



## **Sustainable hearing loss prevention in Native American communities using an ecological framework**

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### **ABSTRACT**

The intervention entitled “Listen for Life,” set out to determine the feasibility and sustainability of a community-based noise-induced hearing loss (NIHL) prevention program in three American Indian (AI) communities. An ecological framework was used to design a strategy that worked with each level of influence in the community to promote the NIHL prevention message. When viewed through the lens of an ecological framework, community-based interventions such as NIHL prevention offer the possibility of producing more effective behavior change, longer-lasting program effects, and greater program sustainability than individual interventions. The results of this study support the idea that utilizing an ecological framework, and intervening at multiple levels of influence can achieve NIHL program sustainability. While NIHL prevention in school children was at the core of this program, disseminating messages to the larger community to parents and other community members enhanced the school-based program and secured its longevity. Program sustainability at these sites was achieved, but took considerable program resources and up to 3 years of engagement.

### **THE ECOLOGICAL FRAMEWORK**

The public health Ecological Model, originally developed by Bronfenbrenner as the Ecological Paradigm, categorizes levels of social influence in a community [1]. The model enhances the more limited traditional view of how and why people make decisions, stating that individuals, institutions, organizations and governments, acting in concert to motivate people to reduce health risks and change behaviors, can be a valuable asset in a prevention campaign [2]. When viewed through the lens of an ecological framework, community-based interventions such as noise-induced hearing loss (NIHL) prevention offer the possibility of producing more effective behavior change [3], longer-lasting program effects, and greater program sustainability, than individual interventions.

The Ecological model shown in Diagram 1 is spherical, showing ever-expanding circles. This suggests that influence comes neither from a single source nor is it static. Rarely is one message sufficient to motivate an individual to use a protective device such as earplugs. Dynamic forces motivate and sustain us, and it follows that individual behavior is influenced by many different messages from many sources. Influence is categorized as coming from personal experience (intra-personal), from others (interpersonal), from organizations and groups, from the community, and/or from public policies or guidelines that are recommended or enforced. The ecological model states that the interaction of messages associated with these levels of influence should be more motivating than messages coming from any single level [4].

## The Ecological Model in Public Health

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### Diagram 1

The intervention entitled “Listen for Life,” set out to determine the feasibility and sustainability of a community-based NIHL prevention program in three American Indian (AI) communities. An ecological framework was used to design a strategy that worked with each level of influence in the community.

The individual level of influence is the core, upon which all other levels of influence interact. This level of influence assumes that everyone possesses a set of beliefs, attitudes and behaviors, and a level of knowledge. These are a result of relevant past experiences, knowledge and skills acquired, our environment, and, to a certain extent, genetics. These intra-personal characteristics are unique to each of us [3]. They shape our thinking about health behaviors like taking action to reduce the risk of NIHL. People who have had close relatives with moderate to severe hearing loss, for example, are much more motivated to care

about NIHL prevention than others who have not known anyone who has suffered hearing loss. This level of influence is based on past experience, and personal knowledge and beliefs.

The interpersonal level of influence comes from our family, friends, co-workers, and important others [3]. People observe others, they talk to like-minded people, they value others' opinions, and they are influenced by what they hear. We know that individuals are personally responsible for initiating and continuing health behavior strategies to reduce NIHL risk, however, as is the case with other health behaviors, for example drug use, the use of hearing protection strategies are perhaps in large part determined by their social relationships and the information and support they receive from others in their social milieu [5,6]. Adults are influenced by family, friends and co-workers, and are likely to form attitudes and behaviors based on their perception of what their peers say and how they act [6,7]. Parents and peer behaviors greatly affect the health behavior actions of children. Studies suggest that as children age peer influence increases and parental influence wanes [8,9].

The next level of influence has been termed the Organization or group level. Everyone belongs to an organized group of one sort or another, whether loosely or in the more traditional sense. Institutions, small businesses, large corporations, health care organizations, civic organizations, as well as military service groups all fall within this category [3]. Most institutions, and corporations have written, or unwritten, core values, and members are influenced by the norms and actions espoused by the institution [7]. In addition, groups, whether organized or not, tend to be made of people with shared values. Individuals who belong to the same group or organization are more likely to influence each other than acquaintances who have little in common [10]. Reddy [11] studied hearing health promotion in the workplace and found the ecological model a valuable theoretical foundation to promote hearing protection strategies among workers.

