

Survey on Behaviors and Opinions about iPod Use among College Students

Carolyn Novaleski, John Benedict, Leeanna Erway, Courtney Fenton, Kristin Horan, Meryl Jacobs, Sarah Kitko, Leeann Koch, Erin Lolley, Stephanie Marcino, Janelle Strickler

¹Pamela A. Smith, Ph.D., CCC-SLP
Department of Audiology and Speech Pathology
Bloomsburg University, Bloomsburg, PA 17815

ABSTRACT

As the popularity of Personal Listening Devices has increased in recent years, there is a lack of agreement about the effects of Personal Listening Devices on hearing health. The purpose of this study was to investigate the knowledge, opinions, and behaviors of college students with respect to iPods and hearing. Thus, a 27-item survey was adapted from the Personal Listening Device and Hearing Questionnaire and administered to 459 undergraduate and graduate students. Compared to female participants, male participants were significantly more likely to report setting iPods at higher volume levels. Compared to white participants, nonwhite participants were also significantly more likely to report setting iPods at higher volume levels. Participants in communication majors were more likely than those in non-communication majors to practice safer listening behaviors and to allocate the responsibility of hearing health to Personal Listening Device manufacturers. These results agree with previous findings in the literature that male and nonwhite populations may be at greater risk of developing hearing loss secondary to iPod use.

Keywords: college students; hearing loss; iPods; personal listening devices

The increasing popularity of Personal Listening Devices (PLDs) has sparked interest in studying the effects of leisure noise on hearing health (Peng *et al.* 2007). In the past, studies emphasized occupational noise exposure and the risk of developing sensorineural hearing loss (Chung *et al.* 2005). Researchers only recently began to study the effects of leisure noise on hearing, in particular PLD usage such as MP3 players and iPods (Vogel *et al.* 2007). Lee *et al.* (1985) found that the risk of hearing loss increased when participants listened to headphones attached to cassette players at relatively safe volumes for extended durations. Chung *et al.* (2005) suggested that awareness about the potential hearing effects of PLDs is low among adolescents. This is cause for concern since many studies indicated that adolescents and young adults are at greater risk of developing hearing loss based on self-reported unsafe listening practices with PLDs (Vogel *et al.* 2007).

Kim *et al.* (2009) conducted a study to test the hearing of frequent PLD users. Participants were tested using pure-tone audiometry. They were presented with a series of frequencies and intensities. Participants were grouped according to listening practices and frequency of use. No significant differences in hearing were found with participants who used PLDs daily. However, participants who used PLDs for longer than five years had higher hearing thresholds. Participants who used PLDs for longer than 15 years also had higher hearing thresholds at 4,000 Hertz. These findings suggested that hearing was negatively affected with longer PLD usage, particularly at higher frequencies. Kim *et al.* (2009) suggested that consumers be made aware of the long-term effects of PLDs on hearing health and learn to adopt safer listening practices to prevent hearing loss.

While some researchers focused on adolescent and adult populations (Chung *et al.* 2005), few targeted the college population to the same extent. Because college students are

¹Faculty mentor and correspondence psmith@bloomu.edu

believed to be frequent PLD users, a survey study by Danhauer *et al.* (2009) investigated the use of iPods among college students. An 83-item survey was administered to students from Division I schools via online and paper surveys. Nearly two thirds of participants reported owning an iPod, suggesting that iPod use is prevalent among this population. A large number of participants reported using earbud style headphones over other styles. Few participants reported symptoms of hearing loss following iPod use, and only a small percentage reported listening for more than three hours at a time. Moreover, the authors concluded that although a small portion of college students are at risk of developing hearing loss, the majority of college iPod users practice safe listening behaviors.

