AUTOMATED AUDIOLOGY AND TELEMEDICINE

Breaking Down Barriers to Diagnostic Audiometry

Are there Barriers to Diagnositic Audiology?

- Growth rate of HI patients outpacing that of audiologists
- Access to audiometry is primarily inbound generated
- Ability to provide diagnostic audiometry restricted by infrastructure and equipment requirements

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Barrier or Opportunity?

- Viewpoint
  - Continue traditional methods?
  - Create new paradigm to meet new challenges?
- Requires willingness to change
  - Evaluate, i.e. public health vs military vs private practice
  - Explore solutions to meet specific demand

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What needs to change?

"Hearing health professionals can be proactive and shape the new processes – or others will inflict change without us"

Ian Windmill

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Necessity is the Mother of Invention

- Challenge: Addressing unmet need
  1. Minting more AuDs takes time
  2. Retirement and attrition are inevitable
  3. Can't change population growth
- Opportunity:
  - Leverage technology to expand capacity

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Necessity is the Mother of Invention

- Challenge: Addressing limited access
  1. Can't duplicate traditional audiology workplace with sound booths, etc.
  2. Only seeing patients who can get to us limits our reach
- Opportunity:
  - Employ technology to expand access points

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What can we change?

- Explore how we deliver services
  - Maintain high level of clinical excellence
  - Allow for optimal patient interaction
  - Expand points of service
  - Reach larger, more diverse groups
  - Contribute to increased productivity, revenue

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Tele-audiology

- Leverage resources and access patients

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Benefits of Tele-Audiology

- Increase efficiency
- Reduce “drop rate” from referrals
- Patient convenience
- Expand catchment area for practice without increasing satellite operations

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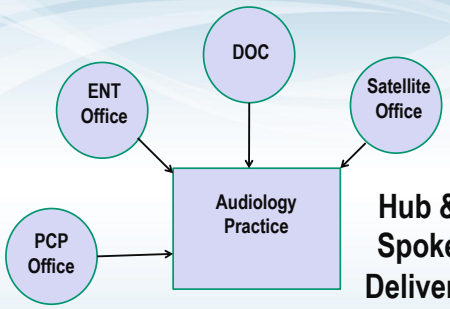
Hearing Health Delivery



Hub & Spoke Delivery

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Delivery Models

- Real Time
  - Direct contact between patients and providers
- Store and Forward
  - Audiologist overreads test results

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Considerations

- Video conference system
- IT support and connectivity
- Federal and state regulatory/license issues
- Reimbursement
- Provider liability
- Equipment

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Needs Analysis

- Provide diagnostic testing based on sound audiological principals
- Be configurable by audiologist and operated by audiology or audiology extender, LOCALLY or REMOTELY
- Portable, compact
- Not require a sound booth

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Otogram™ Technology

- The Otogram is an integrated, automated system, designed to perform a battery of audiological tests.

"The Otogram does not change the underlying principles or methods for audiometry, nor does it produce results different from manual audiometry"

– Aaron R. Thornton, PhD
Audiologist

Standard of Care

Otology & Neurotology
30:670–683 © 2009, Otology & Neurotology, Inc.

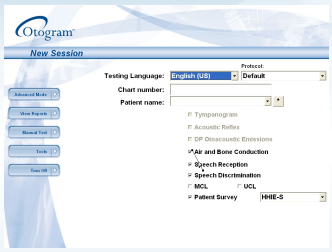
Computer-Assisted Audiometry Versus
Manual Audiometry

Conclusion: The Otogram is just as reliable as audiologists at determining hearing thresholds. We recommend that the Otogram can be safely used in a controlled clinical setting supervised by audiologists.

