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Tele-Audiology Today: Part II- Current Research, Practical Demonstrations, and Program Fundamentals

Samantha Kleindienst Robler, AuD, PhD

April 15, 2020

Presenter Disclosures

- Financial:
  - Honorarium for presenting this course
  - No financial gain or endorsement of any specific telehealth technologies
- Non-financial:
  - Member on the ASHA Political Action Committee (PAC) Board
  - Reviewer for the Technology and Telepractice Committee for ASHA Convention
  - Employee of Norton Sound Health Corporation

Sponsor/Content Disclosures

- Sponsor Disclosure: This course is presented by Salus University in partnership with AudiologyOnline.

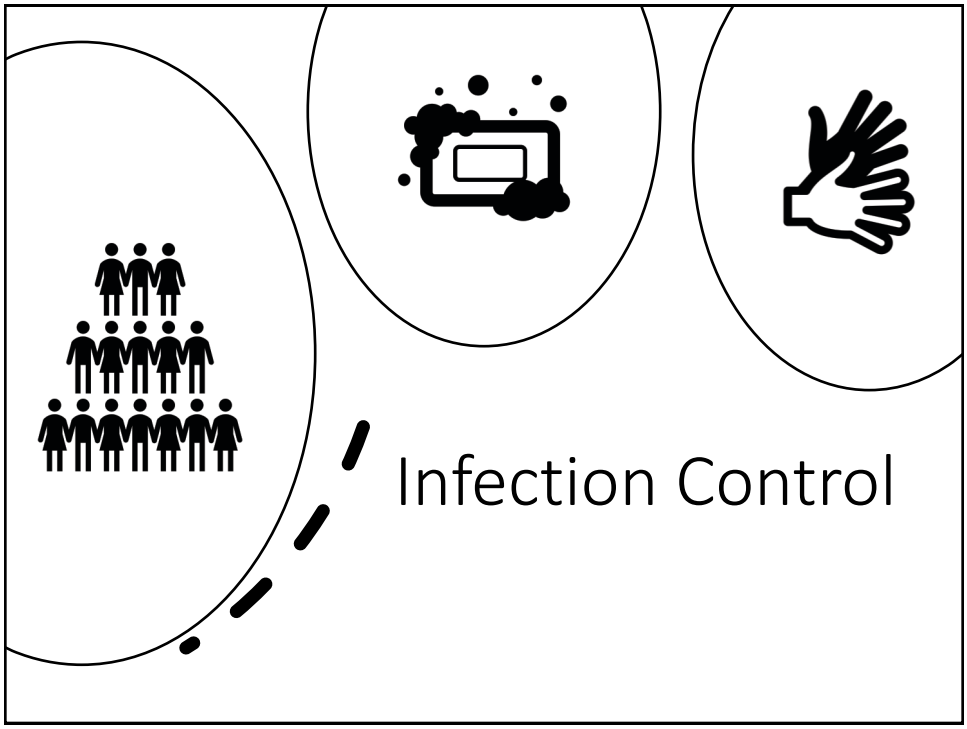
  Content Disclosure: This learning event does not focus exclusively on any specific product or service.

Learning Outcomes

As a result of this course, participants will be able to:

- describe current research in tele-audiology.
- discuss examples of tele-audiology models of care based on demonstrations of telemedicine used in remote and isolated communities of Northwest Alaska.
- describe foundational components for building a telehealth program.

COVID-19: Direct to Patient Solutions



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Research in Tele-Audiology

- Pure tone audiometry
- Mobile hearing screening
- Cochlear implants
- Amplification
  - Remote fittings/follow-up and rehabilitation
- Tinnitus
- Balance
- NBHS
  - OAE/AABR/ABR

Q1

Tele-audiology and CIs

- Impedance, ECAP, Programming, Speech Perception
  - Hughes et al 2012
  - Geohring et al 2012
  - Sevier et al 2019
    - DAI

Tele-audiology- Aural Hab/Rehab

- Auditory-Visual Therapy
  - Constantinescu 2012
- Speech Language Pathology
  - Grogan-Johnson et al 2010
- Adult/Pediatric Hearing Loss, Cochlear Implant
  - Telepractice and eLearning Laboratory (TeLL)
    - Huston 2011
- Early Intervention

Tele-Audiology: NBHS

- Krumm et al 2008
  - DPOAE/AABR
- Hayes 2012
  - OAE/ABR/Counseling
- Ramkumar et al 2013, 2014
  - ABR
    - Satellite vs broadband
- Hatton et al 2018
  - ABR/program details
- Remote Access

Tele-Audiology: Diagnostics

- Validity of Automated Threshold Audiometry: A Systematic Review and Meta-Analysis
  - Mahomed et al 2013
- overall average differences between manual and automated air conduction audiometry
  - 0.4 dB, 6.1 SD
- test-retest differences for manual (1.3 dB, 6.1 SD) and automated (0.3 dB, 6.9 SD) audiometry

Automated audiometry provides accurate measure of hearing
BUT more evidence needed for bone conduction and difficult to test

Tele-Audiology: Diagnostics

- Automated Audiometry: A Review of the Implementation and Evaluation Methods
  - Shojaeemend & Ayatollahi 2018
- Software, hardware, smartphone/tablets

No significant differences between automated and traditional audiometry

Tele-Audiology: Diagnostics

- Manual pure tone audiometry
  - Krumm et al 2007
- OAEs
  - Krumm et al 2007
- Automated pure tone air/bone
  - Swanepoel & Biagio 2011
  - Eikelboom et al 2013