Despite the growing field of research on PLDs, studies are incongruent with respect to the effects of PLD usage on hearing. While several studies indicated that PLD users are at significant risk of developing hearing loss (Kim *et al.* 2009; Peng *et al.* 2007), other studies suggested that there is no such risk (Mostafapour *et al.* 1998; Williams 2005). Thus, the purpose of the present study was to determine if college students reported responses consistent with the Danhauer *et al.* (2009) study regarding iPod use and to gain better understanding of iPod practices among a college population. The present study surveyed college students on their knowledge, opinions, and behaviors about hearing and PLD usage; the study was limited to iPod devices. Selected questions were taken from the Personal Listening Device and Hearing Questionnaire from Danhauer *et al.* (2009) to compare responses from both studies. We expected the majority of college students to report iPod use based on Danhauer and colleagues' finding that iPod usage is prevalent among the college population. It was also hypothesized that students in communication majors would report safer listening practices and more knowledge about hearing issues than students in non-communication majors. This was based on the belief that students in communication majors (e.g., Audiology, Speech Pathology) received more education about hearing health through school curricula than students in other majors.

METHODS AND MATERIALS

Participants

Participants were 459 undergraduate and graduate students (147 males, 312 females) from general education classes at Bloomsburg University, Bloomsburg, PA. Although age was not reported, participants indicated class standing (freshman, sophomore, junior, or senior) on the survey form. Participants were offered an incentive by having their name placed in a lottery for the opportunity to win gift certificates to stores and restaurants. Some participants were also offered extra credit in a course. Participants signed consent forms and the Institutional Review Board approved the protocol.

Survey Instrument

A 27-item survey (Appendix 1) was adapted from the Personal Listening Device and Hearing Questionnaire developed by Danhauer *et al.* (2009). Survey questions were se-

lected based on relevance to hearing health and ease of comparison between studies. The survey consisted of closed-ended, multiple choice questions and was divided into four sections: (1) demographic information, including gender, ethnic background, college status, and academic major (questions 1 to 4); (2) knowledge, opinions, and behaviors regarding iPod use (questions 5 to 13, 23 to 27); (3) self-reported symptoms of potential hearing loss based upon a 6-point rating scale ranging from 1 = never to 6 = always (questions 14 to 19); and (4) levels of participant agreement to questions 20-22 based on a 6-point Likert scale ranging from 1 = strongly disagree to 6 = strongly agree. No identifying information was included on the survey.

Administration of Survey

To gain a representative sample of college students, we chose to survey students in undergraduate general education classes. We obtained permission from faculty members to administer paper and pencil surveys to students during class. Classes included a general psychology class of approximately 200 students, an introductory art history class of approximately 150 students, and smaller introductory-level classes in communication studies, exercise science, and statistics with approximately 30 students in each class. Participants were instructed to complete the survey during class and to detach the consent form from the survey. It took approximately 15 minutes to complete; surveys were collected immediately after completion. The return rate was 91.8%. The survey data were entered into an Excel spreadsheet by the first author and rechecked for accuracy by the remaining authors. Incomplete surveys and surveys with unclear responses were eliminated. The data were analyzed using SPSS-16.0 statistical software.

RESULTS

Table 1 provides the demographic information based on the survey. The demographic information of participants indicates that more females were surveyed than males (approx-

Table 1. Percentages of responses for demographic information. There were 384 responses to the survey.

Question #	Response	%
1 Gender	Male	29.7
	Female	70.3
2 Ethnic Background	Asian/Pacific Islander	1.8
	Hispanic/Latino	2.3
	Black/African	8.9
	White/Caucasian	86.5
	Other	0.5
3 College Status	Freshman	27.9
	Sophomore	32.8
	Junior	18.8
	Senior	20.0
4 Major	Graduate student	0.5
	Communication	11.7
	Non-communication	88.3

imately 70 and 30%, respectively). The majority of participants reported their ethnic background as White/Caucasian (86.5%), while the remaining participants reported their ethnic backgrounds as Black/African, Hispanic/Latino, and Asian or Pacific Islander (8.9, 2.3, and 1.8%, respectively). These responses were later reclassified as white and non-white. There was a representative distribution of reported college status for undergraduate students. However, only a small portion of participants were graduate students (0.5%). Participants wrote their academic major on a provided line and these responses were later reclassified as communication majors (11.7%) and non-communication majors (88.3%). Communication majors included Audiology, Speech Pathology, American Sign Language Interpreting, and Deaf Education. Non-communication majors included all other responses.

