RESEARCH ARTICLE

NOISE LEVELS IN A NIGERIAN TERTIARY INSTITUTION

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ABSTRACT

Noise-induced hearing loss is an important public health priority since exposure to excessive noise is the major avoidable cause of permanent hearing impairment worldwide and it is expected to add substantially to the global burden of disability as populations live longer and industrialization spreads. This study aimed to assess levels of noise on a random walk across busy "noisy" areas on the campus of the University of Ibadan, Nigeria, in order to determine whether noise posed a risk to hearing and health on the campus. The study was a cross-sectional study in which data on sound pressure levels and the use of protective devices were collected across several busy "noisy" outdoor locations on a random walk through the campus. Sound pressure levels were higher than 85dB in most of the locations. Both the highest and the lowest levels of 112dB and 67dB respectively were found associated with power generating sets, and ear protection observed was inadequate. The study demonstrated the presence of dangerous levels of noise on the campus and an inadequate awareness of the danger, a situation that calls for urgent intensification of action towards hearing conservation, noise awareness and noise abatement programs.

INTRODUCTION

Noise is an unwanted sound and is among the most pervasive pollutants today. However, experts agree that it is not possible to define noise exclusively on the basis of physical parameters of sound. Rather, noise is defined operationally as audible acoustic energy that adversely affects, or may affect the physiological and psychological wellbeing of people (Berglund & Lindvall, 1995). From a physical point of view, sound can have a range of different physical characteristics, but it only becomes noise when it has an undesirable physiological or psychological effect on people (Hamza, 2008). Although not physically visible, noise has been a major catalyst to climate change and practical sources of human health catastrophes globally (Alawode et al, 2008).

Noise is very prevalent in the environment (Berglund & Lindvall, 1995). Common sources include traffic noise, aircraft noise (Jarup, et al, 2008), noise from railroads, construction noise, noise in Industries noise from buildings, (Wetheral, 1991), household equipment, (such as generators, vacuum cleaners, washing machines, grinding machines and some kitchen appliances, lawn mowers) and noise from leisure activities (shooting activities, loud music and music played back in headphones, loudspeakers, home theatres, impulse noise from toys, motorcycle, car racing and other sporting events). All these sources can faithfully reproduce music and other sounds at levels well above known dangerous levels (Wetheral, 1991). And with the progression of industrialization the risk is continually increasing.

Noise has been found to pose several hazards to health. Noise Induced Hearing Loss (NIHL), a permanent impairment in hearing, is probably the most obvious and easily quantified effects of excessive exposure to noise (Humes, Joellenbeck & Durch, 2005, NIOSH, 1998, Ologe, Akande & Olajide 2006; Osibogun, Igweze & Adeniran 2000; Owolawi 2004; Abe 2005, Bakare,1980). Another important hazard is interference with communication, one of the most important components of noise-related annoyance, which can cause anything from a slight irritation to a serious safety hazard involving accidents or even fatalities (Berglund & Lindvall, 1995). Other hazards include psychological effects such as headache, fatigue and irritability, impaired scholastic performance (Cohen and Weinstein, 1981) sleep disturbance (WHO, 2009), affectation of performance, productivity and behaviour at work, other auditory effects such as earache and tinnitus (Simmons et al, 2008), extra auditory health effects ranging from risk factor for hypertension (Gosta et al, 2007, Jarup et al, 2008) to psychosis and even a possible threat to foetal development (Pierson, 1996).

According to the World Health Organization, exposure to excessive noise is the major avoidable cause of permanent hearing impairment worldwide. In the developed nations, excessive noise is at least partially the cause in more than one-third of those with hearing impairment and the risk from social noise is increasing for young people. In developing countries such as Nigeria, occupational, urban, and environmental noise are increasing risk factors for hearing impairment, there is often a lack of both effective legislation against noise and well implemented programs to prevent noise-induced hearing loss.
and there is a serious shortage of accurate epidemiological information on prevalence, risk factors and costs of NIHL. Noise-induced hearing loss is therefore an important public health priority because, as populations live longer and industrialization spreads, NIHL will add substantially to the global burden of disability (WHO, 1997). The objective of this study is to assess the levels of noise on a random walk across busy "noisy" areas on the campus of one of the largest universities in Nigeria in order to determine whether noise poses a risk to hearing and health in this environment. The study area was the University of Ibadan, Ibadan, Nigeria which is the oldest university in Nigeria. It is located five miles (8 kilometers) from the centre of the city of Ibadan in Western Nigeria and has a population of 33,481 students.