Tele-Audiology: School

- Pure tones
  - Automated
    - Tablet
      - Kam et al 2011, 2014
    - Smartphone based app
      - HearScreen
      - Ear Scale (Chu et al 2019)
  - Remote Access
  - Real time
    - Audiology support of screening, interpretation of results
    - Lancaster et al 2008

Tele-Audiology: Dx Models

Real time	Store-and-Forward
▪ Remote Access	▪ Mobile Audiometer
▪ Mobile Audiometer	▪ Smartphone app

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Tele-Audiology: Diagnostics

- Mobile Audiometers
  - KUDUwave
  - AMTAS
  - Shoebox
  - WAHTS
- Cell phone-based
  - HearTest (HearX)
- Web-based
  - www.ListenLively.com
- Home Kit
  - Home Hearing Test
- Smartphone app-based





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Application-based Tele-Audiology

- Hearing
  - Bright 2016
- Otoscopy
  - CellScope
    - Mousseau et al 2018
  - Tyto
    - McDaniel et al 2019
- Vestibular/Balance
  - Polechonski et al 2019
  - Hsieh et al 2019
- Tinnitus
  - Sereda et al 2019

Q2

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Tele-Audiology: Hearing Aids

- Review: adult hearing aid journey
  - Paglialonga et al 2018
- Remote Hearing Aid Fitting/programming
  - Penteado et al 2012
  - Ferrari & Bernardez-Braga 2009
  - Pross et al 2016
- Patient self-fitting and adjustment

Table 1 Overview of the eHealth services across the phases of the patient journey (N = number of records)

Services	Phases		
	Pre-fitting	Fitting	Post-fitting
(1) Education and information (N = 10)			
(1.1) HL and HA information (N = 3)	✓		✓
(1.2) Counselling and patient education (N = 10)	✓		✓
(1.3) Group discussions and forums (N = 4)	✓		✓
(2) Screening and assessment (N = 4)			
(2.1) Pure-tone audiometry (N = 1)	✓		
(2.2) Speech-audiometry (N = 2)	✓	✓	
(2.3) Self-assessment and PROM/PREM (N = 4)	✓	✓	✓
(3) Hearing rehabilitation (N = 14)			
(3.1) Sound enhancement (N = 2)		✓	
(3.2) HA control and fitting (N = 6)		✓	
(3.3) Auditory and cognitive training (N = 9)	✓		✓
(4) General (tele-audiology) (N = 3)	✓	✓	✓

HA hearing aid, *HL* hearing loss, *PROM* patient-reported outcome measures, *PREM* patient-reported experience measures

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Research in Tele-Audiology

- Summary
  - Recent review articles and published research suggest nearly all audiological services can be done via over a distance with thoughtful modifications

> "But we must acknowledge that today's technological advancements have opened the doors for the creative development of distance delivery of hearing services through a variety of available advanced communication and video systems. In fact, it may be that acceptance and embracement of these new methods for distant delivery of hearing services will be the ultimate saving grace for the future of our profession. – Dr. Northern (2012)"

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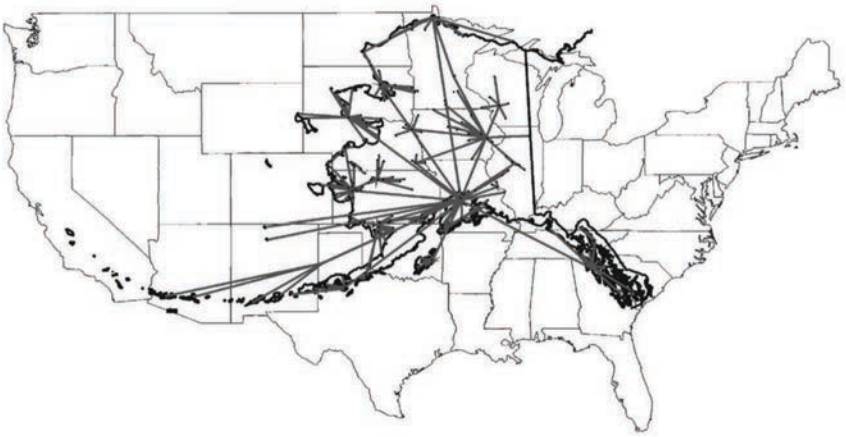
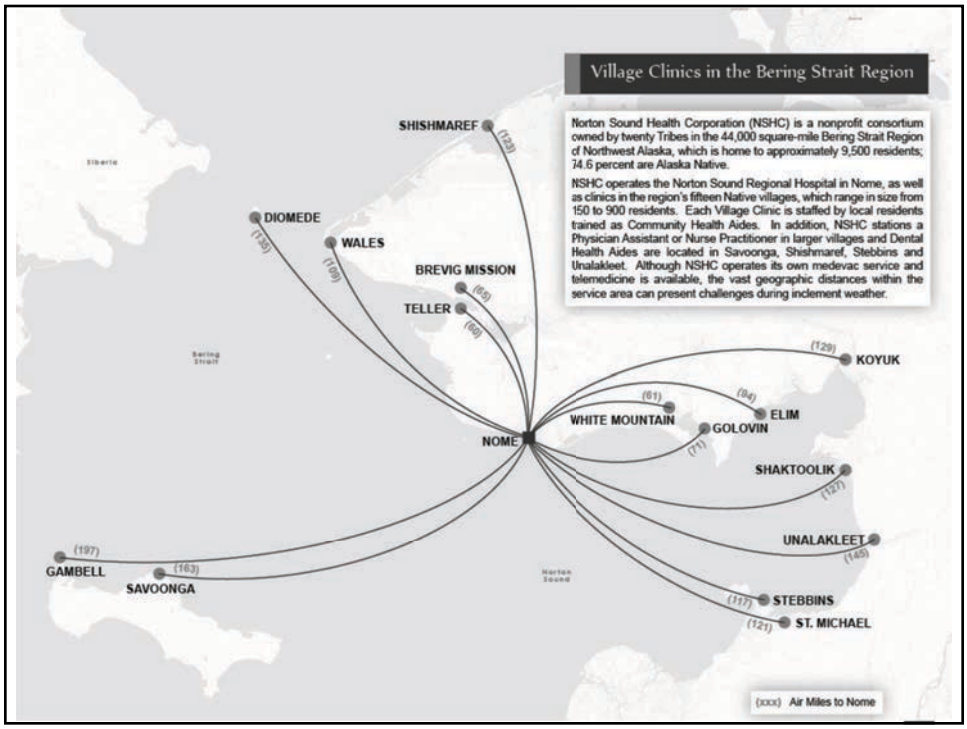