Table 2. Percentages of responses for iPod knowledge, opinions, and behaviors.

Question #	Response (%)			Total
	Yes	No	Don't Know	
5	91.9	8.1	0	100
6	58.6	32.3	9.1	100
7	22.4	63.3	14.3	100
8	10.4	80.7	8.9	100
9	93.5	6.5	0	100
10	74.2	19.3	6.5	100
11	64.3	24.5	11.2	100
12	45.3	52.1	2.6	100
13	32.3	43.7	24	100

This reclassification was intended to determine if there were differences between the degree of education concerning hearing health and PLD listening behaviors.

Table 2 shows the responses to questions 5-13 of participants' knowledge, opinions, and behaviors concerning iPod use (see Appendix 1). The majority of participants (91.9%) reported using an iPod (Question 5) and 93.5% of participants who reported using an iPod indicated that they set their iPod volume level higher when in noisy backgrounds (Question 9). The responses to Question 24 indicate that earbuds were the most frequently reported style of headphones (86.7%). Since Hodgetts et al. (2007) found that participants listened to MP3 players at the highest preferred-listening levels while using earbud headphones in noisy conditions, the present study also investigated this relationship. The data were analyzed using a chi-square test. There was no significant difference between reported headphone style and volume level when in noisy backgrounds (Questions 24 and 9, respectively), ($\chi^2_{(3, N=384)} = 1.32, p > 0.05$).

While 45.3% of participants indicated that they were surprised by the iPod volume level of their previous usage

(Question 12), more than half of participants (63.3%) reported that other people around them could not hear their iPods (Question 7). The majority of participants (80.7%) disagreed with the idea that people with pre-existing hearing loss do not have to worry about future hazardous noise exposure (Question 8). Approximately one third of participants (32.3%) reported believing that their iPod use could have contributed to a possible hearing loss (Question 13). However, this question did not specify if participants believed that they did or did not have a hearing loss. Nearly three fourths of participants (74.2%) reported a preference in turning down the volume level rather than limiting the duration of listening (Question 10). More than half of participants (64.3%) reported that PLD manufacturers should build output limiters in devices to prevent hearing losses (Question 11).

Participants responded to a series of questions regarding the frequency of perceived hearing loss symptoms following iPod use. Based upon a 6-point Likert scale (1 = never to 6 = always), only 1.3, 1.3, and 2.6% of participants reported frequently or always experiencing ringing in the ears (Question 14), mumbled or muffled voices (Question 17), and fullness or fuzziness in the ears (Questions 18). The majority of participants reported experiencing symptoms of hearing loss rarely or never for Questions 14, 17, and 18 (85.9, 90.1, and 78.9%, respectively).

The present study found significant differences ($\chi^2_{(2, N=384)} = 15.77, p = 0.000$) in reported iPod volume setting between gen-

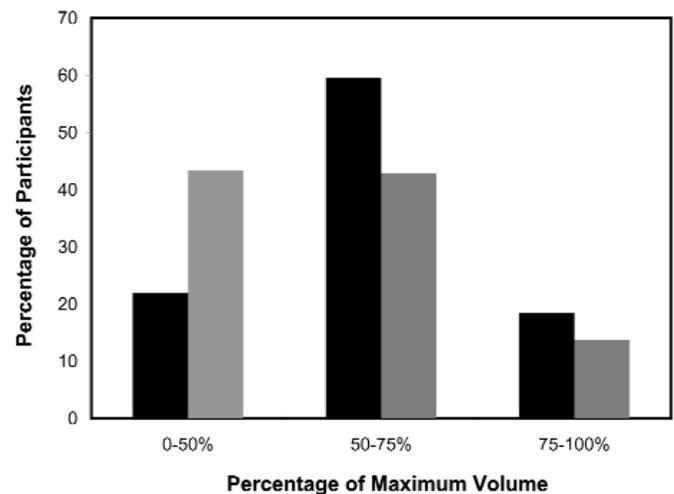


Figure 1. Gender differences in reported iPod volume setting (Question 25). Dark shaded bars are percentages of male responses and light shaded bars are percentages of female responses.