METHODS

The study was a cross-sectional study in which data on sound pressure levels were collected across several outdoor locations within the university campus of the University of Ibadan. Three criteria were used to select locations for the study: location within the campus, location in a place with high daytime population density and the presence of sources of community noise. Identified areas were tagged "noise sites". Sound pressure level data were subsequently collected in the identified areas with the aid of an HS5633 digital sound pressure level meter which accorded with the requirements of IEC61627 (Sound Pressure Level Meter) standard. Single recordings were taken from at least one location in each of the sites. Results are presented in the form of a table. The presence or absence of ear protection in these areas was also noted.

RESULTS

Table 1 Sound Pressure Levels in identified

<table>
<thead>
<tr>
<th>&quot;Noise&quot; site</th>
<th>Sound Level (dB)</th>
<th>Contact?</th>
<th>Ear Protection?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Treatment Plant</td>
<td>105</td>
<td>Yes*</td>
<td></td>
</tr>
<tr>
<td>Electricity Generator</td>
<td>103</td>
<td>Yes*</td>
<td></td>
</tr>
<tr>
<td>High-lift pump</td>
<td>85</td>
<td>Yes*</td>
<td></td>
</tr>
<tr>
<td>Low – Lift Pump</td>
<td>89</td>
<td>Yes*</td>
<td></td>
</tr>
<tr>
<td>Air Blower</td>
<td>99</td>
<td>Yes*</td>
<td></td>
</tr>
<tr>
<td>Automobile Horn (Next to a car)</td>
<td>92</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Ambient Noise (Bus stop)</td>
<td>74</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>I.C.T Centre, Queens Hall</td>
<td>67</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Electricity Generator</td>
<td>67</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Kenneth Dike Library</td>
<td>112</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Electricity Generator</td>
<td>85</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Old Air Conditioner (Window Type) unit</td>
<td>93</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Student Union Building Electricity Generator</td>
<td>107</td>
<td>Yes*</td>
<td></td>
</tr>
<tr>
<td>Maintenance Department</td>
<td>82</td>
<td>Yes*</td>
<td></td>
</tr>
<tr>
<td>Cummins Generator at Power House</td>
<td>77</td>
<td>Yes*</td>
<td></td>
</tr>
</tbody>
</table>

* Protection used only by a few people

Seven noise sites were identified that matched the selection criteria. Sound pressure levels in the selected areas are shown in table 1. The highest level of noise of 112dB was found associated with the generator at the Kenneth Dike Library. The lowest level was found also associated with a generator at the ICT centre in Queen's hall. Only three (21.4%) of these sites had levels of noise below 85 dB and There was use of ear protective devices observed at some of the sites but only by a few people.

DISCUSSION AND RECOMMENDATIONS

We ascertained that the levels of noise in several places in the study area were dangerously high. We also found that peoples' awareness of the dangers of exposure to noise may be inadequate and that even in the industrial areas adequate steps were not been taken to ensure compliance with the recommended safety regulations. This was evidenced by the inadequacy of use of protective measures even among workers in the areas with machinery where the practice of occupational safety procedures was expected. The presence of high levels of coupled with possible inadequacy of awareness and use or enforcement of protective measures makes the situation very grave.

NIHL usually occurs gradually over many years by listening to sound that is too loud, for too long but it can also occur from a single activity. To prevent NIHL from noise exposure especially in workplaces, guidelines have been issued various regulating agencies. The United States Occupational Safety and Health Administration (OSHA) guidelines permit exposure to 85 dB for 16 hours per day, and uses a 5-dB time-intensity trade-off: for every 5 dB increase in noise level, the allowable exposure time is reduced by half. For every 5 dB decrease in noise level, the allowable exposure time is doubled. Thus, the allowable time is 16 hours at 85 dB, 8 hours at 90 dB, 4 hours at 95 dB, 2 hours at 100 dB, 1 hour at 105 dB and so on (OSHA, 1983). However, the United States National Institute for Occupational Safety and Health (NIOSH) has stricter recommendations. NIOSH recommends an exposure limit of 85 dB for 8 hours per day, and uses a 3 dB time-intensity trade-off: for every 3 dB increase in noise level, the allowable exposure time is reduced by half. For every 3 dB decrease in noise level, the allowable exposure time is doubled. Thus allowable time is 8 hours at 85 dB, 4 hours at 88 dB, 2 hours at 91 dB, one hour at 94 dB, 30 minutes at 97 dB, and so on (NIOSH, 1998, NIOSH & CDC, 2002). The NIOSH values are based on scientific studies relating noise exposure to hearing loss, and are more protective of hearing (Niquette, 2011). The standards do not account for noisy activities and hobbies (e.g., concerts, ATVs, snowmobiles, power tools, car races, live music, etc.) which may further increase risk for NIHL (Niquette, 2011).