Map provided by
Alaska Native Tribal Health Consortium
Division of Information Technology
www.anthc.org



History of Telehealth in Alaska

1905 1915 1931 1955 1964 1971 1974 1980 1990 1992 **1996+**

Submarine cables

Radiotelegraphy

Short-wave high frequency radio

Joint use of radio frequencies

Community Health Aide/Practitioner

ATS-1

ATS-6

Dial-up telephone

Fax, digitized x-ray

Telemedicine trials

AFHCAN

AFHCAN Cart

- Equipment
  - Video otoscope
  - Tympanometer/audiometer
  - Dental Camera
  - Vitals/EKG
  - Digital Camera
  - Scanner
  - Camera and speaker
  - Stethoscope
  - Spirometer
- Health areas: ear, hearing, heart, respiratory, derm, trauma, dental, eye, general

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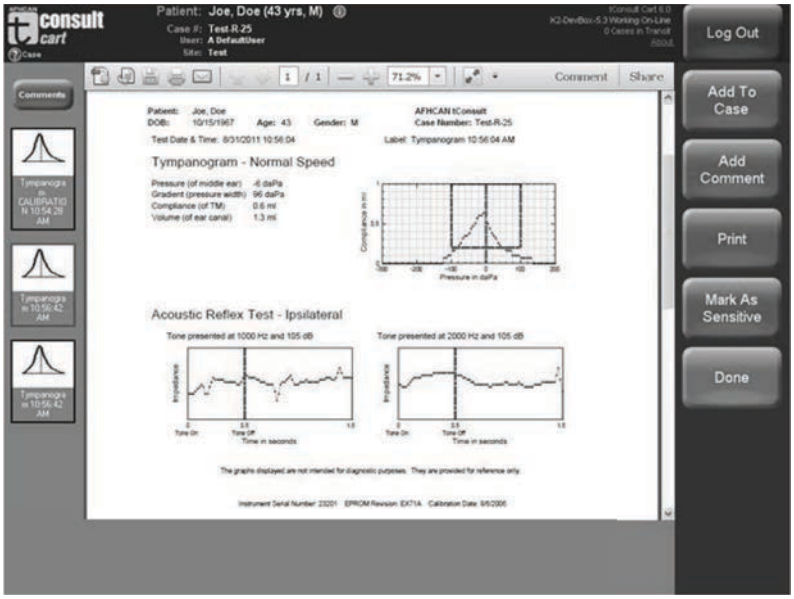