Objective: The Otogram is an automated computer-assisted audiometer that allows patients to self-administer audiometry for their pure-tone audiogram. There has been no research published in a peer-reviewed journal, validating its use in an otology outpatient clinic. We therefore proposed to investigate and compare the inter-rater and intrarater accuracy and reliability of audiologists and of the Otogram in an English-speaking British population.
Design: Prospective non-randomized validation study.
Setting: Secondary otolaryngology center and otology outpatient clinic.
Participants: Forty-eight NHS patients referred to an otology outpatient clinic.
Main Outcome Measures: Each patient had 2 pure-tone audiograms. Hearing thresholds in decibels hearing level were ascertained by fully trained British audiologists and by the Otogram.
Results: Using the weighted κ statistic, the level of agreement in air-conduction (κ = 0.965) and bone-conduction (κ = 0.927) thresholds between the audiologist and the Otogram on the same patient was equivalent to the inter-rater level of agreement between pairs of audiologists. Approximately 94% of air-conduction thresholds and 91% of bone-conduction thresholds measured by the Otogram fell within 10 dB of thresholds measured by an audiologist. Intrarater comparisons between audiologists were very good for air-conduction (κ = 0.978) and bone-conduction (κ = 0.964). The intrarater level of agreement between repeated Otogram thresholds was just as good for air-conduction (κ = 0.974) and bone-conduction (κ = 0.945) thresholds.
Conclusion: The Otogram is just as reliable as audiologists at determining hearing thresholds. We recommend that the Otogram can be safely used in a controlled clinical setting supervised by audiologists. **Key Words:** Audiology—Automated audiometry—Computer-assisted audiometry—Health services research—Otogram—Otology.
Otol Neurotol 30:676–683, 2009.

Otogram™ Test Battery

- ✓ Air/Bone Conduction
- ✓ with Masking
- ✓ Speech Threshold
- ✓ with Masking
- ✓ Speech Discrimination
- ✓ with Masking
- ✓ Stenger
- ✓ Additional options
  - ✓ Tympanometry
  - ✓ Acoustic Reflex
  - ✓ DP Otoacoustic Emissions



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Otogram™ Languages

- English
  - American
  - British
  - Australian
- Spanish
- Russian
- Portuguese
- Italian
- Korean
- Vietnamese
- Arabic
- Cantonese
- Mandarin Chinese
  - Simple
  - Traditional

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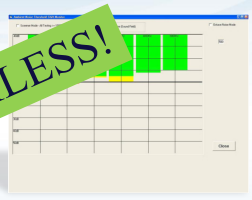
Ambient Noise Monitoring

- Patented system watches for excessive ambient noise levels
- Thresholds impacted by ambient noise reported in Otogram
- Allows tests to be administered in a quiet room



GO BOOTHLESS!

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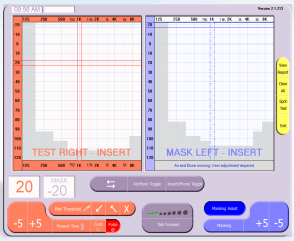
Pure Tone Testing

- Manual Mode
  - Original test
  - Recheck



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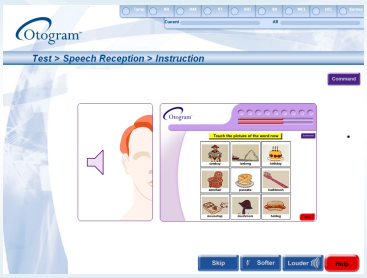
Speech Instruction



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Speech Testing

- Words presented via insert earphones
  - Headphone Option
- Closed-Set paradigm
  - Open Set Option
- Picture pointing task
- Patient responses monitored

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Monitoring: Stenger Test

- Otogram employs Stenger in presence of large interaural differences to rule out malingering
  - Automatic
  - Discrete
  - Reported

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Standard Reporting Conventions

Automated Audiometry & Telemedicine

- Video otoscopy
- Diagnostic evaluation
- Counseling
- Treatment/Programming
- Follow-Up

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Enables Expansion

- Building referral sites
  - ENT
  - PCP, Ophthalmology, Geriatrics
- Veteran's contracts
  - Overflow testing
- Government programs
  - DOC
  - FAA

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Reasons to utilize technology

- Access more patients
- Improve productivity
- Increase effective use of resources
- Improve profitability

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Reasons not to utilize technology

- Enjoy doing tasks that have been automated
- Like driving to satellite offices
- Content with current practice growth rate
- Don't want more money

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Opportunity knocks…
Technology answers!

Traditional Method

- Sound booth
- Audiologist
- Travel
- Make $

Reimagined Method

- Quiet room
- Supervised audiology extender
- Remote
- Make $$$

Increase access and capacity…
…Mission accomplished!

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