



GREAT PLAINS
Center for Agricultural Health

Hearing Loss Prevention Training Kit

gpcah.org

Hearing Loss Prevention Training Kit

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Introduction

The Hearing Loss Prevention outreach kit was developed to help you present information that will guide farmers and youth on:

- 1) Why farmers should be concerned about noise-induced hearing loss (NIHL),
- 2) Which activities/environments involve hazardous noise exposures, and
- 3) What farmers can do to reduce noise exposure on the farm and/or prevent NIHL.

This kit was developed using findings from decades of research (see references), outreach materials created by the Great Plains Center for Agricultural Health (GPCAH) staff, and items created by other organizations dedicated to hearing loss prevention.

The following “train-the-trainer” introduction will **help presenters understand what farmers can do to decrease their chances of experiencing noise-induced hearing loss and tinnitus.**

Background Information for Trainer

Noise-induced hearing loss results from damage to hair cells (cilia) in the inner ear. This type of hearing loss is usually caused by exposure to excessively loud sounds and cannot be medically or surgically corrected. Noise-induced hearing loss usually results from repeated exposure to loud sounds over a long period of time, but damage can also happen after a one-time exposure to a very loud sound (like fireworks or a gunshot).

A substantial proportion of Americans working in agriculture, forestry, fishing, and hunting are estimated to have hearing loss, although the reports of the actual prevalence ranges from 17% to 72% (Thelin et al. 1983, Beckett et al. 2000). Long-term exposures to loud sounds throughout one’s working life can cause not only hearing loss and tinnitus (ringing in the ears that does not go away), but may also lead to high blood pressure, heart disease, stroke, heart attacks, reduced cognitive abilities, personal injury, anxiety, stress, depression, learning difficulties, and sleep disorders (Basner et al. 2014, Münzel et al. 2014).

Strategies to reduce the risk of developing hearing loss from workplace noise include reducing how long someone works in loud environments, reducing sound levels by maintaining equipment or enclosing critical noise sources, and, most commonly, wearing hearing protection devices (HPDs). In the Midwest, 72% of farm workers never or rarely use hearing protection (Carpenter et al. 2002). They use HPDs in high-noise environments only 29% of the time (McCullagh et al. 2016). Only 29% of young farm workers use hearing protection, even while 61% report ringing in the ears (Reed et al. 2006).

Knowing where sounds are loud and what to do to protect your hearing while engaging in tasks with loud exposures are both necessary to identify where preventive methods might work. Many motivated farmers receive classroom training on hearing protection (Kearney et al. 2015), but such classes have not effectively changed behavior (DeRoo and Rautiainen 2000). Consequently, knowledge gaps on hazard recognition and appropriate response persist (Cramer et al. 2016). The availability of HPDs close to high-noise areas has been associated with increased HPD use among farm workers (McCullagh et al. 2016); therefore, ensuring that farmers know what areas are “loud” and how to select and use hearing protection correctly is still necessary to help farmers make the healthy choice.

Areas/activities that are associated with high noise levels include:

- Livestock buildings (especially pigs)
- Mowers
- ATVs
- Pressure washers
- Leaf blowers
- Tractors/other large equipment
- Power tools/shop
- Grain dryers
- Concerts
- Fireworks
- Gunshots
- Stock car races/tractor pulls

Hearing Protection Devices (HPDs) protect your ears by reducing the force of the sound waves reaching the inner ear. The best HPD for you is one that fits well and that you will consistently wear in high-noise environments.

There are 3 main types of HPD:

- Formable ear plugs – made of soft foam that must be rolled down to be inserted, then expands to block the ear canal
- Push-in ear plugs
- Earmuffs

In 2015, GPCAH staff surveyed 699 farmers from Midwestern states about their HPD use. We found that 52% of Midwestern farmers surveyed reported symptoms of noise induced hearing loss, and 33% reported regularly experiencing tinnitus (ringing in the ears). Barriers to HPD use included inconvenience, not having them when needed, uncertainty about when or how to use them, discomfort when wearing, short-duration task, and concerns about interference with useful sound. Facilitators for use included very loud noise or pain experienced, HPD clearly visible when going out for the day, recognizing that a task required hearing protection, reminders from a coworker or family member, accessible when needed, required by employers, and a general increased awareness about hearing loss and how to prevent it.

