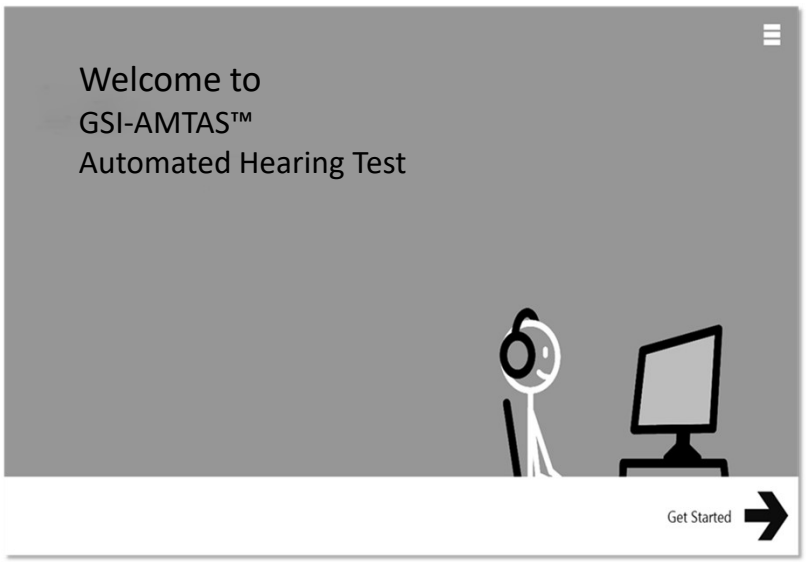

Learning Outcomes

- Upon completion of this session, the participant will be able describe the audiometric tests included with AMTAS.
- Upon completion of this session, the participant will be able to define 3 quality indicators used for determining the reliability of the AMTAS exam.
- Upon completion of this session, the participant will be able to describe 3 ways AMTAS can be utilized in an audiology practice.

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Agenda

0-5 Minutes	Introduction; Overview of AMTAS
5-25 Minutes	Why Automated Audiometry
25-55 Minutes	How to implement AMTAS
55-60 Minutes	Summary; Q and A

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GSI AMTAS – Overview

Automated **M**ethod for **T**esting **A**uditory **S**ensitivity

- Software program – works with GSI audiometers
- Self administered automated test for obtaining a diagnostic or screening audiogram
- Patented algorithms ensure quality and reliability of evaluation.

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GSI AMTAS - Overview

- Reporting Includes:
  - AMTAS-pure tone air and bone with masking, speech with masking (SRT + WRS)
  - AMCLASS-classification of audiometric findings
  - QUALIND-overall reliability plus data quality indicators
  - REPORT-audiometric + patient

5

Why Automated Audiometry?

6

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The Crisis Coming in Audiology. Barry Freeman, Audiology Today Nov/Dec 2009

"A shortfall in the number of audiologists is predicted to occur in the not-so-distant future. If we do not address this impending crisis, any gaps in care will be filled by alternatives outside the profession."

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Incidence of Hearing Loss

- World Health Organization, March 2015
  - 360 million people
    - 328 million Adults and 32 million children
  - 1/3 of people over 65 have hearing loss
- US Department of Health and Human Services
  - About 2 to 3 out of every 1,000 children
  - 30 million aged 12 years or older has hearing loss

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"Demand for Audiology Services: 30 Year Projection and Impact on Academic Programs" I. Windmill & B. Freeman, JAA 2013; 24, 407-413

- About 16,000 licensed audiologists
  - 20 % do not impact/participate in patient care.
  - Of the remaining 12,800, only 11,200 practice full time
  - About 600 Audiologist graduate each year (estimated that 40% never enter the field)
  - 400 retire each year

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Trends

- Fewer students entering the profession than the projected retirements of active audiologists
- The audiology profession will have little or no growth
- There will be an increase in demand for hearing health care services

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Solution for demand

- Number of audiologists must be increased
- Increase productivity and efficiency
- Increase avenues of access to Audiologists

