Sound Intensity Levels of a University Wellness Center

Jeffrey Burnett, Frederick Britten, and Laci Dearden

The purpose of this study was to investigate the sound intensity levels of a university-based wellness center. This research was initiated in response to the explosion of wellness centers being renovated and constructed across the nation at the university level and the need to entertain participants during fitness activities with some type of auditory sound. Measurements were taken in the wellness center under three conditions: quiet, music on, and music on/active. The intensity levels varied depending on the condition. Although the sound intensity was at an acceptable level during the quiet and music on condition, intensity levels reached an unacceptable level during the music on/active condition when not controlled by an administrator. This study provides a heightened awareness of the risks of possible hearing loss and promotes a role for professionals in health and human performance to collaborate with professionals in communication disorders in setting a safe intensity level of all audio systems.

Keywords: hearing health awareness, fitness centers, noise levels

The International Health, Racquet & Sportsclub Association (2007) released statistics that stated that the health industry in the United States was a $449.7 billion industry in 2006. It was also stated that the fitness facility industry recorded $15.9 billion in revenues alone in 2006. This same study determined that the number of fitness facilities in the United States grew from 17,807 in 2001 to 29,069 in 2006, and 41.3 million people in our society are now members of some type of fitness facility. This is an 8.6% increase over the previous year. The rises in memberships are centered around the growing concern of society’s health and the future costs associated with an unhealthy lifestyle (American Sports Data, 2006). Surprisingly, one side effect—possible hearing loss—has occurred in this fast-growing fitness-facility realm. In almost all cases, the acoustical background is music that would be judged as “loud.” One might wonder if there is an increased risk of hearing loss for individuals who are exposed to this loud noise. Loudness is a subjective experience and is considered the psychological counterpart of the physical measurement of sound intensity (Martin & Clark, 2006). Sound intensity is expressed in decibels (dB). In the environment, the decibel (dB) measurement is expressed in sound pressure level (SPL) on an A-weighted scale (this may be

Burnett is with the Dept. of Health and Human Performance, and Britten and Dearden the Dept. of Audiology, Fort Hays State University, Hays, KS 67601.
expressed as dBA). As a reference, environmental sounds will vary, but typically, normal conversational speech occurs around 65 dB SPL (Martin & Clark, 2006). When considering sound intensity levels, it has been found that levels of 78 dB SPL and above have a strong potential for creating hearing loss that is irreversible (Mills, 1988). For the manufacturing industry, the 8-hr limit for noise exposure without the use of hearing protection is 85 dB (American Speech-Language-Hearing Association [ASHA], 2007). Knowing this, it would be important to initiate an increased awareness of the potential for the risk of hearing loss that might exist within the health care facilities.

Presence of Risk for Hearing Loss in Fitness Facilities

There is still a paucity of research concerning fitness facilities and the potential for hearing loss. A study by Hull (1995) found that 80% of the health clubs and spas played music at 105 dB, which is over the 85 dB suggested level and thus poses a potential hearing health risk. In 2006, the American Speech-Language-Hearing Association listed health clubs as facilities that commonly exceed the desired decibel level of 85 dB. This excessive intensity level directly relates to an increased risk for hearing loss. Smaldino (1998) and Munson (1995) have studied the effects of fitness levels and hearing loss, but little research pertains to hearing loss possibly resulting from the noise level of a facility. With the popularity of these facilities, and the need to entertain within these facilities, one must consider the effects that facility audio systems, personal audio technology with earphones, and exercise equipment noise have on patrons’ hearing health. In addition to the increased risk for hearing loss, ASHA (2007) confirms that there are nonauditory effects of noise on individuals. These would include such things as increased blood pressure, negative cardiovascular effects, and increased breathing rates. Aaberg (2006) stated that the fitness industry has released more research in the last decade than the last five decades combined concerning fitness levels. However, this same industry has ignored important components of hearing health care. To determine the potential effects, the sound intensities must first be documented. Therefore, the purpose of this study was to investigate the sound intensity levels and frequency analysis of a university-based wellness center.

Methodology

A descriptive methodology was used to investigate the sound intensity levels and frequency response measurements of a university wellness center. The university wellness center where data were collected was located in a public university with over 5,200 users a month. Sound-level measurements were taken in the university wellness center during a quiet time (no music or activity) and an active time (when patrons were using the facility). Measurements were taken over a period of two days.
Equipment. A Quest Technologies Model 2700 sound level meter was used to measure the sound intensity levels, and a Model OB-300 combination 1/1–1/3 Octave Band Filter was used to measure the octave frequencies during data collection. The A-weighted scale is the most commonly used scale to measure medium- to high-frequency sounds and is considered the standard when addressing sound intensity levels in determining hearing damage in environmental and/or audio equipments. The octave band filter was used to conduct a spectral analysis of octaves between 63 Hz and 8,000 Hz on the linear scale. This type of measurement is important in obtaining information on the frequency of the sound within the environment (Eglin, 2006).