Training Scenarios

We have developed four training scenarios on the topic of hearing loss prevention. The objective of each scenario is to inform farmers and their families about how to protect their hearing while working on the farm. For each scenario, we have listed the intended audience and the materials needed. Links are provided in the materials list when available. Advice on how to engage your audience, topics for discussion, and other pertinent details follow.

Scenario 1: Hearing Loss Prevention Table Display

Intended audience: Farmers, farm family members

Materials/activities used (links provided in kit contents below):

- [3-panel display](#)
- [Hearing loss prevention handouts](#)
- [3M Roll Model device](#) with practice plugs
- Ear plugs to hand out

Engagement: The center panel of this display is usually what draws farmers to engage – they see the damaged corn field and come to look closer at it.

Ask: Do you know anyone with hearing loss?

Follow-up: Have you ever had ringing in your ears? Have things sounded muffled after you've been around loud noise for a while?

Discussion: Depending on their answers and interest, you can discuss the topics below. Before the person leaves, give them a pair ear plugs (if you have multiple styles, let them choose which type to take with them)

- How hearing loss affects daily life (left panel)
 - difficulty hearing when there is background noise
 - need to increase volume on radio or television louder than others
 - lose the ability to hear certain sounds in speech
 - constant ringing in the ears (tinnitus)
- Areas/activities on the farm that are high-noise and require hearing protection (right panel)
 - ATVs
 - Mowers
 - Livestock
 - Large farm equipment
 - Machinery, power tools
 - Leaf blowers, chainsaws
 - Gunshots
- Prevention:
 - Limit time in loud environments when you can
 - Wear hearing protection when you must be in loud environments for longer than is safe
 - How to choose hearing protection
 - Discuss types of HPD
 - Store preferred HPD in areas of the farm where you will need it – or – store it in the vehicle you drive; the most important thing is to have it where you need it.
 - **Emphasize that the best hearing protection is the one that fits you well and that you will wear consistently when needed**



Example of a table display at the 2019 National FFA Convention

Scenario 2: Hearing Loss Prevention (HLP) for Elementary Youth

Intended audience: Elementary-aged youth in classroom or at an Agricultural Safety Day event

Time required: 15-20 minutes

Materials/activities used:

- [Youth HLP presentation](#) (with suggested [script](#), if desired)
- [Youth Hair cell model activity](#) (uses 5-6 pipe cleaners per youth)
- Practice plugs
- [3M Roll Model device](#) (optional)
- [Youth HLP handout](#) (optional)
- Ear plugs (one pair per youth) (optional)
- [Youth HLP follow-up exercise](#) worksheet (one per youth – optional)
- [Youth HLP Bookmark](#) (one per youth – optional)



This is a short class with fun slides, a suggested script, embedded video, and activities to reinforce concepts.

If take-home bags are provided to youth attending the event, good contributions include: [Youth HLP handout](#) with a pair of ear plugs + the [Youth HLP follow-up exercise](#) and/or [Youth HLP bookmark](#).

Scenario 3: Script and Activities for Middle School Youth

Intended audience: Middle school youth in the classroom, 4-H/FFA groups

Time required: 35-40 minutes

Materials/activities used:

- [Middle school HLP presentation](#) (with suggested [script](#), if desired)
- [Middle school HLP activity sheets](#) and supplies for chosen activity(ies)
 - Cup & String Telephone – 2 cups, 10 ft string, scissors, pencil
 - Hair Cell Models – marshmallows, angel hair pasta (alternative: use [Youth Hair cell model activity](#) instead, if clean-up is a concern – requires 5-6 pipe cleaners per student)
 - Sound Scavenger Hunt – personal electronic device, Decibel X app (free download), pencil



This is a short class with suggested script, embedded video, and 3 optional activities to reinforce concepts. Each activity has facilitator instructions followed by the student worksheet.

Scenario 4: Hearing Loss Simulator

Intended audience: Adults and older youth, employees

Materials/activities used:

- NIOSH HLSim hearing loss simulator (free to download - installed on PC):
<https://www.cdc.gov/niosh/mining/works/coversheet1820.html>
- Noise-cancelling headphones (optional – use if in area with a lot of background noise)
- Video containing background information and demo of the software (coming soon)
- [HLSim Handout](#) (Quick start guide)
- [HLSim Activity sheet](#) (optional)
- Sound files (farm related): <https://gpcah.public-health.uiowa.edu/audio-recordings/>

Young farmers have told us that experiencing what it would be like to live with noise-induced hearing loss may motivate them to use hearing protection more often. NIOSH has created a hearing loss simulator (HLSim) that allows them to do just that. The 10-minute video created by GPCAH will help you learn to use the key features of HLSim and provide background information and hearing loss prevention tips. You can also add any of the farm-related sound files (linked above) to the simulator. Our quick reference handout explains how to do this transfer.