The Community level of influence is characterized as actions that seek to affect change in the community as a whole [3]. These include coalitions of people that work together to promote awareness and change attitudes at the community level. Media messages play a critical role also. The source of the message must be credible and trustworthy to viewers/readers. If credible messages are framed appropriately they can move people from awareness of dangerous noise levels to acting to protect themselves from the danger. Media messages can also give extra support to school programs, especially when parents and children hear messages together and discuss information kids learned in school. The communication strategy, described below in the methods section of this paper was an important component of this intervention. Both social and traditional media were used to disseminate information and promote change at the community level.

Public Policy is the final level of influence in the Ecological model [2]. Understandably it is considered the "enforcement" portion of the model. This level addresses our formal laws and policies in noise levels. Occupational safety regulations exist in the U.S. [12] as well as some noise annoyance policies. However, Native American reservations enact many of their own Indian Nation laws and policies.

## **THE LISTEN FOR LIFE PROGRAM**

The specific aim of the Listen for Life program was two-fold. Initially, the program was focused on increasing knowledge and changing attitudes and behaviors related to sound exposure and appropriate use of hearing protective strategies in tribal children by teaching about Dangerous Decibels in the schools and disseminating messages at multiple levels of influence in the community. Secondly, the program sought to establish self-sustaining school programs and continuing community messages about NIHL prevention. In other words, this program was designed for long-term sustainability.

### **American Indian Communities**

Representatives to the Northwest Portland Area Indian Health Board invited the Oregon Health and Science University Prevention Research Center to partner in promoting hearing health among youth in their communities. This adapted hearing loss prevention campaign utilized several levels of influence and worked with many community groups to disseminate, share and reinforce knowledge, attitudes, beliefs and behavior goals. The purpose of the work was to reduce NIHL in the Native community where hearing loss is two to four times greater than found in other U.S. subgroups [13].

By their very nature, most Native American reservations are inclusive and homogeneous. Tribal Councils govern the members. Geography, customs and activities are shared, elders in the community are honored, and media is local. Many reservations also have their own schools. These characteristics, taken together, provide an ideal community environment in which to offer NIHL prevention.

Individuals from two AI communities (referred to as Communities A and B) learned about the Dangerous Decibels program and initiated invitations to bring the Listen for Life program to their reservations. In addition, an urban AI Center (referred to as Community C) also responded positively to an invitation to promote hearing health. Community members from three Oregon AI communities participated. Partnerships were created with Tribal Councils on the reservations and with the administrative officers at the community services center.

Community A was a reservation with 4,200 members of three confederated tribes. Education was provided at a reservation tribal school. Reservation websites, Facebook pages, newspapers, and radio stations were local and community held.

Community B was a reservation with 2,965 members, also of three confederated tribes. Elementary students attended public schools in a nearby town.

Community C was an urban, non-profit community organization serving 10,000 individuals from >380 tribal backgrounds. Its purpose was to support youth and families through cultural identity and education. It communicated to staff and members through e-mail, an e-newsletter, website, and Facebook page. The interventions were initiated in each of the three communities over 3 sequential years. While the year of introduction to the program was sequential, components were continued in each community until 2014.

## **METHODS**

### **At the Individual level**

In the first year of the program, during the developmental stage, 3 focus groups were conducted on the reservations. It was clear from early program focus groups conducted in the tribal communities that many adult members had previous knowledge and experience with hearing loss and the hardships that come with this disability. Program materials and campaign messages were created and adapted as a result of the information obtained from individual members.

### **At the Interpersonal Level**

The Dangerous Decibels® program, the core of the Listen for Life intervention, is an example of how interpersonal actions can influence NIHL. This classroom program targeted 4<sup>th</sup> and 5<sup>th</sup> graders in all three communities, every year. Certified program staff initially taught the lesson. However, tribal educators in all 3 communities became certified to teach the program within 2 years. Students learned about NIHL, participated in hands-on model building, discussed the consequences of NIHL and used technology to find out what they know. During the classroom program kids observed their peers, viewed their peers practicing using hearing protection, and learned as a class about other strategies to avoid loud noises in an interactive and positive lesson plan.

All students who went through the program also participated in the Dangerous Decibels Virtual Exhibit web-based educational activities that support the educational messages presented by the classroom presentation. While not an interpersonal exchange with the teacher this online “booster” was conducted during school, and as a reminder of the lesson they received about a month earlier. Students were evaluated at baseline, post program and at 3 months using the Dangerous Decibels valid and reliable survey instrument.

