Roger™ for young children
When a child can hear more words, life is on

Agenda
1. Challenges: access and acquisition
2. The solution: Roger
3. Roger benefits for young children
4. Evidence
5. Benefits

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Learning Objectives

1. After this course learners will be able to discuss the Roger for Toddlers portfolio and its benefits to children with hearing loss.
2. After this course learners will be able to describe the audiological features of Roger.
3. After this course learners will be able to discuss the best hearing solutions for children and explain how Roger works with other products.

Pediatric commitment for 45 years

- Foster professional development
- Work closely with our International Pediatric Advisory Board
- Conduct internal and external research studies
- Host our global pediatric conferences

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Our Why

At Phonak we want to give every child the opportunity to hear and understand in every situation so they can develop speech, communicate effectively, play, laugh, and be confident in everything that they aspire to be or do.

1 Challenges: access and acquisition

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To be ready for school a child needs to:

- **Hear approximately 45 million words** by the age of 4 years.*

- **Have 20,000 hours of listening** in infancy and early childhood as a basis for reading.**

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The Listening Brain

- Wearing technology creates the brain’s foundation for listening and spoken language.
- Brain development solutions by Phonak deliver the cleanest signal possible

How much exposure is necessary?

45 million words by 4 years of age*

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Ears are the doorway to the brain

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- We hear with the brain and not our ears!
- The brain can only learn to understand information that actually reaches the brain
- Quality and quantity matter - “Garble in, garble out!”
- Modern hearing technology breaks through the doorway

Outcomes of Children with Hearing Loss (OCHL)

<table>
<thead>
<tr>
<th>Ongoing multi-site longitudinal study</th>
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<tbody>
<tr>
<td>University of Iowa</td>
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<tr>
<td>Boys Town National Research Hospital</td>
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<tr>
<td>University of North Carolina at Chapel Hill</td>
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317 kids

Between 5 months and 17 years

Mild to severe hearing loss

Guarding against language delay

3 key predictors of better outcomes:
These guide our approach and development of solutions for children

- Well fit hearing aids
- Consistent hearing aid use
- Quality language input

Challenging listening environments

40% of speech in a child’s typical day comes from a distance of over six feet and/or with ‘overlapping’ noise


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[Logo of continued]
The challenges of understanding

- Meaningful education = adequate access to hearing:
  - Teachers
  - Parents
  - Siblings
- Hearing challenges for children with hearing loss:
  - Classrooms
  - Home life
  - Outdoors
- Studies* show:
  - Hearing instruments alone are not enough
  - More intelligent solutions are needed

(FM has been the typical solution)


2

The solution: Roger

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The solution: Roger

Roger is a digital, wireless remote microphone system

Roger provides speech and language access in noisy situations and over distance

Roger digital technology

<table>
<thead>
<tr>
<th>Roger</th>
<th>• 2.4 GHz wireless technology</th>
<th>Improvement speech understanding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart behavior</td>
<td>• The remote microphone signal measures the environmental noise in real-time and adjusts the receivers to provide the best signal-to-noise ratio</td>
<td></td>
</tr>
<tr>
<td>Fully compatible</td>
<td>• Fully compatible with hearing aids, bone anchored devices and cochlear implant systems</td>
<td></td>
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</tbody>
</table>

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PHONAK
life is on

Continued
Why the name Roger?

- Roger comes from aviation
- It means *message received and understood*

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Digital Wireless Characteristics

- 2.4GHz ISM – Globally License Free
- Audio signals are sampled and digitized
- Then packaged in very short (160 μs) digital bursts of codes (packets)
- Packets are broadcast several times, each at different channels between 2.4000 and 2.4835 GHz
- Audio Delay is less than 25ms

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[Continued Logo]
Frequency Hopping Characteristics

What does frequency hopping do?
- Frequency hopping is adaptive and automatic
- Free channels between 2.4-2.4835 GHz are used
- Receivers talk back to microphones about occupied channels
- Roger microphone can “sense” the presence of WiFi and respond accordingly

How does frequency hopping benefit me?
- Microphone will automatically avoid occupied channels
- Prevents signal cross over
- Avoid complicated channel schematics for multi-talker networks
- Privacy guaranteed

Roger microphone portfolio

Roger for Education | Roger for Home
Roger receiver overview

Roger 18  Roger 19  Roger X  Roger MyLink

Roger 17  Roger 20  Roger 21

What makes a complete Roger system?

