Classroom+ Learning Series:
Cochlear® Nucleus® Technology for Schools
Amy Isaacs Donaldson, AuD, CCC/A
Professional Education Manager

Agenda
- What school professionals should know about cochlear implants in children
- Nucleus® technology update
- Remote microphone technology for Nucleus implants
- Resources and support

Cochlear’s Mission
We help people hear and be heard.
We empower people to connect with others and live a full life.
We transform the way people understand and treat hearing loss.
We innovate and bring to market a range of implantable hearing solutions that deliver a lifetime of hearing outcomes.
Why Consider a Cochlear Implant?

- For children who are deaf or hard of hearing, hearing aids may not be enough.
- Powerful hearing aids may provide access to only part of the speech signal.
- Cochlear implants are able to restore audibility across the frequency spectrum.

Outcomes for Children with Cochlear Implants

1990's: Studies demonstrate pre-lingually deafened children can develop spoken language if provided cochlear implants.
2000's: Studies confirm that earlier implantation leads to better outcomes for spoken language.
Present: Studies reveal spoken language skills for children implanted early approach normal hearing peers; favorable educational, social, and emotional development.

We Want Them To Hear

Birth Rate

Incidence of HL

CI Penetration

2. Centers for Disease Control. EHDI Data. 2016
Early Hearing Detection and Intervention (EHDI) Goals

1. Hearing Screening before 1 month of age
2. Diagnostic Evaluation before 3 months of age
3. Referral to Early Intervention before 6 months of age


3.7 Million Babies Screened (2016)

~65,000 did not pass hearing screening
- 53% of those were re-screened and passed
- 9.7% had confirmed hearing loss
- 25.4% were lost to follow up

Of the over 6,000 children diagnosed with hearing loss:
- 66% were enrolled in early intervention
- 19% were lost to follow up

National Early Childhood Assessment Project (NECAP) supports evaluation of outcomes after referral


Utilization of Cochlear Implants for Children

- Varies widely by country
  - Australia: 97% (birth to 2)
  - United Kingdom: Over 90%
  - Germany: 65%
  - United States: 50% or less

- Varies widely by state in the US
  - Colorado: 86% (profound) and 71% (severe)
  - North Carolina: 61%

- Less than a third of parents whose children received implants indicated that they received information on cochlear implant candidacy from their early intervention professional

Rather than delivering comprehensive, evidence-based information on language development options, the US system is heavily influenced by the individual state agencies' approach to deafness and even by the individual perspective of the early intervention professional who provides services to families; hence there is great variability in the nature of information provided...such discrepancies in the accuracy and completeness of information provided lay the foundation for the relatively low rate of pediatric CI utilization in the United States.”

~Sorkin & Buchman (2016)

Candidacy for Cochlear Implants

- Children 12 to 24 months of age who have bilateral profound sensorineural deafness and demonstrate limited benefit from appropriate binaural hearing aids.
- Lack of progress in the development of simple auditory skills in conjunction with appropriate amplification and participation in intensive aural habilitation over a three to six month period.
- Quantified on a measure such as the Meaningful Auditory Integration Scale or the Early Speech Perception test

- Children 2 years of age or older may demonstrate severe to profound hearing loss bilaterally:
  - ≤ 30% correct on the open set Multisyllabic Lexical Neighborhood Test (MLNT) or Lexical Neighborhood Test (LNT), depending upon the child's cognitive and linguistic skills. A three to six month hearing aid trial is recommended for children without previous aided experience.

Nucleus® Cochlear Implant Indications for Pediatrics
**Cochlear Implant Candidacy**

**Considerations for CI Candidacy**
- Audibility of the speech signal
- Speech and language development
- Hearing aid use
- Communication mode
- Family and environment
- Educational services

**When to Consider a Cochlear Implant**

In a school-age child (over age 2), when a severe to profound sensorineural hearing loss is present and when the child:
- is not making appropriate progress in speech and language or auditory goals
- is falling behind their normal hearing peers in school
- is struggling with behavioral concerns, especially if there are new or worsening concerns
- struggles to hear their peers and/or teacher(s) in all environments

**Support for Families**

- Facebook Groups
  - Cochlear Town USA
- Cochlear Website
  - [www.cochlear.com](http://www.cochlear.com)
- Organizations
  - [www.agbell.org](http://www.agbell.org)
  - [www.infanthearing.org](http://www.infanthearing.org)
- Online Communities
  - Hear & Now
  - Cochlear Resource Guide for Parents
    - Available in English, Spanish and French
    - Click “Request a free information guide” on the Cochlear website
  - Cochlear Concierge
    - Caring professionals who are available to answer questions and provide support for candidates and family members
    - English and Spanish support available
    - concierge@cochlear.com
  - Support Groups
    - Local organizations
      - May be affiliated with CI clinics
  - Cochlear Volunteers
    - Cochlear Connections
    - Events
      - Listed on the Cochlear website or social media
The Cochlear™ Nucleus® Implant System

