011).

Huttunen, K.H., V.P. Sivonen, and V.T. Poykko. “Symphony orchestra musicians’ use of hearing protection and attenuation of custom-made hearing protectors as measured with two different real-ear attenuation at threshold methods.” *Noise and Health* 13, no. 51 (2011): 176-188.

Johnson, Cheryl DeConde, and Deanna K. Meinke. “Noise-Induced Hearing Loss: Implications for School.” *Seminars in Hearing* 29, no. 1 (February 2008): 59-66.

Killion, M., E. DeVilviss, and J. Stewart. “An Ear plug with uniform 15-dB attenuation.” *Hearing Journal* 45, no. 5 (1988): 14-17.

Koskinen, Heli. “Hearing Conservation Among Classical Musicians; Needs, Means, and Attitudes.” (DST diss., Alto University School of Science and Technology, 2010), 17.

Laitinen, Heli. “Factors affecting the use of hearing protectors among classical music players.” *Noise and Health* 7, no. 26 (January-March 2005): 21-29.

_____ and T. Poulsen. “Questionnaire investigation of musicians’ use of hearing protectors, self reported hearing disorders, and their experience of their working environment.” *International Journal of Audiology* 47, no. 4 (2008): 160-168.

_____, Esko M. Toppila, Pekka S. Olkinuora, and Kaarina Kuisma. “Sound Exposure Among the Finnish National Opera Personnel.” *Applied Occupational and Environmental Hygiene* 18, no. 3 (March 2003): 177-182.

Lang, Leslie. “Environmental Impact on Hearing: Is Anyone Listening?” *Environmental health Perspectives* 102, no. 11 (November 1994): 924.

Mace, Sandra Teglas. “A descriptive analysis of university music performance teachers’ sound-level exposures during a typical day of teaching, performing, and rehearsing.” Paper presented at the 9th International Conference of Music Perception and Cognition, Univ. of Bologna, Italy, August 22-26, 2006.

McBride, David, Frank Gill, David Proops, Malcolm Harrington, Kerry Gardiner, and Cynthia Attwell. “Noise and the Classical Musician.” *British Medical Journal* 305, no. 6868 (December 1992): 1561-1563.

McLeod, Tamara C. Valovich Ph.D., Laura C. Decoster A.T.C., Kieth J. Loud M.D., Lyle J. Micheli M.D., J. Terry Parker Ph.D., Michelle A. Sandrey Ph.D., and Christopher White M.S. “National Athletic Trainers’ Association Position Statement: Prevention of Pediatric Overuse Injuries.” *Journal of Athletic Training* 46, no. 2 (April 2011): 206-220.

Miller, Vanessa, Michael Stewart, and Mark Lehman. “Noise Exposure Levels for Student Musicians.” *Medical Problems of Performing Artists* 22, no.4 (December 2007): 160-165.

Millican, J. Si. “Band and Orchestra Teachers’ Rankings of General Pedagogical Knowledge and Skill.” Journal of Music Teacher Education 19, no.1 (August 2009): 68-79.

Music Educator’s National Conference (MENC): The National Association for Music Education, “Health in Music Education (Position Statement),” http://www.menc.org/about/view/health-in-music-education-position-statement (accessed August 5, 2011).

Music Teachers National Association. “MTNA: Health in Music Teaching.” http://www.mtna.org/Portals/1/PDFs/WellnessStatement.pdf (accessed August 5, 2011).

National Association of Schools of Music. “About NASM” from the homepage. http://nasm.arts-accredit.org/index.jsp?page=About+NASM (accessed March 1, 2012).

_____. “Addendum to the NASM Handbook 2010-11.” http://nasm.arts-accredit.org/site/docs/Handbook/NASM_HANDBOOK_2010-11_T.pdf (accessed January 5, 2012).

_____. “Handbook 2010-11.” http://nasm.arts-accredit.org/site/docs/Handbook/NASM_HANDBOOK_2010-11_T.pdf (accessed August 8, 2011). ISSN: 0164-2847.

_____. “NASM-PAMA Draft Advisories for Hearing Health.” http://nasm.arts-accredit.org/index.jsp?page=NASM-PAMA_0_Drafts (accessed August 2, 2011).

Peters, Cheryl, Jadine Thom, Elaina McIntyre, Meghan Winters, Kay Teschke, and Hugh Davies. *Noise and Hearing Loss in Musicians.* Vancouver: Safety and Health in Art Production and Entertainment, 2005. SHAPE.

Qualtrics. Web-Based Survey Software. http://qualtrics.com (accessed August 15, 2011).

Quest Technologies, *Noise Dosimetry Glossary of Terms*. http://questtechnologies.com/Assets/Documents/Sound%20Level%20Meter%20Terms.pdf

Rawool, Vishakha W., and Lynda A. Colligon-Wayne. "Auditory lifestyles and beliefs related to hearing loss among college students in the USA." *Noise & Health* 10, no. 38 (Jan.-Mar. 2008): 1-10.

Reid, Allison Wright. *A sound Ear (I): Exploring the Issues of Noise Damage in Orchestras.* London: Association of British Orchestras, 2001. ABO.

Reid, Allison Wright, and Malcolm Warne Holland. *A Sound Ear II: The Control of Noise at Work Regulations 2005 and Their Impact on Orchestras.* London: Association of British Orchestras, 2008. ABO.

Rumsey, Francis, and Tim McCormick. *Sound and Recording*. 6th ed. Oxford: Focal Press, 2009.

Sataloff, Rober Thayor and Joseph Sataloff. "Hearing Loss in Musicians." Journal of Occupational Hearing Loss 1, no. 3 (1998): 185-194.

Sound Advice. "Schools and Colleges." http://soundadvice.info/schoolsandcolleges/schoolsandcolleges-step1.htm (accessed February 18, 2012).

Steurer, Martin, Susanne Simak, Doris Maria Denk, and Michael Kautzky. "Does Choir Singing Cause Noise-Induced Hearing Loss?." *Audiology* 37 (1998): 38-51.

UK Government. "The Control of Noise at Work Regulations Act of 2005." http://www.legislation.gov.uk/uksi/2005/1643/contents/made (accessed July 1, 2011).

U.S. Department of Health and Human Services. National Institute of Occupational Safety and Health. *Criteria for a Recommended Standard: Occupational Noise Exposure*. Rev ed. 1998. PB: 98-126.

_____. National Institute of Occupational Safety and Health, *Preventing Occupational Hearing Loss: A Practical Guide,* Rev. ed. 1996 (Cincinnati, OH, PB: 96-110), 37.

U.S. Department of Labor. Occupational Safety and Health Administration, "OSHA's mission." http://www.osha.gov/about.html (accessed February 18, 2012).

_____. Occupational Safety and Health Administration. *Regulations (Standards-CFR: 1910)*. http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=9735 (accessed February 18, 2012).

_____. Occupational Safety and Health Administration, Standard Number 1910.95 (May 2, 1983). http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=19093 (accessed February 18, 2012).

Zander, M.F., C. Spahn, and B. Richer. “Employment and acceptance of hearing protectors in classical symphony and opera orchestras.” *Noise and Health* 10, no. 38 (2008): 14-26.

Zeigler, M.C., and J. A. Taylor. “The Effects of a Tinnitus Awareness Survey on College Music Majors’ Hearing Conservation Behaviors.” *Medical Problems of Preforming Artists* 16, no. 4 (2001): 136-143.