Hearing instrument  +  Roger receiver  +  Roger microphone

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Automatic activation of Roger

1. Transmission from the Roger microphone activates the Roger program
2. Automatic switching into the Roger program occurs in <400ms
3. Switching out of Roger program occurs after ~50 seconds of no transmission

Available in AutoSense Sky OS and also in Startup program

How the Sky B RogerReady program helps you and your patients

- RogerReady now enabled by default for all Junior mode fittings in Phonak Target
- Activates <400ms of speaker talking; ensuring children don’t miss the beginning of a sentence again
- Automatic activation means parent / teacher won’t forget to turn program on

[References]
Standaert, L. & Levy, C. RogerReady: Automating the Roger Experience Field Study Notes (April, 2018)

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Continued
MultiBeam Technology addresses loss of signal-to-noise ratio (SNR) in far field

- Creates beams in six directions
- Automatically selects the beam with the best SNR
- Speech understanding improves up to 61% in a group conversation in 75 dBA of noise compared to using hearing aids alone*

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MultiBeam Technology

- 12 test subjects with moderate to severe binaural hearing loss
- Speech understanding tested with HINT sentences
- Speech recognition **improves up to 61%** in a group conversation in 75 dB(A) of noise compared to hearing aid alone*

Test performed at University of Texas By L. Thibodeau

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* Based on preliminary data. Peer-reviewed article and Field Study News in preparation, available end of 2018 at www.phonakpro.com/evidence
The winning Roger strategy

1. Bringing the microphone **to the source**
2. Optimizing SNR at the source with **beam former**
3. **Adaptively** mixing wireless mic signal and ear-level microphone
   – **increasing** the gain of the Roger receiver in higher ambient noise levels
4. **Reducing** the gain when no voice is present

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3

Roger benefits for toddlers

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[Continued]
Access to more

Use of a Roger system at home ensures a young child with hearing loss has access to more spoken language

With Roger and appropriate amplification, we ensure children hear more from a distance

Incidental language learning

Roger allows a child to hear more
A large percentage of language is acquired through incidental learning

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Roger is helpful in many situations

At home
In a stroller
In the car
At the park

4 Evidence

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In the few studies on remote microphone use in homes, caregivers have reported:

- Improved child access to speech, incidental learning, and overhearing\(^1\)
- Improved listening skills\(^2\)
- Increased imitation of words and sentences, enhanced clarity of speech and general well-being of the child\(^3\)
- Improved attention, and receptive language, and reduced listening effort and fatigue\(^4\)

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\(^1\) Flynn, Flynn & Gregory, 2005; Mulla & McCracken, 2013
\(^2\) Mulla & McCracken, 2014
\(^3\) Mulla & McCracken, 2013
\(^4\) Möller, Donaghy, Beauchaine, Lewis & Stelmachowicz, 1996
Roger usage at home

Consistent use of Roger at home can be considered a significant step towards achieving the exposure to 45 million words to be ready for school.

![Diagram showing 5,300 more words a day in their children.](image)

*Compared to using hearing aids alone. Based on average hearing aid use time of an 8 hour day.*

Roger usage at home

Based on parent responses to the FM Listening Evaluation Questionnaire, while using the Roger system...

- **80%** of families report greater responsiveness
- **35%** report less frustration in their children

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[Logo]
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Benefits

Simple and reliable

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<thead>
<tr>
<th>Simple</th>
<th>Reliable &amp; robust</th>
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<tr>
<td></td>
<td>Water and dust resistant</td>
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</table>

One click connection of receivers

Connect

Overall benefits of Roger for young children

- More speech and language access
- Improved speech understanding
- Easy, reliable and safe

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Additional Resources

Introducing the BabyBeats™ App

Early intervention resource

Establishing pre-verbal skills through interactive, natural musical engagement helps develop the listening brain

There is a growing evidence that music assists with early listening & language development & emotional well-being of children

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[continued]
Why BabyBeats?

1. Saw improvements in the early listening and communication skills while using BabyBeats
2. Saw improved interest in sounds, attention, reaction and copying at other times of the day when not using BabyBeats
3. Felt more confident to interact with their infant and increasingly use their voice during the vocal play activities
4. Were more relaxed when playing with their infant, displayed more non-verbal communication, were engaged in more face-to-face interaction
5. Greatly enjoyed all four musical trails

*Parents surveyed at the Elizabeth Foundation, UK
We’re in this together

- Built on 45 years of commitment to the most precious years
- We share a commitment to let every child live their life without limits
- Together, we support the best possible outcomes for children with hearing loss

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