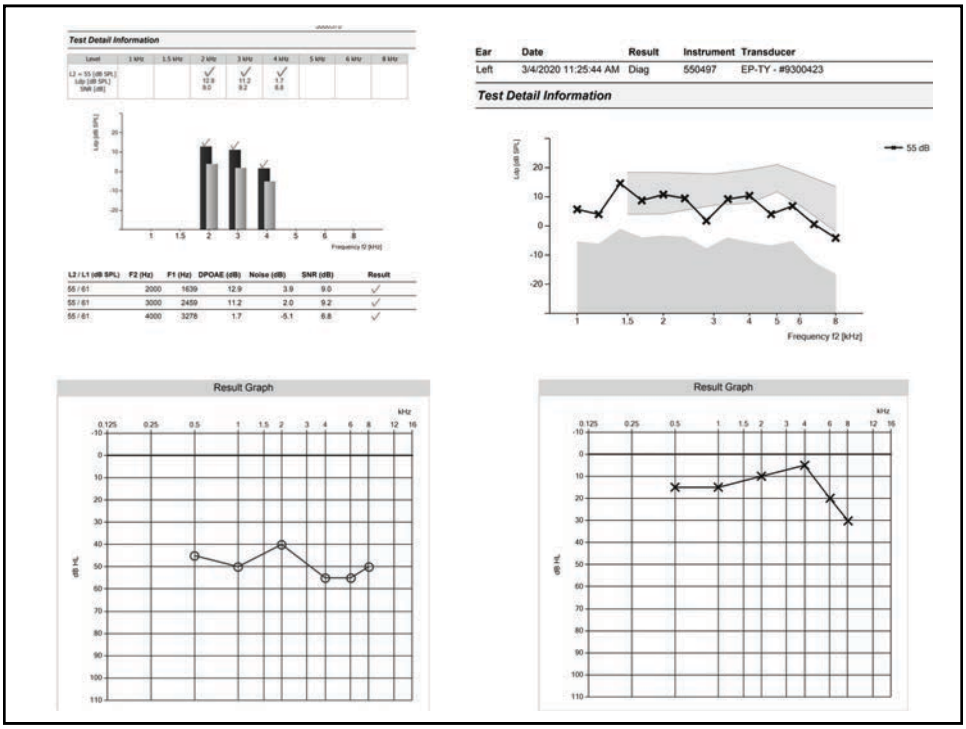

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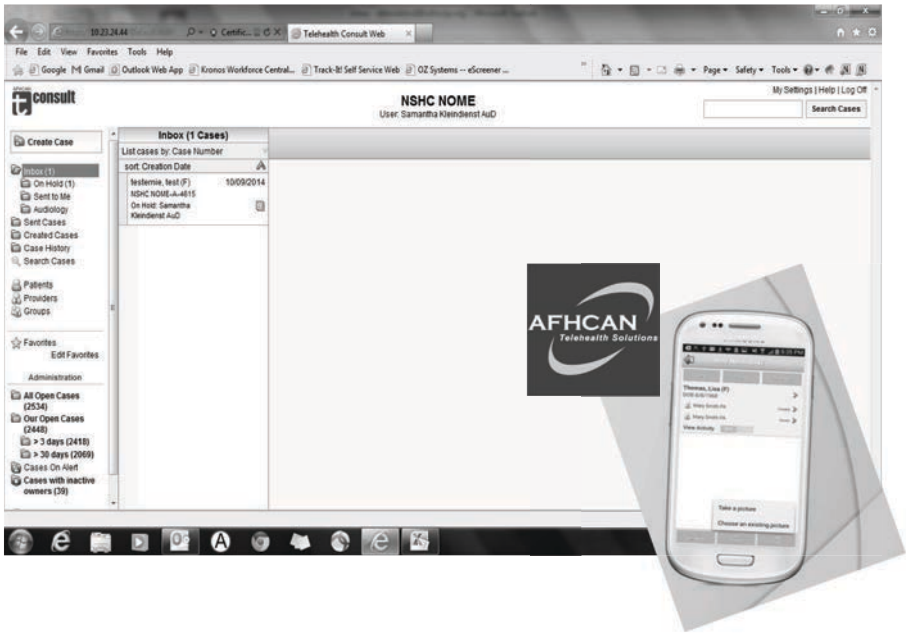

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Case created

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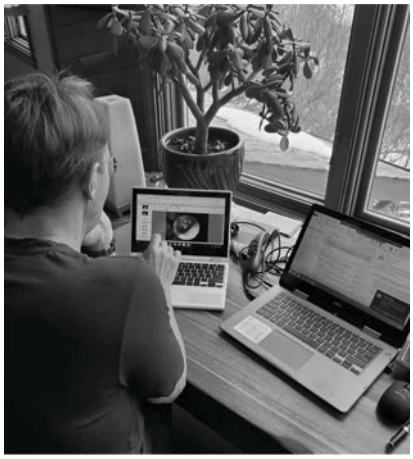
Case Received/Reviewed



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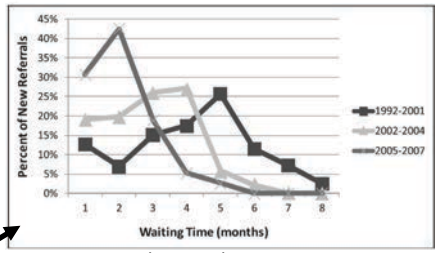
Outcomes



- Reduced wait-time
  - Ferguson et al. (2008)
  - Hofstetter, Kokesh, Ferguson, Hood (2010)
- Improved Cost effectiveness, reduced travel
  - Kokesh, Ferguson, Patricoski, LeMaster (2009)
- Burden on family and healthcare system
- Improved antibiotic stewardship

Q7

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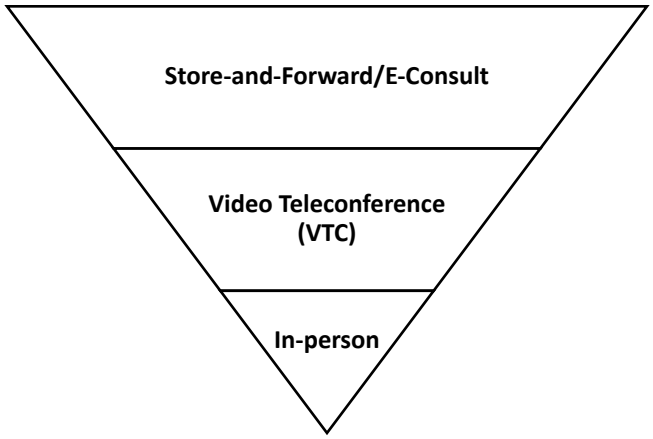
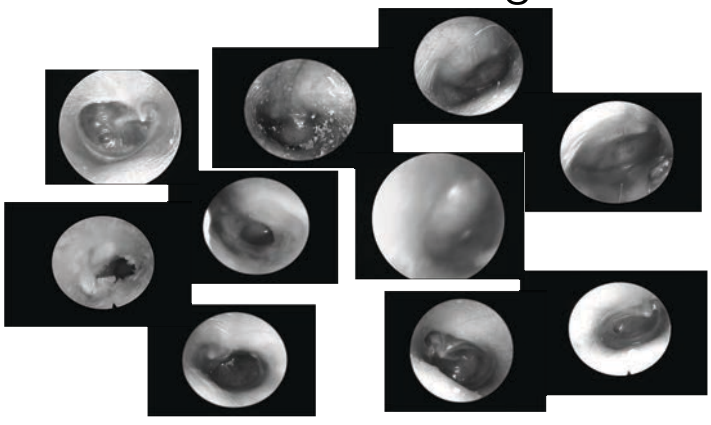