- Two main components
  - The internal implant
  - The external sound processor

How it Works (Video)
Cochlear Implant Surgery

- Routine outpatient procedure usually lasting about 2 hours
- Requires minimal or no hair shaving
- Small incision behind the ear
- Usually a few days off school with quick recovery time
- Major complications are rare
- Sound processor activation will usually happen 3-4 weeks after surgery
- Nucleus cochlear implants are designed with MRI safety in mind*

*Approved for MRI up to 3.0T with the magnet removed at 1.5T with magnet in place with use of Cochlear Nucleus Implant Bandage and Ear.

Choose Quality. Choose Cochlear.

Most reliable today

![Graph showing reliability comparison](image)

Most reliable over time

![Graph showing reliability comparison over time](image)

The Nucleus 7 Sound Processor

Nucleus 7 is the smallest, lightest and only Made for iPhone cochlear implant processor which delivers proven hearing performance.

Hear Your Way


Hear Your Way: SmartSound® iQ with SCAN

SCAN, Noise Reduction and Wind Noise Reduction are FDA approved for children 6 and older*

- Dual microphone technology designed to help filter out background noise
- Automatically adjusts to the hearing situation
- Industry first scene classifier (SCAN)*
- Speech perception for children is significantly improved in noise with the addition of SmartSound iQ*

Connect Your Way: Made for iPhone

Nucleus 7 is the first and only Made for iPhone cochlear implant processor1

Bluetooth® LE and MFi for Hearing Device technology from Apple® lets patients connect directly to Apple iOS devices and stream music, phone calls and more.


Nucleus Smart App: First for iPhone®, First for Android™

Advanced control of the sound processor and wireless accessories, personalization and support – directly from your device*

*devices running iOS 10 or later or Lollipop 5.0 and Bluetooth 4 or later.
Wear Your Way: Kanso® Sound Processor

- Dual microphone technology and SmartSound IQ with SCAN provides equivalent performance to a behind-the-ear sound processor
- Connectivity with True Wireless™ accessories
- Discreet and easy to use
- Allows freedom for use of glasses, hats, etc.
- Several retention options available

Connect Your Way: True Wireless™

- Mini Microphone 2+
  - Clear speech delivered right to the sound processor
- Phone Clip
  - Hands free streaming from Bluetooth-enabled phones and devices
- TV Streamer
  - Direct streaming from the TV to the sound processor

Wear Your Way: Aqua+ for Nucleus 7 and Kanso

- Can be used up to 3 meters deep (almost 10 feet) for up to 2 hours*
- Can be re-used up to 50 times with appropriate care
- Rechargeable batteries (Nucleus 7) or alkaline batteries (Kanso) must be used with Aqua*

Choosing a Cochlear Implant

- Hearing Aids
  - Children may be fit with new hearing aids every few years
  - May choose a different brand of hearing aid at any time
  - Brand may be chosen for the features available today
  - Hearing aid wearer has very little direct contact with the hearing aid manufacturer

- Cochlear Implant
  - Implant is placed sometime after 12 months of age and will be with the child for a lifetime
  - Upgrades to external sound processors will happen over time, but brands cannot be changed
  - Recipients will have a lifetime relationship with their cochlear implant company
  - A commitment to lifetime innovation may be just as important as current features
  - Cochlear implant must work with different hearing aid and assistive technology

Using Remote Microphone Technology with Nucleus Sound Processors

Factors Affecting Language Outcomes

1. Early fitting of hearing aid or cochlear implant
2. Nonverbal cognitive ability
3. Level of maternal education
4. Early activation of cochlear implant

Technology Factors

1. Better signal-to-noise ratio
2. Consistent audibility of speech sounds
3. Evidence-based protocol for technology selection and fit
4. Intervention that encourages greater communication and vocabulary
Consistent Audibility of Speech Sounds

- Language-rich environments are crucial for hearing children to reach developmental milestones.
- Children who are deaf or hard of hearing require increased signal-to-noise ratio to access language in noisy environments.
- Cristofari et al. (2017) is the first large scale study to look at normative data on CI data logging, including wear time, as well as environments patients experienced.

Better Signal to Noise Ratio

- An increased signal-to-noise ratio is required in children with implants to achieve the same level of response as normal hearing children.
- The use of an FM system allows for improvements in speech-in-noise of up to 20 dB relative to non-FM condition.
- What about the use of modern wireless remote microphone systems?

