Sound Levels at Local Bars and Restaurants

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Abstract

Dangerous sounds can be encountered throughout activities in everyday life. One of the biggest leisure activities done by college-aged people is going out to local bars and restaurants. The purposed of this study was to see how safe it is for employees and patrons to be in these environments for long periods of times, as well as if there are ways to test sound levels without buying expensive equipment. Data was collected from eleven local bars and restaurants during a four week period using an iPhone 5 SLA Lite app and a Casella CEL-620B Type 1 sound level meter with octave band analysis. Overall, sound levels were shown to be above the recommended 85 dB(A) levels, proving that workers and patrons are spending their times in unsafe levels. Also, phone apps are shown to be less reliable compared to actual sound meters.

Hearing is the second most important sense to have (Kollár, 2008). However, many studies show that the incidence of noise-induced hearing loss (NIHL) is rising, especially among young populations. One of the biggest reasons for young person's contributing causes is recreational noise. "It is estimated that over two decades, the number of young people with social noise exposure has tripled (to around 19%) since the early 1980s, while occupational noise has decreased" (Serra et al., 2014). One of the biggest reasons for this is because of how young adults are spending their free time. As college students, one of the biggest recreational activities is going out with friends to eat and drink. Wherever you go, there is a bar or restaurant just miles from campus. According to a study done in Australia, "annual noise exposure from the five leisure activities ranged from 0–6.77 times the acceptable noise exposure, with nightclubs posing the greatest risk. Those who attended one noisy activity were more likely to attend others, in particular nightclubs, pubs, and live music events" (Gilliver, Williams, 2012). Not only are patrons affected by this, workers have to be in hazardous hearing areas, usually without protection provided. It is important for young adults especially college students to be aware of health risks.

Whether it's for a huge sporting match or just a night out with the friends, students all over the United States can be found at the local bar. During peak times, it's impossible to hear what people are trying to say. Although patrons aren't spending their whole days at bars, their hearing is still affected. Depending on how high the levels are, you don't need to be at the bar for 8 hours a day to experience some degree of damage. However, there are many people who do spend 8 hours a day or 40 hours a week in those settings. Some workers may even spend over 40 hours a week. According to the

Occupational Safety Heath Administration (OSHA), workers should not be exposed to sounds that are above 85 decibels/dB(A) during the equivalent 8-hour shift. The chart below shows the maximum amount of time one should spend per day in an noisy area, based on the sound levels:

Figure 1

Average Sound Exposure Levels Needed to Reach the Maximum Allowable Daily Dose of 100%

Time to reach 100% noise dose	Exposure level per NIOSH REL
8 hours	85 dB(A)
4 hours	88 dB(A)
2 hours	91 dB(A)
60 minutes	94 dB(A)
30 minutes	97 dB(A)
15 minutes	100 dB(A)

In published research on nightclubs, the measured levels have almost always exceeded the recommended guidelines and often showed levels above 100 dB(A). As shown from the chart above, one shouldn't be in a bar or restaurant with those exposures for more then 15 minutes (Kardous, Themann, Morata, Lotz, 2016). In reality, one shouldn't be anywhere without ear protections that gives off over 100 dB(A). Those levels are just unsafe for anyone. For a little more detailed explanation about workers, the next chart below specifically shows how much sounds affect the average worker (Johnson, 2009):

Figure 2

Exposure Level (8-hr time-weighted average)	Excess Risk
80 dB A	1%
85 dB A	8%
90 dB A	25%

Excess risk of developing material hearing impairment as a function of daily noise exposure (assuming a 5-day work week) over a 40-year working lifetime

In a similar study, "…sound level at a rock concert is always around 100–115dBA. Considering the same hearing damage risk criteria of 85 dBA exposure duration for eight hours, the author suggested that exposure duration of 100 dBA should be less than 1.25 hours per week…" (Zhao, Manchaiah, French, Price, 2009). Although not a bar or restaurant, this study shows that the way our generation is spending leisure time is causing harm. A few hours of being out with the friends can be more harmful then anyone every expected.