Procedure. Measurements were taken for a quiet environment when the wellness center equipment was not being used and the audio system was turned off. For the active environment, measurements were taken under four conditions while patrons were using the wellness center equipment: audio system at one-half volume, audio system at three-fourths volume, audio system at full volume, and with the audio system turned off. The type of music played through the audio system in this study was a local top-40 music “pop” genre station that is considered the favorite brand of music offered to the student population. Measurements were taken at specific operator locations at each workout station for each condition during a morning and evening to ensure reliability.

Results

Results of this study showed an average sound intensity level of 56.4 dB SPL (on an A-weighted scale). Table 1 shows a summary of the data in each of the conditions. During activity, when patrons were using the facility and the audio system was on, the sound intensity levels averaged 67.9 dBA, 86.8 dBA, and 87.6 dBA for the one-half, three-fourths, and full-volume settings, respectively. The mean intensity level during activity without music was found to be 62.3 dB SPL.

Figure 1 shows the results of the frequency analysis, which confirms that the highest sound intensity levels were within the lower frequency range of 63 Hz to 500 Hz. This would be expected because much of the sound within any environment

<table>
<thead>
<tr>
<th>Condition</th>
<th>Sound intensity level</th>
</tr>
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<tbody>
<tr>
<td>Quiet</td>
<td>56.4 dB SPL</td>
</tr>
<tr>
<td>Music on</td>
<td></td>
</tr>
<tr>
<td>one-half</td>
<td>67.9 dB SPL</td>
</tr>
<tr>
<td>three-fourths</td>
<td>86.8 dB SPL</td>
</tr>
<tr>
<td>full volume</td>
<td>87.6 dB SPL</td>
</tr>
</tbody>
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Note. SPL: sound pressure level.
is considered lower frequency; however, results do show that the spectrum of the sound within the wellness center was a complex sound, which consists of multiple frequencies.

**Conclusions**

The results of this study show that the sound intensity levels were acceptable in the quiet and activity with no music conditions. In other words, the risk of hearing damage was minimal in these conditions. When the volume setting of the audio system was set at one-half, the sound intensity levels were still acceptable, but when the volume setting was raised to three-fourths and full settings, the sound intensity levels surpassed the acceptable level and the risk of hearing loss was increased.

Based on the results of these data, it was determined that the sound intensity levels in this particular wellness center did exceed the safe level of 85 dB SPL when the volume setting of the audio system was above one-half. The results would concur with those of other studies (Hull, 1995; Yaremchuk, 1999); it is possible for audio systems to create a potential hearing health risk. It should be noted that in this particular university wellness center, the director now maintains the audio system level at one-half volume and restricts volume control so that patrons may not change it to an unhealthy level. Therefore, intensity levels are now within safe limits. This control of the equipment ensures that the audio system is played at an intensity level that is considered to be both comfortable and safe. The director also has complete control over the genre of music being played; it is regulated to

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**Figure 1** — Frequency analysis of sound intensity levels.
the local students’ favorite “pop” genre radio station. As long as the volume is controlled at a safe level, the genre of music would typically have no effect on the intensity in a general audio system of a facility. One observation made during the active period was the number of patrons who were using personal audio technology such as mp3 players and Apple iPods. Although there was not an attempt within this study to obtain measurements of these devices, the devices could certainly increase the risk for hearing loss. Professionals in communication sciences and disorders should take a more active role in the hearing health at fitness facilities. They may do this by educating directors of wellness centers and sharing their knowledge of the increased risk for hearing loss when the audio systems of a facility are played at an unsafe intensity level. Wellness center directors should also be proactive to ensure the hearing health of patrons. One way that directors may address the issue of hearing health in their facilities is by paying special attention to the volume settings of audio equipment purchased for the wellness center. Some popular audio systems, such as Cardio Theatre®, have no warnings or suggestions concerning a safe volume setting on a typical system without the personal viewing screen. Wellness center directors may also collaborate with audiologists and speech-language pathologists to set up appropriate sound intensity levels in their wellness centers and to educate the center’s patrons about the noise levels that can put them at risk for hearing loss. When collaboration occurs, it is possible to provide a fitness environment that promotes healthy hearing just as much as it promotes other aspects of a healthy lifestyle.

References