HLSim can be used on its own in employee training, and it also makes a great addition to a table display at an event where you have space and electricity available.

Kit Contents and Additional Materials Needed

All resources used in training scenarios (shown below) are found at:

<https://gpcah.public-health.uiowa.edu/outreach-2/topics/hearing-loss-prevention/>

Handout

Two-sided cards, 4x9"

Hearing Loss Among Farmers

ATV, push mower	90 dB	2.5 hours
Tractor (all tractors or combine grain crop)	92 dB	95 min
ATV combine	95 dB	47 min
Hay mowing, table saw, hedge trimmer	100 dB	15 min
Tractor, combine (no cab), grain auger	105 dB	4 min
Chainsaw	135 dB	<1 min

Hearing Loss Prevention

- Reduce sound levels by selecting equipment with the quietest option.
- Reduce noise exposure duration.
- Isolate yourself from noise.
- Use hearing protection: the higher the NRR, the better.
- Identify "HIGH NOISE" areas or equipment to avoid noise or use hearing protection.
- Use daily noise exposure duration.

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- Use daily noise exposure duration.

Hearing protection

What type is best for you?

- ROLL between your thumb and fingers.
- REACH over your head and pull up on your ear.
- INSERT rolled plug into ear canal.
- HOLD plug in place as it expands to ensure proper fit.

Protección auditiva

¿Cuál es la mejor para ti?

- RUEDA el tapón entre tu pulgar y los dedos.
- AGARRA el tapón por la oreja y tira.
- SOSTÉN el tapón en su lugar mientras se expande para asegurar un ajuste adecuado.
- MANTÉN el tapón en su lugar mientras se expande para asegurar un ajuste adecuado.

Protect your Ears

Why should you protect your ears?

- Hearing loss happens every day from many different noises.
- Hearing loss is permanent and can't be cured.
- Hearing loss from noise can be prevented.

To Prevent Hearing Loss

- Avoid loud noises.
- Use hearing protection when around loud noises.
- Limit how long you are exposed to loud noises.

Bookmark

Two-sided bookmark, 2x6" (lamination recommended)

Protect your Ears

Hearing loss happens every day from many different noises.

Hearing loss is permanent and can't be cured.

Hearing loss from noise can be prevented.

Noise Type	Sound Level	Max Time
ATV, push mower	90 dB	2.5 hrs
Tractor or combine (with cab)	92 dB	95 min
ATV combine	95 dB	47 min
Hay mowing, table saw, hedge trimmer	100 dB	15 min
Tractor or combine (no cab)	105 dB	4 min
Chainsaw	135 dB	<1 min

To Prevent Hearing Loss

- Turn it down. Turn down the volume if you can.
- Walk away. Move away from loud noises.
- Protect your ears. Use earplugs or earmuffs.

What can harm your ears?

- Firecrackers
- Gunshots
- Tractors and Combines
- Lawn mowers
- Farm animals
- Grain equipment
- ATVs

Front

Back

Posters

Single-sided 11x17" posters (English and Spanish)

WHAT DO YOU HAVE TO LOSE?

Effects of Hearing Damage

TYPE	Daily Activities	Speech
NORMAL Hearing		"Let's talk about a field of corn."
MILD Hearing Loss	 Difficulty hearing some speech and whispering	"Let's talk about a field of corn."
MODERATE Hearing Loss	 Difficulty hearing group conversations	"Let's talk about a field of corn."
SEVERE Hearing Loss	 Difficulty hearing TV, radio, a person talking	"Let's talk about a field of corn."
TINNITUS	 Ringing and/or buzzing in the ears	Noticable in quiet settings.

www.GPCH.org

HOW LOUD IS TOO LOUD?