ders (Figure 1). Male participants contributed more to the calculated χ^2 value, suggesting that they were more likely to report setting iPods between 50-75 and 75-100% of maximum volume level (59.7 and 18.4%, respectively) than female participants (43.0 and 13.7%, respectively). Similarly, female participants were more likely to report setting iPods at 0-50% of maximum volume level (43.3%) than male participants (21.9%) based on the portion that they contributed to the calculated χ^2 total.

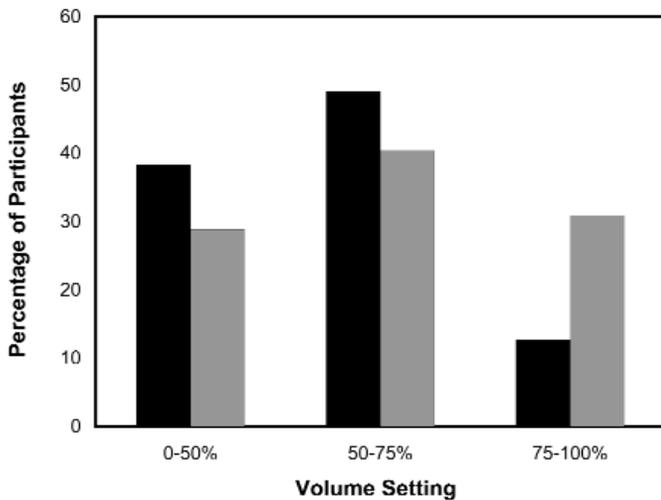


Figure 2. Ethnic differences in reported iPod volume setting. Dark shaded bars are percentages of responses of white participants and light shaded bars are percentages of responses of nonwhite participants.

There was a significant difference between ethnic backgrounds and reported setting of maximum volume level, ($\chi^2(2, N = 384) = 11.56, p = 0.003$). Figure 2 shows the differences in reported iPod setting of maximum volume level between ethnic groups. A smaller percentage of white participants (12.7%) reported setting their iPods at 75-100% of maximum volume level than did nonwhite participants (30.8%). White participants were more likely to report setting their iPods at 0-50 and 50-75% of maximum volume level (38.3 and 49.0%, respectively) than nonwhite participants (28.8 and 40.4%, respectively).

The present study found differences between majors and beliefs about PLD manufacturers' responsibility to hearing health (Figure 3 – Question 11) and between majors and re-

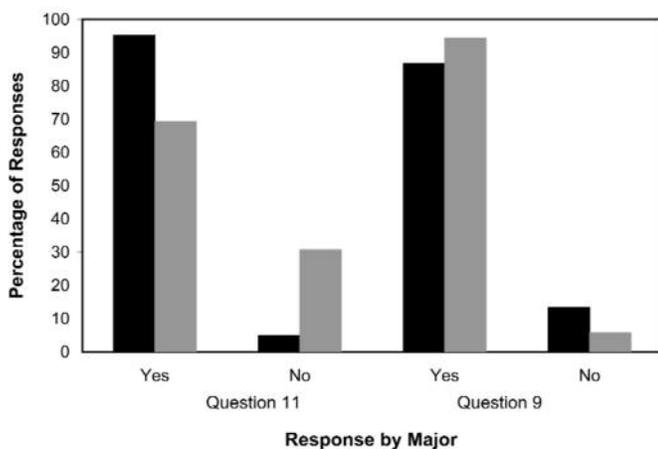


Figure 3. Responses of communication majors (dark shaded bars) and non-communication majors (light shaded bars) on opinions of PLD manufacturers' responsibility to limit volume output (Question 11), and on reported iPod volume setting in noisy backgrounds (Question 9).