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Academy of Audiology

- 2010, Audiology Assistant position statement
  - "Audiology is poised to experience an expansion in need for audiologic services. The appropriate use of assistants positions the profession to meet the expanding needs for patient care in a cost-effective manner, without compromising patient care."
- Purpose of the audiologist's assistant:
  - Improve access to audiologists
  - Increase productivity
  - Reduce costs

Currently, at least 20 states regulate audiologist's assistants

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ASHA website

- Audiology assistants
  - improve access to patient care
  - increase productivity
  - reduce costs
- Teleaudiology Clinical Technicians (TCTs)
  - Provide patient/equipment interface support from a site located at a distance from the actual patient testing site.
  - TCTs are primarily used by the Veterans Administration

13

The Role of Audiology Assistants in the Clinical Setting – Research Project – Joseph Duran, May 2002

- E-mail survey audiologists (118) and otolaryngologists (16)

- Results:
  - Agree on which tasks are appropriate for audiology assistants
  - Audiologist feel audiology assistants may be a threat to the profession of audiology whereas otolaryngologists do not.
  - Majority feel that assistants could help reduce audiologists' current duties
  - 75%of otolaryngologists agreed that assistants could help reduce the current backlog compared to 42% of audiologists.

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Why Automated Audiometry?

Can an automated test be trusted…

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AMTAS – Automated Method for Testing Auditory Sensitivity

- Methodology and validity in process for several years
  - Multiple published studies
- Developed by Dr. Robert Margolis after commission from the VA

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AMTAS: Automated method for testing auditory sensitivity: Validation studies, International Journal of Audiology, 2010, 49: 185-194

- Inter-tester Differences for Manual Audiometry
- AMTAS Manual Threshold Comparison
- Inter-subject Variability with Bone Conductor Placement

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Study 1-Inter-tester Differences for Manual Audiometry

- 3 sites; 6 patients (included normal and sensorineural hearing loss) tested by 2 audiologists (with at least 10 years of experience)
  - Air-conduction thresholds absolute differences ranged from 2.4 to 6.3 dB. The overall mean absolute difference for all frequencies was 4.1 dB, with a 95% confidence interval of 2.3 to 6.0 dB.
  - For bone-conduction thresholds, mean absolute difference for frequencies tested, excluding 250 Hz, was 5.4 dB, with a 95% confidence interval of 2.9 to 7.9 dB.

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Study 2 – AMTAS Manual Threshold Comparison

- 30 subjects (5 normal hearing, 25 hearing impaired) were tested with AMTAS and manual audiometry
- Air-conduction absolute differences (AMTAS-Manual), ranged from 3.0 to 4.5 dB with mean absolute difference 3.6 dB.
- Bone-conduction thresholds (AMTAS-Manual), ranged from 7.4 to 8.1 dB with mean absolute difference of 7.7 dB. (Differences attributed to forehead vs mastoid placement and calibration)

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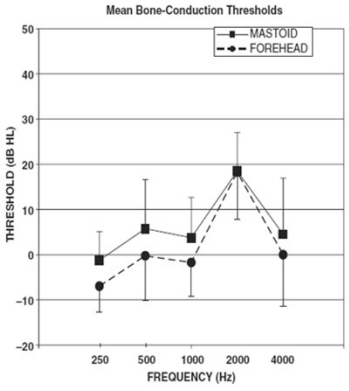
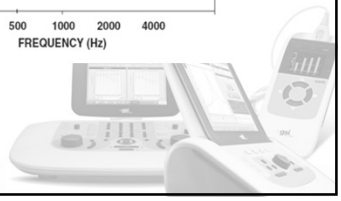
Study 3 – Intersubject variability with Bone Conductor placement

- 5 female and 5 male subjects with normal hearing
- Similar variability with both sites





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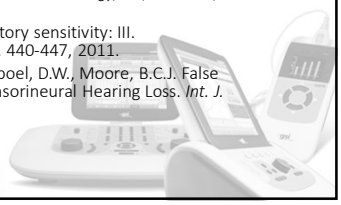
AMTAS Publications