Farm Equipment	Noise Level (dB)	Max Safe Time	Icon
ATV, Push Mower	90 dB	2.5 HRS	
Tractor/Combine (with Cab), Grain Auger	92 dB	1.5 HRS	
Air Compressor, Shop Vac	95 dB	47 MIN	
Pigs Squealing, Irrigation Pump	100 dB	15 MIN	
Riding Mower, Pressure Washer	102 dB	9 MIN	
Tractor (No Cab), Grain Dryer	105 dB	4 MIN	
Leaf Blower	110 dB	1-2 MIN	
Chain Saw	115 dB	< 1 MIN	

For more information, see our website: www.GPCH.org

¿QUÉ PUEDES PERDER?

Efectos de la pérdida de la audición

TIPO	Actividades	Habla
Escuchando normal		"Hablemos de un campo de maíz."
Pérdida leve de audición	 Dificultad para oír partes del habla y los susurros	"Hablemos de un campo de maíz."
Pérdida moderada de audición	 Dificultad para oír conversaciones en grupo	"Hablemos de un campo de maíz."
Pérdida severa de audición	 Dificultad para oír la TV, la radio o a una persona hablando	"Hablemos de un campo de maíz."
Tinnitus/acúfenos	 Se nota un zumbido en los oídos	Se nota más cuando hay silencio

www.GPCH.org

¿QUÉ TAN ALTO ES DEMASIADO ALTO?

Equipo agrícola	Nivel de ruido (dB)	Tiempo máximo de seguridad	Tiempo máximo de usar protección auditiva
ATV, Podaadora	90 dB	2.5 HRS	
Tractores (con cabina), barrenas	92 dB	1.5 HRS	
Compresor de aire, aspiradora	95 dB	47 MIN	
Cerdo chillando, bomba de riego	100 dB	15 MIN	
Cortacésped, lavadora a presión	102 dB	9 MIN	
Tractor (sin cabina), secadora de granos	105 dB	4 MIN	
Soplador de hojas	110 dB	1-2 MIN	
Sierra eléctrica	115 dB	< 1 MIN	

www.GPCH.org

Display for Hearing Loss Prevention (Scenario 1)

Three 24x36" single-sided panels

WHAT DO YOU HAVE TO LOSE?

TYPE	Daily Activities	Speech
NORMAL Hearing		"Let's talk about a field of corn."
MILD Hearing Loss	 Difficulty hearing some speech and whispering	"Let's talk about a field of corn."
MODERATE Hearing Loss	 Difficulty hearing group conversations	"Let's talk about a field of corn."
SEVERE Hearing Loss	 Difficulty hearing TV, radio, a person talking	"Let's talk about a field of corn."
TINNITUS	 Ringing and/or buzzing in the ears	Noticable in quiet settings.

YOUR EARS are just as important as these EARS.

Healthy

Damaged

Healthy

Damaged

Source of ear hair cell photos: dangerousdecibels.org

Noise Induced Hearing Loss and Farmers

33% of farmers in the Midwest region reported RINGING IN THE EARS.

33%, or 2 out of 6

52% reported DIFFICULTY HEARING CONVERSATIONS, TV, AND RADIO.

52%, or 3 out of 6

GPCH.org
Facebook.com/gpcah

GREAT PLAINS
www.greatplains.org

UISAFE
www.uisafe.org

HOW LOUD IS TOO LOUD?

Farm Equipment	Noise Level (dB)	Max Safe Time	Icon
ATV, Push Mower	90 dB	2.5 HRS	
Tractor/Combine (with Cab), Grain Auger	92 dB	1.5 HRS	
Air Compressor, Shop Vac	95 dB	47 MIN	
Pigs Squealing, Irrigation Pump	100 dB	15 MIN	
Riding Mower, Pressure Washer	102 dB	9 MIN	
Tractor (No Cab), Grain Dryer	105 dB	4 MIN	
Leaf Blower	110 dB	1-2 MIN	
Chain Saw	115 dB	< 1 MIN	

Interactive Activities & Teaching tools

[HLSim Handout](#)

[HLSim Activities](#)

[Middle School HLP Presentation](#)

[Middle School HLP Script](#)

[Middle School HLP Activities](#)

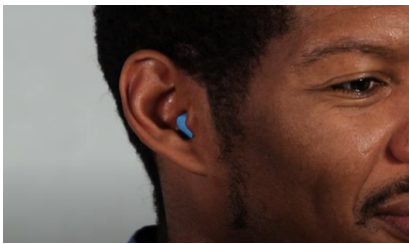
[Youth HLP Presentation](#)