Workflow for use of telemedicine in audiology and otolaryngology specialty care to increase access and timeliness of care, while reducing travel

Otologic Disease and Infection-mediated Hearing Loss



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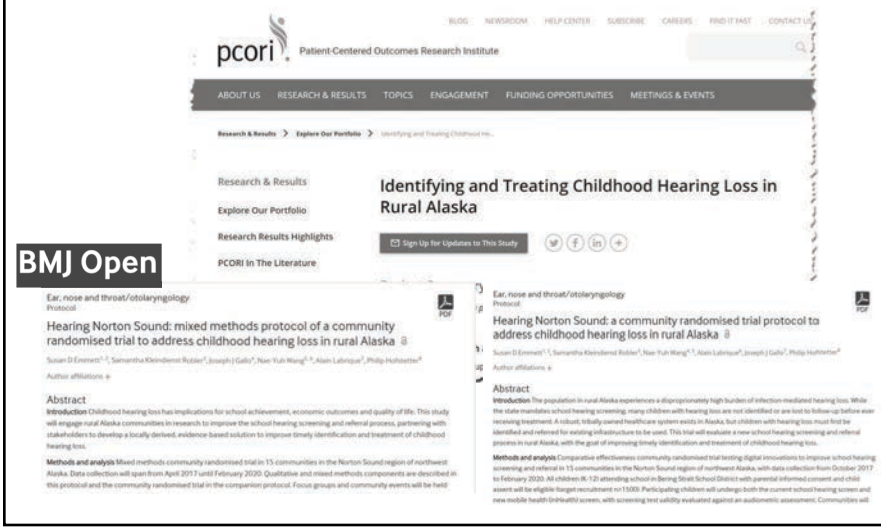
Telehealth for Prevention-RCT



BMJ Open

Ear, nose and throat/otolaryngology
Protocol

Hearing Norton Sound: mixed methods protocol of a community randomised trial to address childhood hearing loss in rural Alaska

Abstract

Ear, nose and throat/otolaryngology
Protocol

Hearing Norton Sound: a community randomised trial protocol to address childhood hearing loss in rural Alaska

Abstract

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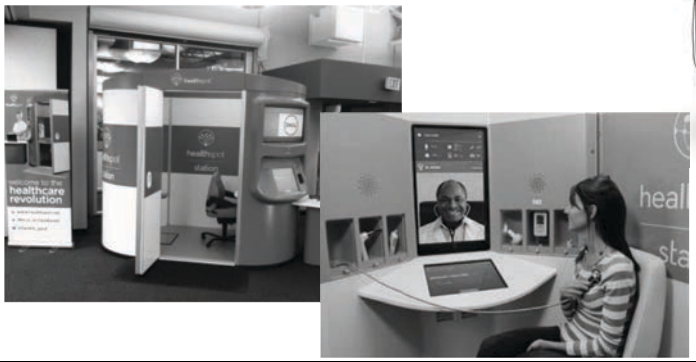
Other Example Systems

- Otometrics (VA)
- HealthSpot Platform (MCHS)



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Telehealth Workflows-rural AK

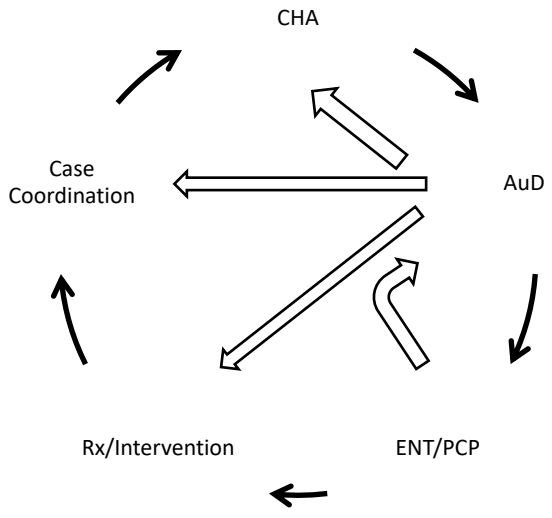
CHA to Audiology/ENT

- Digital Otoscopy
- Tympanometry
- Automated Audiometry
- Vitals
- History

Audiology to ENT

- Digital Otoscopy
- Tympanometry/Reflexes
- Full Diagnostic Audiogram
- History
- Suggested Management

Q4



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Cases Examples

- Cholesteatoma
- Sudden sensorineural hearing loss
- Brain tumor
- AOM/SOM
  - Nasopharyngeal Carcinoma
- Tube/tympanoplasty/mastoidectomy follow-up
- Hearing aid fitting

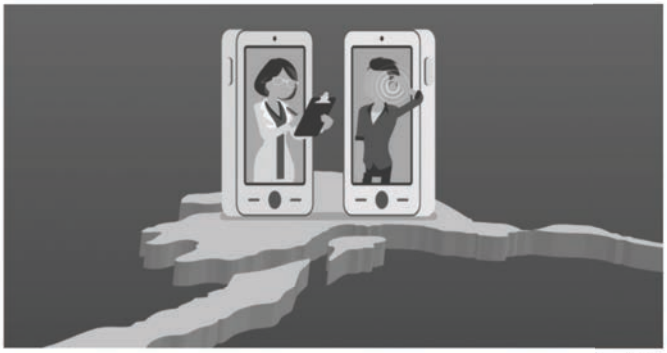
Q5

Telehealth: The Great Equalizer

By Samantha Kleindienst Robler | John Kokesh | Susan D. Emmett | Philip Hofstetter

Appears in Audiology Today March/April 2020

Opportunities for telehealth solutions are expanding as new technologies emerge and consumers drive the market. Smartphone peripherals such as otoscopes, hearing testing, electrocardiogram, stethoscopes, ultrasound, and remote patient monitoring are helping to enable less visit-centric health care, better continuity of care, and increased communication with patients.