ported volume setting increases (Figure 3 – Question 9). Significantly more communication majors (95.1%) believed that PLD manufacturers should build output limiters in their devices to limit the volume ($\chi^2(1, N = 341) = 12.01, p = 0.001$) than did non-communication majors (69.3%). Similarly, a significantly smaller percentage ($\chi^2(1, N = 384) = 3.90, p = 0.048$) of communication majors (86.7%) reported setting iPod volume levels higher when in noisy backgrounds than non-communication majors (94.4%).

DISCUSSION

While Danhauer *et al.* (2009) surveyed college students from multiple Division I schools, the present study surveyed college students from only one Division II school. Incentives were offered for participation in the present study; however, incentives were not used by Danhauer and his colleagues. A larger percentage of participants in the present study reported iPod use compared to those in Danhauer *et al.*, supporting our hypothesis that iPod use is prevalent in the college population. Since the Danhauer *et al.* study was conducted in 2006 and the present study in 2009, this higher prevalence of iPod use may be related to the increasing technology and popularity of PLDs. Few participants from both studies reported frequent symptoms of hearing loss. Participants in the present study were more likely to report using earbud headphones and turning the volume level higher when in noisy backgrounds than participants from Danhauer *et al.* These are behaviors that may increase the risk of developing hearing loss (Hodgetts *et al.* 2009; Hodgetts *et al.* 2007).

The results of the present study suggest that male students were statistically more likely to listen to iPods at higher volume levels than females. These data agree with multiple findings reported in the literature (Kageyama 1999; Torre 2008; Vogel *et al.* 2007; Williams 2005). Pure-tone audiometry of adolescent PLD users showed that male participants had higher hearing thresholds than female participants (Kim 2009). Kageyama (1999) suggested that this trend may be related to sex differences in sensory responses, as males may have higher sensation-seeking levels or tolerate higher volumes than females. This could be evaluated further with the effects of aging, as Williams (2005) found that as participant age increased, the amount of preferred noise exposure from personal stereo players decreased. However, this gender difference might also suggest differences in health awareness, such that females may be more health conscious and may modify their health-related behaviors more frequently than males.

The present study also found that nonwhite students were statistically more likely to listen to iPods at higher volume levels. These data are consistent with other studies. For example, Torre (2008) found that African American college students were more likely to report listening to PLDs at loud volumes than other racial groups. In addition, Hispanic teenagers were more likely than Caucasian teenagers to report listening to PLDs at higher volume levels and for longer durations (Wittman 2006). It should be noted that since there was a limited cultural sample in the present study, participants

were reclassified as either white or nonwhite. Crandell (2004) suggested that there may be a discrepancy in education about hearing health among racial groups, since African American young adults reported less knowledge about hearing damage and hearing loss symptoms than Caucasian young adults. This potential lack of awareness about hearing damage among ethnic minorities may contribute to the reported unsafe PLD listening practices. Such listening behaviors among participants could also be attributed to cultural differences.

Students in communication majors were statistically more likely to agree that PLD manufacturers are responsible for building output limiters in devices than students in non-communication majors. This finding may suggest that students in communication majors are more educated about factors that might contribute to the development of sensorineural hearing loss. For instance, these students would be more likely to learn about the legal obligations for employers and manufacturers to take preventative measures toward occupational noise exposure. Students in communication majors were also statistically less likely to report turning their iPod volume levels higher when in noisy backgrounds, suggesting that they practice safer PLD listening behaviors. Therefore, these findings indicate that students in communication majors are more likely to allocate hearing health responsibility to PLD manufacturers in addition to implementing personal responsibility for their own hearing.