There needs to be a stop to this problem before it becomes an epidemic. "It will be too late to discover in 10 or 20 years that entire generations of young people are suffering from hearing problems, much earlier than the deterioration expected due to aging" (Muchnik, Amir, Shabtai, Kaplan-Neeman, 2011). It is very important for everyone, especially young adults, to realize how important hearing health is. Earplugs should be provided frequently. Fortunately, there are so many phone apps out right now that give you an estimate of the sound levels that are being given off. Ranging in prices, including free versions, there are downloadable apps available to most people. It

wouldn't hurt for anyone to have sound level meter apps on their phones to know when the area they are in is unsafe or not. College students especially are at the age where a lot of leisure time is spent where loud music is being played. It would be beneficial for students to have a phone app that can be accessed at any time without paying a fortune.

Purpose:

There are a few things that are being accomplished with this study. The first is testing sound levels at various local bars and restaurants, which college students may attend, to see what kind of outputs levels are. At each bar and restaurant, the average and peak sound level was recorded. The second purpose of this study is to find out if phone apps are reliable. The phone apps output levels are compared to a professional sound level meter results.

Procedure:

During a 4-week period, data was collected from eleven local bars and restaurants in the Chicago land area. Results were noted at each bar/restaurant during its peak time to get the maximum sound levels that were given out. The time frame ranged from thirty minutes to an hour at each location. Data was collected on the phone and on a sound meter.

On a piece of paper, data was collected at three different times during the meal. The first reading was recorded as soon as both machines entered the building. The second one was noted half way through the night, while the last one was noted right before exiting the building.

Instrumentation:

The SLA Lite app was used to collect data through the phone, which was downloaded from the Apple Store. The phone used was an iPhone 5. The minimum, average and maximum Leq (dB) were the only information the app had available to show. The second device used was the Casella CEL-620B Type 1 sound level meter with octave band analysis. All data was collected and recorded on a separate sheet of paper for later use.

Results:

After collecting and comparing all of the data, results showed averages above the recommended 85 dB(A). With the phone app, it showed an average of 88.49 dB(A), ranging between 76.3 to 94.1 dB(A). With the sound meter, the average was 86.75 dB(A), ranging between 74.0 to 93.8 dB(A). Overall, the averages were similar. Even though averages ended up being very similar, when comparing data from each bar and restaurant individually, data did not always match up. Below is a chart of each bar's and restaurant's average sound level output.