Geographical distance and provider shortage in the state of Alaska make access to specialist health care, such as audiology, difficult. To address this challenge, Alaska has developed a homegrown telehealth network that connects small rural community clinics to specialists. Pre- and post-operative care, management of otologic disease and hearing loss, hearing aid programming, and newborn hearing screening follow-up are a few examples of telehealth-based services provided by audiologists in remote Alaska.

Role of Telehealth

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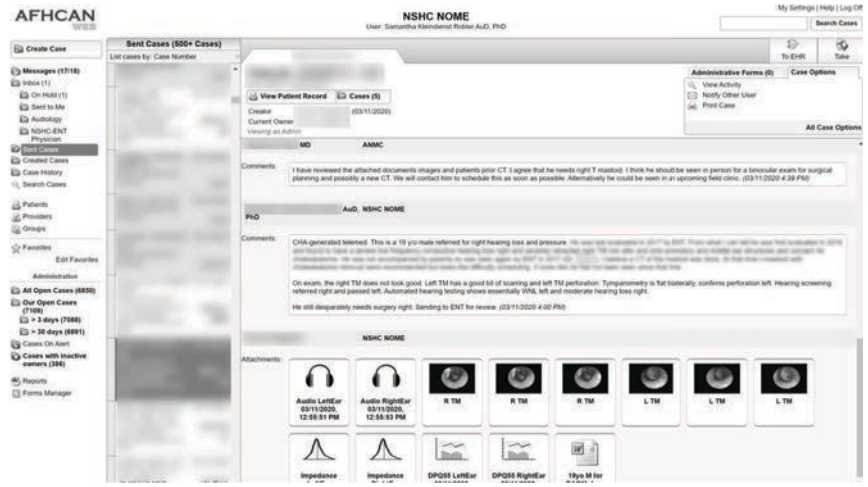
Example telehealth consult



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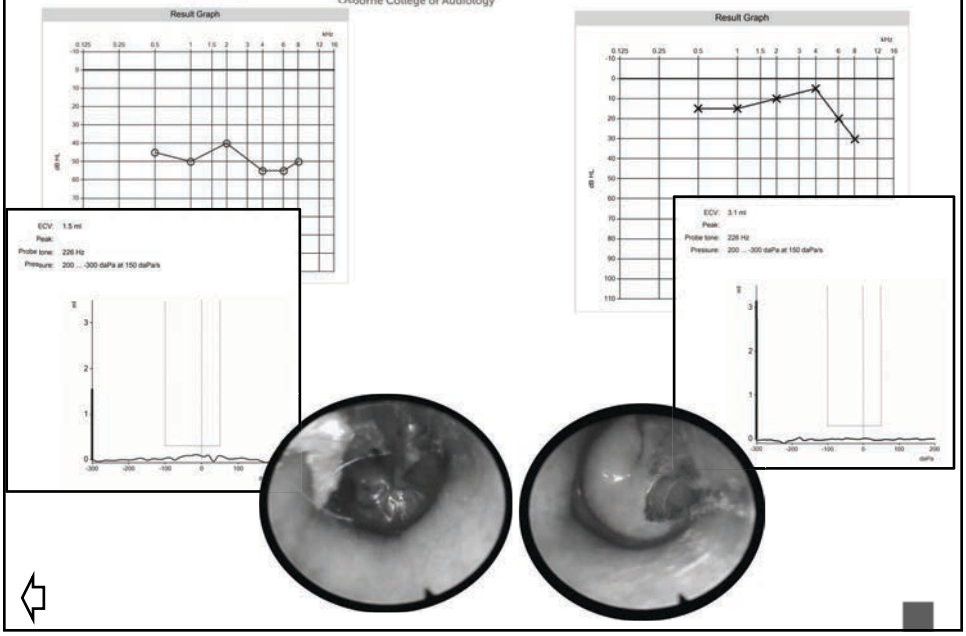

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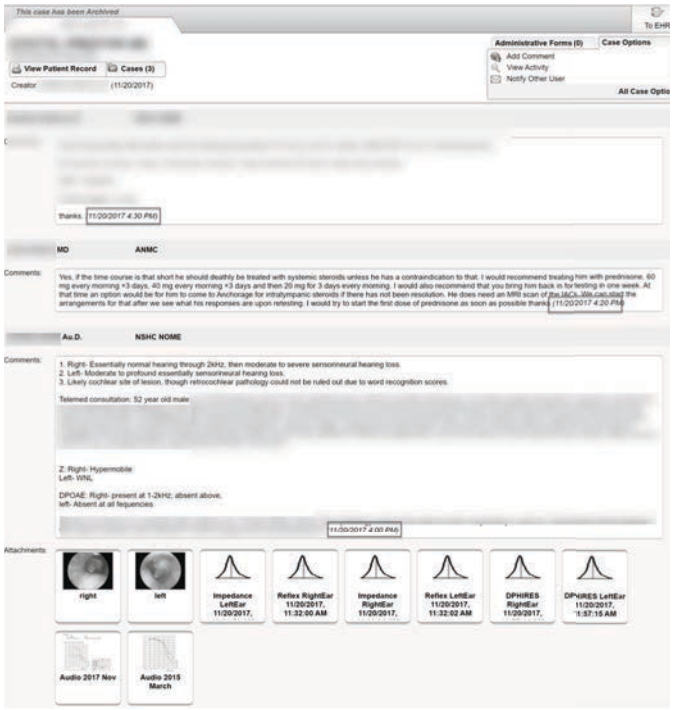