### **At the Level of the Organization**

All reservations are inclusive. They form their own institutions and government entities. Listen for Life created an advisory board made up of health and wellness clinics, community centers, school administrators, and elder groups, on the reservations. These groups were sought out to help adapt Dangerous Decibel materials to reflect the tribal culture. Interested community group members volunteered to help direct the development, implementation, and evaluation of community-based hearing loss and tinnitus interventions. Intercultural communication of information that the advisors provided about the structure of the school system, contact information, local traditions and customs, community sensitivities, and logistic direction proved critical to the effort. They also communicated with each other about the importance of NIHL in the AI community.

### **At the Community Level**

The intervention placed special emphasis on the use of online community websites, and most importantly, the potential use of community social media. Online health messages were tailored to two stages of change according to Prochaska’s Trans-theoretical model. The “Pre-contemplation” stage, those who had not even thought about NIHL prevention, and the

“Contemplation” stage, those who had just begun to think about this public health issue. Prochaska’s model would predict that messages framed specifically around the risk of NIHL and the damage that can be done to hearing are most effective in moving people along from early stages to later stages [14].

Young people in AI communities, like most communities in the U.S., are connected to the Internet for much of the day. They get their news and entertainment online, in many cases from community media sources. Individuals learn about social norms and health risks on Twitter, Facebook, Instagram, and Snapchat [15] Students read about Dangerous Decibels on the community Facebook page.

Community media sites were enlisted to use every media outlet at their disposal to get the word out about the risk of loud sounds and to offer preventive strategies to avoid these dangers. Quarterly news articles were published in the local newspaper and online, and public service announcements were broadcast on the local radio every day in Community A, and less often in the other two communities. Flyers were displayed at central sites in the community. Materials were also copied and disseminated on community Facebook sites. Three 5-minute videos were created featuring tribal members from each community discussing their relationship with noise and hearing loss, and these were posted on community Facebook pages. Appendix A lists the public service announcements that were recorded. They were composed by the staff and advisory teams and broadcast via reservation radio station at Communities A and B and sent out in email blasts to members of Community C.

The intervention staff also hosted parents of students who received the Dangerous Decibels program, and other community members to an evening event in each community at a central location. Communities were invited through mass advertising. The event included a shared meal, raffles, and time for the students to assist the staff in teaching the parents and the community about the messages learned during the school program. A majority of the students that had received the program in school participated in the evening event. One of the components of the evening event was the addition of a tabletop mannequin named Jolene [16]. She is youthful and hip and is fitted with a sound level meter that measures sound levels produced by personal audio systems. Students tested the level at which they listened to their music and found out if it was dangerous or safe for their ears. A description of noise-induced hearing loss and tinnitus prevention was presented to families and friends with a request for them to support the students in healthy listening practices.

### **At the Level of Public Policy**

It was not the purview of this intervention to change Indian Nation policies. However, it is noteworthy that the first step in creating a partnership with these three communities was to meet with Tribal Councils to present the intervention to the governing body in each community. In each case formal presentations were made to the community leadership. The scope of the problem was presented with a tentative plan for the intervention and their unanimous approval was acquired. Interacting, face to face, at the highest level of government on the reservations, offered the project needed support, and gave the program credibility in

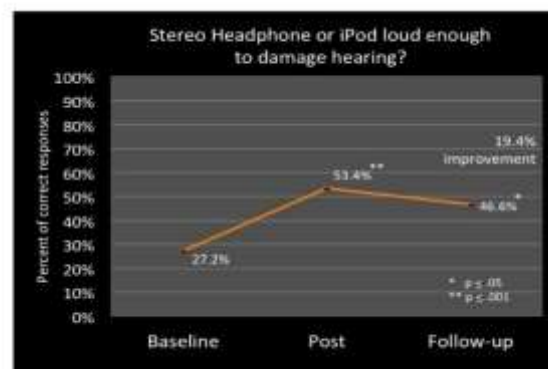
the community. Tribal members accepted the presence of program staff in their communities as a result of the support given us by the governing Councils.