Figure 3

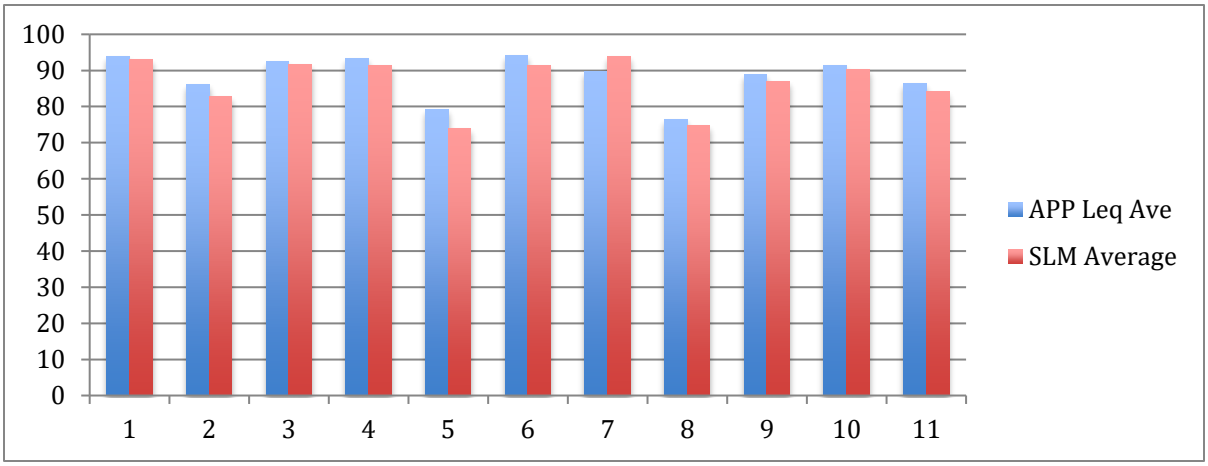
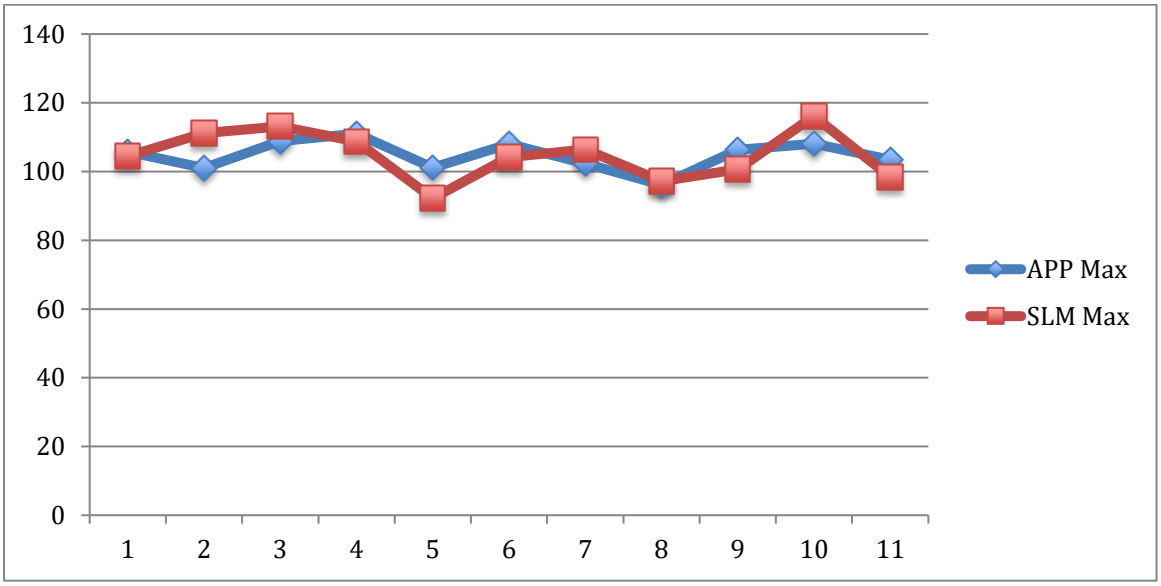


Figure 3 shows the maximum peaks that were reached at each location. The maximum peak average on the phone app reached 104.85 dB(A), with the range from 96.1 to 108.8 dB(A). The average sound meter peak was at 104.79 dB(A), with a range of 92.2 to 116.1 dB(A). Notice that although averages are almost the same, the ranges are a bit different. Figure 4 is a chart of each locations maximum peak on each device.

Figure 4



Overall, results were noted three times during the meal. Averages were also taken at the end. The averages dB(A)'s were recorded as well as the max peaks as so from each location. Figure 5 shows the exact outputs that were recorded throughout the night at each location.