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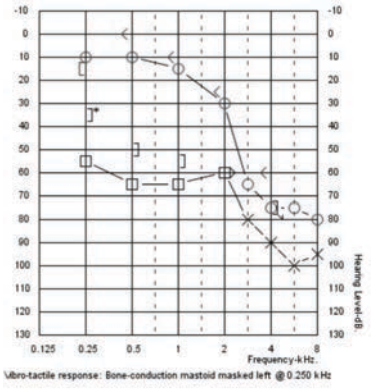
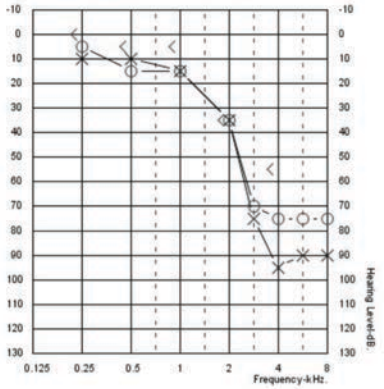
Treatment

Pre



Post



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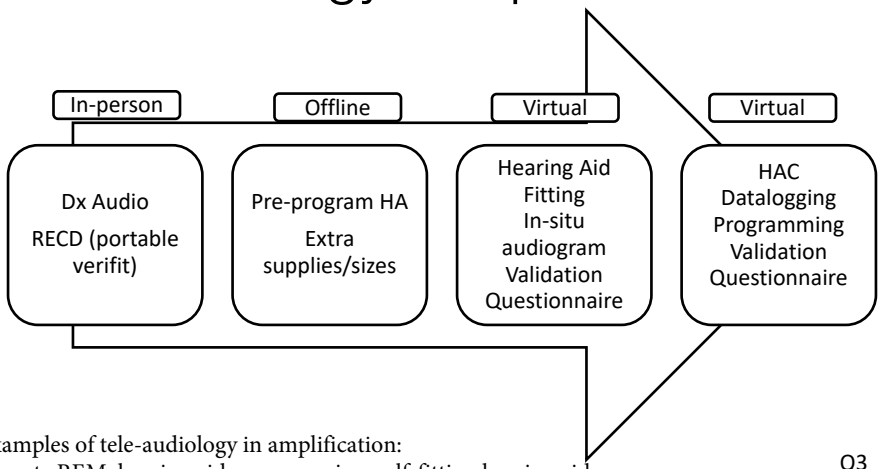
Tele-Audiology- Amplification



Examples of tele-audiology in amplification:
Remote REM, hearing aid programming, self-fitting hearing aids

Q3

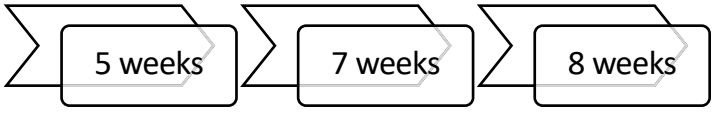
Tele-Audiology- NBHS

- Reduced Loss to Follow-up
  - Hybrid telehealth model with audiology VTC and store-and-forward otoscopy, tympanometry, and OAEs for initial OP follow-up

Q6

NBHS Case Example

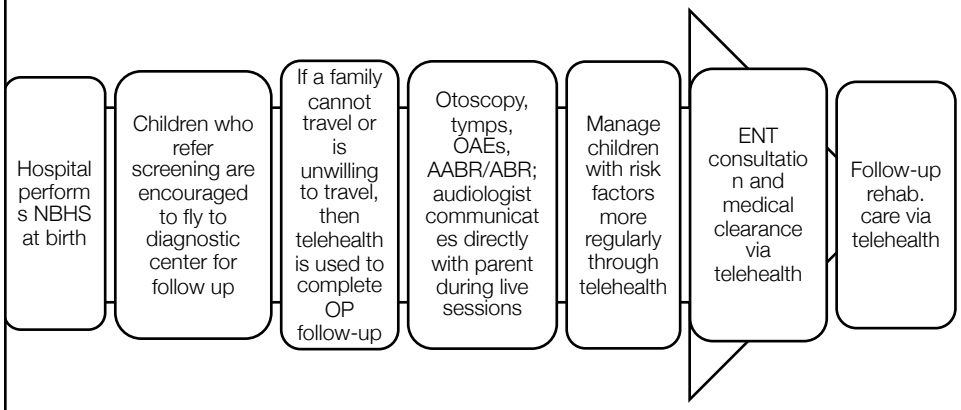
- Newborn male, born at 36 weeks, no complications with pregnancy/birth
- No family history of hearing loss but 3 older siblings with h/o recurrent ear infections and tubes
- Referred NBHS (AABR) left ear, passed right ear