[Youth HLP Script](#)

[Youth Hair Cell Model Activity](#)

[Youth HLP Follow-up Exercise](#)

Audio/Visual (links)



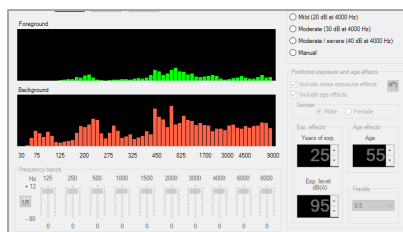
How to insert formable earplugs: [LINK](#)



Roll Model Activity: (coming soon)



How to conduct the hair cell activity: [LINK](#)



NIOSH Hearing loss simulator demonstration: (coming soon)

Additional external resources

It's a Noisy Planet. Protect Their Hearing: <https://www.noisyplanet.nidcd.nih.gov/>

Dangerous Decibels program: <http://dangerousdecibels.org/>

3M Roll model: https://www.3m.com/3M/en_US/p/d/v100795051/

Frequently Asked Questions

Q: I already have NIHL. Do I still need to wear hearing protection in loud environments? Or “It’s too late for me.”

A: It is *never* too late to protect the hearing you have! Yes, you should wear hearing protection every time you are going to be in environments that are loud (>85 decibels) for longer than is safe for your ears (see “how loud is too loud”).

Q: Can I just turn my hearing aids off instead of using ear plugs or earmuffs?

A: No, turning off your hearing aids will not protect your ears from loud noises. You may not be able to hear the sound, but your ears are still being damaged. While hearing aids do go into your ears, they will not block loud noises like hearing protection devices (HPDs) do. Instead, protect your ears by wearing earmuffs (with or without your hearing aids), or take your hearing aids off and use earplugs when you are in loud environments.

Q: How can I tell if I have the earplugs in correctly?

A: When earplugs are correctly seated in your ear canal, you will feel a seal form. There should only be a small amount of the earplug visible from the outside. If you can see a large portion of the earplug sticking out of your ear, there is not enough in the canal to block loud noises.

Q: How will I hear problems with machinery/livestock if I am wearing hearing protection?

A: HPDs reduce the noise, not silence it completely. You can still hear the sounds around you, but at a safer level. Noise-induced hearing loss will cause greater problems with hearing the things you want to hear in the future if you do not protect your hearing in loud environments now.

Q: Earplugs don’t work for me – why should I wear them?

A: If your earplugs are the right size and properly inserted, they will work. If you are using formable (foam) earplugs, be sure you are rolling them as small as you can before inserting them into your ears. Reaching over your head and pulling up and back on your ear before placing them will also make it easier to get the earplugs inserted correctly.

Q: Can I just use my noise-cancelling headphones for hearing protection?

A: That might work for some consistent background noises, but noise-canceling headphones would probably provide only a modest amount of protection. They can not protect your ears from abrupt changes to the sound environment. Additionally, many people end up increasing music volume to compensate for the sound that noise canceling headphones do not block, which can also lead to hearing damage.

Q: What hearing protection should I get for my kids?

A: We recommend earmuffs for children under the age of 10. Young children have very small ear canals and rolling formable earplugs small enough to fit them is difficult. This results in poorly fitted earplugs, which gives a false sense of protection. Older youth can wear earplugs, but they will need repeated training on how to insert them correctly.

Publications and websites with more details:

- [Basner](#), M., W. Babisch, A. Davis, M. Brink, C. Clark, S. Janssen and S. Stansfeld (2014). "Auditory and nonauditory effects of noise on health." *The Lancet* **383**(9925): 1325-1332.
- [Beckett](#), W. S., D. Chamberlain, E. Hallman, J. May, S.-A. Hwang, M. Gomez, S. Eberly, C. Cox and A. Stark (2000). "Hearing conservation for farmers: source apportionment of occupational and environmental factors contributing to hearing loss." *Journal of Occupational and Environmental Medicine* **42**(8): 806-813.
- [Carpenter](#), W. S., B. C. Lee, P. D. Gunderson and D. T. Stueland (2002). "Assessment of personal protective equipment use among Midwestern farmers." *American Journal of Industrial Medicine* **42**(3): 236-247.
- [Cramer](#), M. E., M. J. Wendl, H. Sayles, E. Duysen and C. Achutan (2016). "Knowledge, Attitudes, and Practices for Respiratory and Hearing Health among Midwestern Farmers." *Public Health Nursing*. **34**(4):348-358.
- [DeRoo](#), L. A. and R. H. Rautiainen (2000). "A systematic review of farm safety interventions." *American Journal of Preventive Medicine* **18**(4): 51-62.
- [Kearney](#), G. D., X. Xu, J. A. G. Balanay, D. L. Allen and A. P. Rafferty (2015). "Assessment of personal protective equipment use among farmers in eastern North Carolina: a cross-sectional study." *Journal of Agromedicine* **20**(1): 43-54.
- [McCullagh](#), M. C., T. Banerjee, M. A. Cohen and J. J. Yang (2016). "Effects of interventions on use of hearing protectors among farm operators: A randomized controlled trial." *International Journal of Audiology* **55**(sup1): S3-S12.
- [Münzel](#), T., T. Gori, W. Babisch and M. Basner (2014). "Cardiovascular effects of environmental noise exposure." *European Heart Journal* **35**(13): 829-836.
- [Reed](#), D. B., S. R. Browning, S. C. Westneat and P. S. Kidd (2006). "Personal protective equipment use and safety behaviors among farm adolescents: gender differences and predictors of work practices." *The Journal of Rural Health* **22**(4): 314-320.
- [Leonard](#) S. and F.Gerr. Hearing protection never too early or too late, *Iowa Farmer Today*, February 2015.
- [Sprince](#) N, Park H, Zwerling C, Lynch C, Whitten P, Thu K, Burmeister L, Gillette P, Alavanja, M (2003). Risk factors for animal-related injury among Iowa large-livestock farmers: a case-control study nested in the Agricultural Health Study. *Journal of Rural Health*. **19**(2): 165-73. [PMID: 12696853]
- [Thelin](#), J., D. Joseph, W. Davis, D. Baker and M. Hosokawa (1983). "High-frequency hearing loss in male farmers of Missouri." *Public Health Reports* **98**(3): 268-73.
- CDC Noise-induced hearing loss: https://www.cdc.gov/nceh/hearing_loss/default.html
- CDC Hearing loss in children: <https://www.cdc.gov/ncbddd/hearingloss/noise.html>
- NIOSH Occupational Hearing loss prevention: <https://www.cdc.gov/niosh/topics/noise/default.html>

Presentation Checklist and Order Form

MAKE YOUR OWN KIT

Scenario 1:

- 3-panel display
- Handouts
- Roll model with practice plugs
- Ear plugs to hand out

Scenario 2:

- Youth HLP presentation with script
- Youth Hair cell model activity (uses 5-6 pipe cleaners per youth)
- Practice plugs
- Roll model (optional)
- Youth HLP handout
- ear plugs (one pair per youth)
- Youth HLP follow-up exercise worksheet (one per youth – optional)
- Bookmark (one per youth – optional)

Scenario 3:

- Middle school HLP presentation with script
- Middle school HLP activity sheets and supplies for chosen activity(ies)
 - Cup & String Telephone – 2 cups, 10 ft string, scissors, pencil
 - Hair Cell Models – marshmallows, angel hair pasta (alternative: use Youth Hair cell model activity instead, if clean-up is a concern – requires 5-6 pipe cleaners per student)
 - Sound Scavenger Hunt – personal electronic device, Decibel X app (free download), pencil

Scenario 4:

- PC with NIOSH HLSim hearing loss simulator installed
- Noise-cancelling headphones
- Video containing background information and demonstration of the software
- HLSim Handout/Quick start guide
- HLSim Activity sheet (optional)
- Sound files (farm related) downloaded and installed

ORDER ITEMS FROM GPCAH

- Handout: Hearing loss among farmers
 - Older woman # needed _____
 - Older man # needed _____
 - Younger woman # needed _____
 - Earmuffs # needed _____
- Handout: Protect your ears (child) # needed _____
- Handout: How to choose HPD (English / Spanish) # needed ____ / ____
- Poster: What do I have to lose? (English / Spanish) # needed ____ / ____
- Poster: How loud is too loud? (English / Spanish) # needed ____ / ____
- Display: 3 panels # needed _____

Name:

Institution:

Mailing Address:

Please fill out this order form, copy it, and paste it into an email to cph-greatplainscenter@uiowa.edu. Alternatively, you may call Marsha at (319) 335-6871. Thank you.