Figure 5

	E	F	G	H	I	J	K	L	M	N
1	SLM 1	APP1	SLM 2	APP2	SLM 3	APP3	APP Leq Ave	APP Max	SLM Average	SLM Max
2	93.6	94.8	93.1	94.3	87.5	92.8	93.8	105.8	93.1	104.5
3	85.8	80.7	85.1	86.5	76.5	80.3	86.1	101	82.8	111.2
4	78.4	83.4	91.9	89.4	87.1	86.6	92.4	108.8	91.7	113.1
5	92.1	94.9	91.8	92.9	91.3	90.4	93.3	111	91.5	108.7
6	75.1	77.7	76.3	76.6	67.5	63.8	79.1	101.1	74	92.2
7	87.5	88.2	92.1	93.7	90.2	91.5	94.1	108	91.3	104.2
8	94.3	90.2	89.2	83.4	93.4	91.3	89.7	102.3	93.8	106.4
9	70.1	69.3	72.3	73.7	75.1	77.6	76.3	96.1	74.8	97.2
10	78.90	79.9	89.2	87.4	89.2	91.2	88.8	106.3	86.9	100.6
11	95.8	99.1	83.7	84.1	86.5	89.3	91.3	108.1	90.2	116.1
12	85.1	86.5	83.7	84.5	88.1	85.4	86.4	103.4	84.1	98.4
13	**85.16**	**85.82**	**86.47**	**86.20**	**84.43**	**85.48**	**88.49**	**104.85**	**86.75**	**104.78**

Discussion:

Although the results show similar averages, when comparing each individual bar's data, the numbers were quite off. For example, the max peak at Bar #3 was 108.3 dB(A) on the app, while the device showed 113.1 dB(A). Referring back to the Figure 1, it is clear to see a change of just a few decibels results in a huge change of how much is acceptable for the ear to handle. For example, a human ear can sustain 85 dB(A) for 8 hours, while only 88 dB(A) for only 4 hours. So, although over the 100 dB(A) limit, results so different from each other can cause questions on to whether or not a phone app is reliable enough to give off accurate results while testing sound levels. Furthermore, as a side experiment, the app and device were tested side by side. Music was played off of a computer to see how close the two meters were estimating the sound level outputs. A picture was taken to show exact results at the same time.

Figure 6

In the first of three pictures, the results are nearly the same. The second picture shows around a 5 dB(A) difference, while the third picture shows an almost 10 dB(A) difference. With results like this, it's hard to be able to prove that the phone app is reliable.

Regardless, overall the study does prove that it is not safe for employees to work at bars and restaurants without hearing protection. Even though the numbers did not always line up, both devices showed averages and peaks above the recommended 85 dB(A) mark. Owners and managers need to be more aware of their employees' health. Although one cannot make anyone wear earplugs, with results showing levels above 85dB(A), ear protection should be provided. With the studies averages being between 87-88 dB(A), no one should be a bar for more then 3-4 hours, especially with the average peaks laying around 105 dB(A), and some over 110 dB(A). In reality, 100 dB(A) should be limited to a total of 15 minutes per day.

Not only is it unsafe to work in loud environments, patrons should be aware of hearing health as well. For example, one of the bar's average sound meter reading was a 93.8 dB(A), with a 106.6 dB(A) peak. If relied solely on the average reading, it is unsafe to have spent over just an hour at that bar. However, when friends are going out to only one bar, it is very acceptable to spend over an hour at one place. Not only should workers consider hearing protection, patrons should be bringing earplugs for themselves as well.

Overall, hearing health should be talked about more. Although this study focused only on bars and restaurants, the public needs to realize that they are exposed to dangerous levels everyday. Whether it's walking down a street in the city or watching a live sporting event, ears and hearing are affected. Hearing health is not talked about enough and protection should be more utilized by the public.

If this experiment were to be done over again, a bigger time frame would have been more appropriate. Four weeks to collect data from 10-12 different bars and restaurants was difficult in the sense of always getting each bar and restaurant at its busiest time. If data was truly collected at the busiest time for each bar, the averages and possibly peaks would have probably been much higher, therefore proving the argument even more. Overall, this study proved the initial hypothesis right. Bars and restaurants are giving off dangerous sound levels to their employees and patrons, however there are ways to prevent and protect oneself from the possible damage noisy areas can cause.

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