Case Example-cont

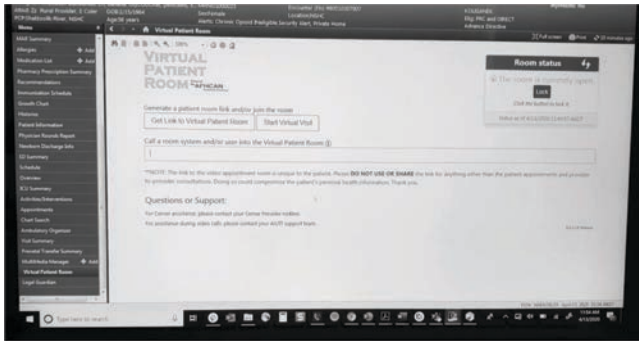
- VTC Audiology (regional hospital to remote clinic)
  - 5 weeks- completed VTC appt (otoscopy, tympanometry, OAEs, counseling)
    - Referred DPOAE screening (4 freq) left, passed right
- In-person Audiology, Store-and-forward to ENT
  - 7 weeks- completed AABR
    - Referred left, concern for possible effusion (type C tympanogram)
    - Consult with ENT via telemedicine resulted in recommendation for course of amoxicillin
- In-person Audiology, Store-and-forward to ENT
  - 8 weeks- completed diagnostic ABR
    - No sign of acute infection but tymps shallow with slight negative pressure
    - ABR normal Wave V right on click @ 20 dB nHL , ABR NR left @ 90 dB nHL
    - Consult with ENT via telemedicine resulted in scheduled for exam with binocular microscope, genetics, ophthalmology
- In-person Audiology and Audiology VTC
  - Update: Fit with amplification (in-person), two HACs for counseling and follow-up via VTC

NBHS telehealth workflow



Demonstration

- Audiology VTC
  - Otoscopy, tympanometry, reflexes, OAEs, automated air conduction, history, and counseling



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Demonstration

- Remote Desktop Connection
  - History and counseling, remote programming

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Direct to patient Models- How to

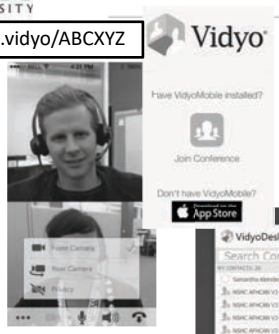
- Telephone check-ins
- Patient Portal/Messaging platforms (e-Consults)
- HACs
  - HA Manufacturers for models/instructions on remote programming
  - Remote Access
- Automated audiometry

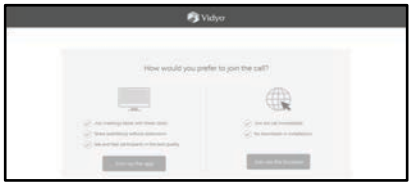
CONTINUED

VTC

- Select Platform
- Learn Formats
  - Smartphone app
  - Desktop app
  - Web-based
  - EHR integration

Rooms.vidyo/ABCXYZ





Technical Pre-Screening for VTC

- What device(s) does the patient have available?
  - Smartphone, laptop, Desktop
- What internet connectivity will the patient be using?
  - Wired Internet, Wi-Fi, Cellular Data (3G/4G)
  - Unlimited or metered
  - Connected/Working
  - Additional Cost
- Does the device to be used for VTC

have functional microphone and speaker?

ANTHC AFHCAN TELEHEALTH

download app in advance

Technical Troubleshooting

- Turn on/off
- Change web browser
- Unplug and re-plug back in
- Check volume
- Check microphone and speaker settings
- Confirm Internet connection
- Try different device if possible

ANTHC AFHCAN TELEHEALTH

Hearing Testing

- Smartphone app
  - Apple- uHear, Mimi, Hearing Test and Ear Age Test
  - Android- Hearing Test
  - Wired headphones-preferably that come with phone
  - Screenshot/PDF results (portal/email messaging)
- Combine with intake assessments and VTC for case history, walking through hearing test, counseling, management plan

Hearing Testing

- Home Hearing Test or iHear
  - Inexpensive device to be used with desktop or laptop
  - Calibrated Headphones

Hearing Testing

- Mobile Audiometry
  - HearScreen/Hear Test
  - KUDUwave
- Combine with intake assessments and VTC for case history, walking through hearing test, counseling, management plan

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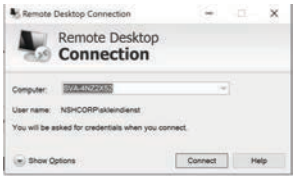
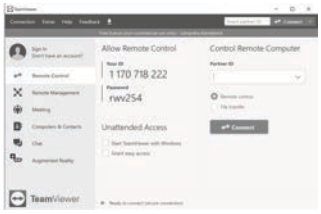
Remote Access

- Remote Desktop Connection
- TeamViewer
- Freeconferencecall.com





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Steps for Building Telehealth Services

- Step 1: Assessment
  - Clinical Need
  - Market Potential
- Step 2: Develop the Model & Plan
  - who, what, when, where, how
- Step 3: Train Personnel
- Step 4: Implement the Solution
  - Implement and monitor

Q9

CONTINUED

Key Components for Telehealth Services

- Appropriate equipment
  - M-health or mobile with universal and user-friendly interface
  - EHR Integration
- Key identification of personnel
  - Buy-in & relationship (team!)
- Initial and on-going training

Q8

Take-aways

- Well-designed Telehealth Models
  - Excellent continuity of care & connected care
  - Accurate and timely diagnosis and management
  - Reduced healthcare cost

Q10

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Questions/Contact

- skleindienst@nshcorp.org
- sjrobler@gmail.com
- 907-434-0433 (call/text)

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