## RESULTS: SUSTAINABILITY

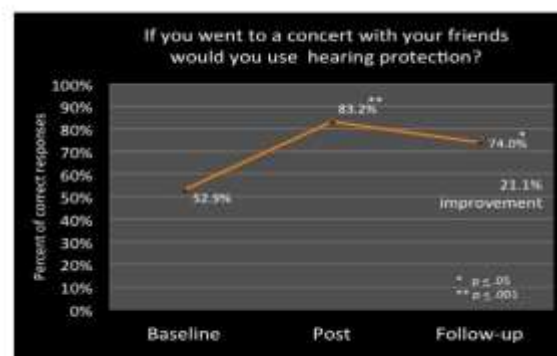
### Dangerous Decibels Program Results

At its core, “Listen for Life” was focused on teaching the Dangerous Decibels program in the schools that reservation children attended (for Communities A and B) and at the community center in Community C. The Dangerous Decibels program (described above) has been tested in many different settings and shown to be effective at the 3<sup>rd</sup> to 5<sup>th</sup> grade levels measuring knowledge, attitudes and behavioral intentions [17, 18]. Our results demonstrate that the AI community children in the Listen for Life program increased their knowledge level, and changed their attitudes and intended behaviors about NIHL. For example, Graphs #1 and #2 demonstrate that the school-based community program was effective for questions concerning stereo headphones (#1), and students use of hearing protection around their friends (#2).

Graph1



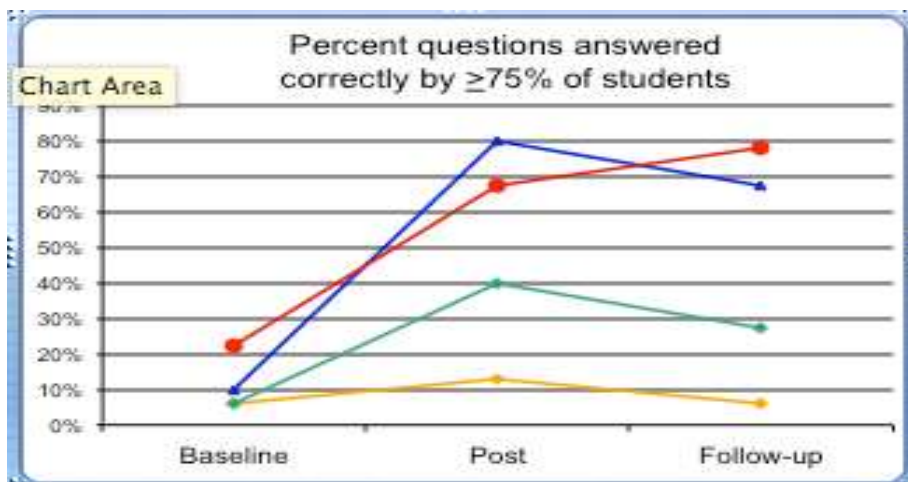
Graph 2



Answers to questions were also compared to past Dangerous Decibels studies without community intervention. We were interested in finding out if NIHL messages directed at parents and the wider community would improve the evaluation results, and whether the improvement would last longer.

Preliminary results show that on several important questions evaluated together as an index, a comparison was made of the questions answered correctly by at least 75% of the students in each group. Graph #3 compares answers from: 1) a museum-only group (who visited a Dangerous Decibel museum exhibit), 2) a virtual exhibit-only group (who participated in computer-based Dangerous Decibels), and 3) a (previous) classroom-only group (who received the program in a school without community involvement) [17], with 4) the community-based AI program students. It shows that students in the AI schools outperformed the other groups by the 3-month follow-up.

**Graph 3**



Museum-only study = 6% at follow-up (yellow line)

Virtual exhibit-only study = 28% at follow-up (green line)

Classroom study (previous) = 68% at follow-up (blue line)

Listen for Life study (current) = 79% at follow-up (red line)

### **Sustainability in the Community**

Results suggest that sustainable hearing health promotion interventions were established in all three communities.

In Community A the Tribal Council funded one educator to continue the school program indefinitely and the program continues to be welcomed in the school (at year 6). The local educator continues to coordinate the program and deliver it annually at the reservation school and at three to four events during the year in the community and at health fairs. The radio station manager continued playing the public service announcements indefinitely because she considered the messages valuable to the community. The local educators found opportunities to present the educational materials at reservation celebrations and events.



A convenience sample of 100 adults at the reservation market in Community A was surveyed at the end of year 1. At that time 33% recalled information from the community (e.g. from media messages, posters, kids in school) about noise, hearing loss, tinnitus, and prevention. At year 5, 66% of a second sample of 100 marketers recalled similar information. In addition, 64% of the 66% who recalled the messages indicated that they had changed listening behaviors as a result of their encounters with the program.

Community B welcomed the program initially but it took two years of program delivery to identify interested tribal members who could carry the program forward. Once tribal members attended a Dangerous Decibels workshop in Portland and became certified as educators the program became permanent (at year 4). Local educators expanded the program from the initial three schools to all seven schools in the district to make the information available to all children, creating a situation in which the local tribal community now provides hearing health promotion education to the entire regional population.