The results of the present study suggest that male and nonwhite college students may be at greatest risk of developing hearing loss secondary to iPod use. The results indicate that college students, who are frequent iPod users, practice several potentially harmful PLD listening behaviors, most notably using earbud headphones and setting iPod volume levels higher in noisy backgrounds (Hodgetts *et al.* 2009; Hodgetts *et al.* 2007). Since several studies (Kim *et al.* 2009; Peng *et al.* 2007) found that long-term PLD use may significantly increase the risk of developing hearing loss, the findings of the present study suggest that the college population would benefit from educational awareness programs about safer PLD listening practices and the potential dangers of long-term PLD use. In particular, education should target male and nonwhite students.

It is acknowledged that a limitation of the present study is an underrepresentation of ethnically and racially diverse populations. We recommend that future research efforts include a more balanced cultural sample for repeated study. Moreover, the methodology of the present study largely reduced problems with responder bias. Since surveys were administered in classroom settings, participants were encouraged to complete the surveys during the allotted class times. The use of incentives also increased participation and contributed to a high response rate. Thus, we collected a large representative sample of responses among college students while reducing the likelihood of obtaining only strong opinions that are often found in self-reported survey data.

Since the present study surveyed college students on only their perceptions about iPod listening practices, it is suggested that future research designs employ objective meas-

ures. The hearing of a large sample of college students should be screened, which would result in either a pass or fail. Hearing screenings would serve as a quick and cost-efficient tool to determine if college iPod users are more or less likely to fail a screening than college non-iPod users. Following this, the hearing of college students might also be tested using pure-tone audiometry to determine if there is a relationship between the frequency of iPod use and hearing thresholds. In addition, longitudinal studies should be conducted with iPod users to facilitate better understanding of the long-term effects of PLDs.

ACKNOWLEDGEMENTS

The authors would like to express their gratitude to Dr. Pamela Smith for her guidance and advocacy for undergraduate research. This work was supported by the Bloomsburg University National Student Speech-Language-Hearing Association.

LITERATURE CITED

- Chung, J.H., C.M. Roches, J. Meunier, and R.D. Eavey. 2005. Evaluation of noise-induced hearing loss in young people using a web-based survey technique. *Pediatrics* 115 (4): 861-867.
- Crandell, C., T.L. Mills, and R. Gauthier. 2004. Knowledge, behaviors, and attitudes about hearing loss and hearing protection among racial/ethnically diverse young adults. *Journal of the National Medical Association* 96 (2): 176-186.
- Danhauer, J.L., C.E. Johnson, A. Byrd, L. DeGood, C. Meuel, A. Pecile, and L.L. Koch. 2009. Survey of college students on iPod use and hearing health. *Journal of the American Academic of Audiology* 20 (1): 5-27.
- Hodgetts, W.E., J.M. Rieger, and R.A. Szarko. 2007. The effects of listening environment and earphone style of preferred listening levels of normal hearing adults using an MP3 player. *Ear and Hearing* 28 (3): 290-297.
- Hodgetts, W., R. Szarko, and J. Rieger. 2009. What is the influence of background noise and exercise on the listening levels of iPod users? *International Journal of Audiology* 48 (12): 825-832.
- Kageyama, T. 1999. Loudness in listening to music with portable headphone stereos. *Perceptual and Motor Skills* 88 (2): 423.
- Kim, M.G., S.M. Hong, H.J. Shim, Y.D. Kim, C. Cha, and S.G. Yeo. 2009. Hearing threshold of Korean adolescents associated with the use of personal music players. *Yonsei Medical Journal* 50 (6): 771-776.
- Lee, P.C., C.W. Senders, B.J. Gantz, and S.R. Otto. 1985. Transient sensorineural hearing loss after overuse of portable headphone cassette radios. *Official Journal of American Academy of Otolaryngology – Head and Neck Surgery* 93 (5): 622-625.
- Mostafapour, S.P., K. Lahargoue, and G.A. Gates. 1998. Noise-induced hearing loss in young adults: The role of personal listening devices and other sources of leisure noise. *The Laryngoscope* 108 (12): 1832-1839.
- Peng, J., Z. Tao, and Z. Huang. 2007. Risk of damage to hearing