Connect Your Way: Cochlear Mini Microphone 2+ (MM2+)

- Clip-on microphone to transmit speech and sound directly to the sound processor (2.5 GHz Wireless)
- Plug-and-play audio streaming with any stereo jack for listening in the classroom, computer-based testing, videos, etc.
- FM compatibility and built-in telecoil
- Improve communication in group settings with conference mic
- Range of over 80 feet*
Comparing Mini Mic 2+ (MM2+) and Roger 20 remote microphones (RM) on the Nucleus 7 Sound Processor.

- Significant improvement over no RM for both MM2+ and Roger at 0 dB SNR.
- Similar improvement for both MM2+ and Roger at -10 dB SNR.
- At -15 dB SNR, MM2+ outperforms Roger with both performing better than no RM.

Multiple studies demonstrate the benefit of remote microphone technology when used with Nucleus cochlear implants.

- Benefits seen are similar between direct wireless microphones (ie, MM2+) and traditional remote microphone systems (ie, Roger).

Selecting Remote Microphone Hearing Assistive Technology (RM-HAT)
Selecting RM-HAT

Considerations:
- Acoustic Environment
- Academic Setting
- Student Characteristics

See the American Academy of Audiology’s guideline “Remote Microphone Hearing Aided Technology for Children and Youth Birth to 21 Years” for more detailed information about choosing, fitting and validating RM-HAT.

Selecting RM-HAT

Integrated Receiver

Universal Receiver with MM2+

WARNING: Accessories that fit between the sound processor and the battery module prevent the battery module from being replaced. If the battery module can be removed, it must remain connected to the sound processor, which means the battery module can be removed and pose a choking or ingestion hazard. Always supervise.

Selecting RM-HAT

Wireless Technology in the Classroom for Nucleus® and Baha® Recipients

- Now available for educators and parents
- Contains information about the selection and fitting of RM-HAT options for students with Nucleus and Baha implants
- Full guide that covers all wireless options for students and contains fitting and troubleshooting information
Fitting and Verifying RM-HAT

Fitting & Troubleshooting Tools

- Wireless Solutions for Nucleus and Baha Recipients (FUN3118)
- Smart App (for Nucleus 7 and Baha 5)
- Remote Control (CR310 for Nucleus 7 or CR210 for Nucleus 6)
- Remote Assistant (CR230 for Nucleus 6)
- Monitor Earphones (Nucleus) or Test Rod/Softband (Baha)
- User Manuals for all equipment
- www.youtube.com/user/cochlearmericas

Fitting Considerations for Remote Microphones (RM)

<table>
<thead>
<tr>
<th>Mixing Ratio</th>
<th>Gain</th>
<th>Activation of RM</th>
<th>Monitoring</th>
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<tbody>
<tr>
<td>The volume of the RM in relation to the volume of the processor microphone</td>
<td>The gain can be set in the RM receiver (ie, Roger 20)</td>
<td>The remote microphone is activated manually or automatically (ie, Auto FM)</td>
<td>Confirming the RM is connected and working, both daily in the classroom and over time</td>
</tr>
</tbody>
</table>

WARNING: Accessories that fit between the sound processor and the battery module prevent the battery module from being locked to the sound processor, which means the battery module can be removed and pose a choking or ingestion hazard. Always supervise.
Confirmation of Remote Microphone (RM) Fittings

1. Check processor lights
2. Check Smart App or remote
3. Listen with monitor earphones
4. Perform a behavioral listening check

"ah ee mm oo ss sh..."

Monitor Earphone Adaptor

Monitor Earphone Adaptor

Processor only

Roger 20 receiver

Monitor Earphone Adaptor

Battery module

Behavioral Evaluation of RM-HAT Fittings

- A protocol has been created for the electroacoustic verification of RM-HAT coupled to cochlear implant sound processors.¹²
- Behavioral evaluation of fitting remains the most common way to verify the RM-HAT is providing benefit.
- Different options are available to school professionals, depending on the need and/or equipment available.

Tools and Resources

**Cochlear Classroom+ Kits**

**Classroom+ Monitoring Kit** (FUZ1515)

Tools and brochures are also available separately – discuss with your local representative or contact Cochlear at:

1-877-883-3101 or
procare@cochlear.com

**Classroom+ Connectivity Kit** (FUZ1514)

**Online Resources**

  - Instructional videos
  - User manuals
  - Accessory information
  - Cochlear Store
  - Warranty information
  - Connecting to the community
- [www.cochlear.com/us/communication-corner](http://www.cochlear.com/us/communication-corner)
  - Customizable rehabilitation
  - Resources for professionals
- [www.youtube.com/cochlearamericas](http://www.youtube.com/cochlearamericas)
  - Recipient stories
  - Instructional videos
Cochlear Concierge and Volunteer Teams

Connect families and recipients to someone who has walked in their shoes

1-877-897-4474
or
concierge@cochlear.com

Growing Up Cochlear (Video)