Community C was a community services center rather than a reservation. Activities were welcomed as an external program but it took 3 years of delivery by the program group before two staff members were trained at a Dangerous Decibels workshop hosted by Indian Health Service in Washington. During the past 2 years, delivery of the program has been part of their job duties.

Currently, all three communities continue to deliver at least the classroom program and Virtual Exhibit components of the intervention. Community A has continued the media components as well as health fair presentations. While the content of the classroom program is script based and easy to maintain, in order to assure accuracy, local educators at each site have monitored the fidelity of the program during presentations by observing local instructors. The Virtual Exhibit content is fixed. Graphics, images, and distributable information are also fixed.

## **DISCUSSION**

The Listen for Life program has become self-sustaining. Self-selected individuals from each community were trained and certified as Dangerous Decibels educators at regional workshops. The program gradually transferred teaching and organizational responsibilities to the local representatives over a 2-year period. The program staff continued to assist communities for the duration of the program, monitoring the fidelity of the presentations for 3 years in Community A, 2 years in Community B, and 1 year in Community C. Annual reports were made to the Tribal Councils, which remain enthusiastically supportive [19].

The results of this study support the idea that utilizing an ecological framework, and intervening at multiple levels of influence can achieve NIHL program sustainability. While NIHL prevention in school children was at the core of this program, disseminating messages to the larger community to parents and other community members enhanced the school-based program results and secured its longevity. Program sustainability at these sites was achieved, but took considerable program resources and up to 3 years of engagement. This level of program support in terms of funding and staff is needed if the public health community is serious about reducing the risk of noise-induced hearing loss.

Finally, as was said above, AI reservations are inclusive and homogeneous. There is one governing body, many tribe members share values and behaviors, and popular local media sources exist. In this relatively ideal intervention environment, NIHL prevention strategies were effective and sustainable. The next step will be to demonstrate that the same level of sustainability can be achieved in more diverse environments with abundant local and national media, and communities that are fragmented.

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## APPENDIX A: Radio Announcements

The Dangerous Decibels program from the Oregon Health and Science University, is coming to the (name of community) this fall to work with the Tribal community on preventing problems caused by exposure to loud sounds. "LISTEN FOR LIFE" is a special program for the whole family. This October, local fourth and fifth graders will learn about how our ears work, break, and how to protect them. The LISTEN FOR LIFE program will also present an evening gathering in October and invite the entire community to enjoy an evening of fun and refreshments where they will learn about saving our ability to hear those things precious to us. We want everyone to hear the sound of the river – listen to the voices of our elders...

Hear the sound of the Drum.... (SFX – drum)

Protect your hearing – so you can listen to what is so valuable to our Native People... Did you know that listening to 90 decibels, for more than 2 hours a day, can damage your hearing? Many kids listen to their music at, and above, 90 decibels. According to the Centers for Disease Control, Native Americans have twice the hearing loss as compared to white people. So teach young people to turn down loud music – and take care of their hearing.

To learn life's lessons – you need to be able to hear them. If you are around loud noise (SFX – power tools noise) you should use earplugs or ear muffs. According to the Centers for Disease Control, Native Americans have twice the hearing loss as compared to white people. So protect your ears from loud sounds and be able to hear for years to come.

Hear the sounds of Mother Earth... (SFX – river, birds...)

Did you know that listening to a really loud sound, such as a rifle shot, (SFX – rifle shot) can do permanent damage to your hearing, instantly. According to the Centers for Disease Control, Native Americans have twice the hearing loss as compared to white people. This may be partly due to higher rates of ear infections, and partly related to exposures to loud sounds from sources such as power tools, amplified music, and firearms. Be aware – limit your exposure to loud sounds, protect your hearing.

Hear the Voice of your Grandmother (SFX – loud music)

No one wants to lose their hearing. And did you know that Native Americans have a higher rate of hearing loss compared to other groups? This may be due to exposures to loud sounds from sources like power tools, firearms, and amplified music. Many kids listen to their music dangerous levels that can damage their hearing. Doctors recommend keeping the volume on your music player below 70%. Prevent hearing loss.... turn down the sound.

There are three things you can do to protect your hearing against loud sounds. Turn down loud music, protect your ears from loud noise and walk away from loud sound. Hearing damage and tinnitus can happen at any age. Loud sound can permanently damage tiny sensors in the inner ear called hair cells. Once damaged, they will not grow back and you will lose some hearing. Taking just a few steps away from a loud sound can make it safer for your ears. Prevent hearing loss, – walk away