Thus it is understandable why NIHL can also occur from a single activity. By 112 dB (the highest sound pressure level in our study), the allowable exposure time, according to NIOSH guidelines is less than one minute. While the situation is already worrisome, recent evidence makes the need for control of noise even more urgent. It is currently believed that in genesis of NIHL there are initially some temporary shifts in the threshold for hearing known as temporary threshold shifts (TTS). With TTS, hearing thresholds usually return to pre exposure levels after a period of auditory quiet. It has therefore been assumed that the structure and function of the auditory system was affected only temporarily by noise with permanent changes only occurring after repeated insults (McBride & Williams, 2001, Niquette, 2011).

However, Kujawa and Liberman (2009) have shown in animal models that while outer hair cells do recover after exposure, other changes in the basal region of the cochlea do not. There is dramatic degeneration of both pre and post-synaptic elements of the inner hair cells and spiral ganglion cells. This damage is not detectable using current test protocols and even the loss of spiral ganglion cells is not seen until weeks or months post-exposure (Niquette, 2011). Kujawa and Liberman (2009) have therefore suggested that noise can cause subclinical damage which has progressive consequences that...
may not manifest until much later, although it may be expressed as difficulty hearing in noisy environments, and/or in associated auditory disorders like tinnitus and hyperacusis (Niquette, 2011). Therefore, the sooner we identify hearing risk and minimize it, the better. This underscores the significance of our findings: even random and brief exposure to noise may pose a risk to hearing and should not be ignored.

It is noteworthy that both the highest and lowest sound pressure levels that were measured in our study were found in association with power generating sets. With poor power supply in our country, power generating sets have become very common. This finding suggests that while there may be need for alternative sources of power, there are options from which people can choose from in order to ensure that the alternative power source does not eventually possess a hazard to hearing, including options like electricity inverters which do not produce the loud noise that generating sets do. Our noise awareness campaigns should make people aware of such options. It should also be noted that power generating sets are also used often at night in this environment. The recommended night time noise level is 40dB (WHO, 2009) and even the lowest ‘noise’ area is associated with noise that is much higher than the recommended night time level.

This study also suggested that the level of awareness of the public is still not high enough. We need to educate our public of the need to reduce the levels of noise and to avoid noise for the purposes of hearing conservation. This is very important because several activities that people are commonly involved with, including leisure activities like music, are capable of generating dangerously high levels of noise (ARHF, 2008). At present, there are at present a few hearing conservation and hearing awareness programs being conducted in our environment but most are sporadic, perhaps on World hearing day or on occasions of meetings of organizations. These activities are commendable but there is need for ongoing and sustained programs that will keep the level of awareness high in the community. There is also a need for ongoing training and retraining of workers in industries about the dangers of noise and how to protect themselves.

As essential parts of noise abatement and hearing conservation programs, there is also a need to monitor environmental noise levels exposures, especially in industrial settings, to assess risk where possible and use hearing protection when necessary to reduce the risk of NIHL. Awareness must be raised about the availability of personal protective equipment with which exposure to noise can be reduced, especially when hazardous exposures are unavoidable in work places and social gatherings. Individual education has also been shown to be beneficial. (Tsikumi, 2008). These protective devices include ear plugs, ear-muffs, sound enclosures (which enclose noisy equipment without limiting access or impeding machine function), acoustic doors and windows sound walls, fences and barriers (which reduce sound transmission), acoustic baffles, banners, curtains, blankets, panels and ceilings (for sound absorption), and sound diffusers designed to redirect or disperse sound waves.

Personal daily noise exposures of people who work in noisy areas can be measured by small noise exposure meters called dosimeters which are physically worn in order to record exposure levels. These levels are used to calculate eight hour Total Weighted Average (TWA) exposure. Alternatively, exposures can be estimated using individual noise levels and duration times for tasks done throughout the day. In addition there should be continuous monitoring of industrial areas, to ensure compliance with industrial regulations for control of noise and the use of protective devices, and vigorous enforcement of existing regulations concerning the control of community noise.

The limitations of this study include the fact that the study took only single point sound pressure level measurements and did not follow up on the trends of the sound pressure level at any of the sites. More comprehensive measurements at every site would have given more accurate pictures of what happens at those "noise" sites. In addition, the study was designed to study noise on a random walk through the campus. A noise map of the entire campus would be of immense value. It would however take more time, cost more and be more difficult to produce. We recommend that future studies can focus on these areas. Despite these limitations however, our study has been able to demonstrate the presence of dangerous levels of noise in the study area and the possible lack of awareness of it in those exposed of the risk to which they are exposed, a situation that calls for very urgent action.

References


Wetheral E. A. 1987. Control of noise and vibration in dwellings; a practical alternative. Inter-noise 87, Beijing, China.


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