- Margolis, R.H. Automated Audiometry – Progress or Pariah? Audiology Online (www.audiologyonline.com). January 17, 2005.
- Margolis, R.H. Automated Audiometry: Progress or Pariah. Audiology Today 17:21, 2005.
- Margolis, R.H., Saly, G., Le, C., Laurence, J. Qualind™: A Method for Assessing the Accuracy of Automated Tests. J. Amer. Acad. Audiol., 18, 78-89, 2007.
- Margolis, R.H., Saly, G.S. Toward a standard description of hearing loss. Int. J. Audiology 46, 746-758, 2007.
- Margolis, R.H., Morgan, D.E. The Value of Automated Audiometry. Insights in Practice for Clinical Audiology, January 2008.
- Margolis, R.H., Saly, G.L. Prevalence of hearing loss types in a clinical population. Ear and Hearing, 29, 524-532, 2008.
- Margolis, R.H., Saly, G.L. Toward a standard description of hearing loss. Int. J. Audiology, 46, 746-758, 2007.
- Margolis, R.H., Saly, G.L. Asymmetrical Hearing Loss: Definition, Validation, Prevalence. Otology & Neurotology, 29, 422-431, 2008.
- Margolis, R.H., Morgan D.E. Automated Pure-Tone Audiometry – An Analysis of Capacity, Need, and Benefit. Amer. J. of Audiology, 17, 109-113, 2008.
- Margolis, R.H., Glasberg, B.R., Creeke, S., Moore, B.C.J. AMTAS – Automated Method for Testing Auditory Sensitivity: Validation Studies. Int. J. Audiology,49, 185-194, 2010.
- Margolis, R.H., Frisina, R., Walton, J.P. (2011). Automated method for testing auditory sensitivity: II. Air Conduction Audiograms in Children and Adults. *Int J Audiology,* 50, 434-439, 2011.
- Margolis, R.H., Moore, B.C.J. Automated method for testing auditory sensitivity: III. Sensorineural hearing loss and air-bone gaps. *Int J Audiology,* 50, 440-447, 2011.
- Margolis, R.H., Eikelboom, R.H., Johnson, C., Ginter, S.M., Swanepoel, D.W., Moore, B.C.J. False Air-Bone Gaps at 4 kHz in Listeners with Normal Hearing and Sensorineural Hearing Loss. *Int. J. Audiology* 52:526-532, 2013.



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How to Implement AMTAS

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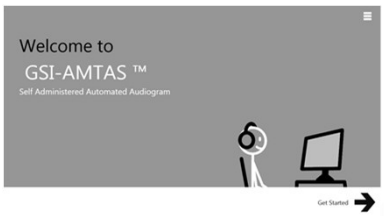
Load AMTAS onto a compatible PC



- CPU: 2.0 GHz, Intel i5 (dual or quad core) or better
- RAM: 4 GB
- Hard Disk: 500 GB or larger
- USB Ports: 4
- Display: 19" or larger,
- Resolution: 1366 x 768 minimum
- Touch screen or mouse/trackball
- CD-ROM Drive or USB for software installation
- Network LAN Card (if connecting to database via a network)

Supported Operating Systems

Microsoft Windows® 10 Pro
Microsoft Windows® 8.1 Pro
Microsoft Windows® 7 Professional

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Connect GSI Audiometer to AMTAS PC

- A/B cable between GSI Audiometer and PC
- Connect the audio out port on the PC to the external in port (EXT A+B) on the GSI Audiometer using a 3.5 mm stereo audio cable.

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GSI AMTAS Pro Configuration

The main Config App screen contains two main sections, and a menu bar at the bottom

- Test Options
- General Options

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Test Options: Screening Configuration

- Frequency determines which pure tones are included (minimum of 3)
- Intensity determines if the output level for the test is at 20 or 25 dB HL
- Pass Criteria section determines the number of presented frequencies where a response is required in order to pass

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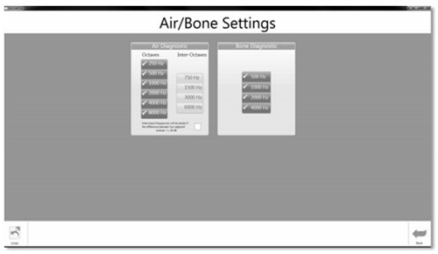
Test Options: Air / Bone Configuration

- The octave frequencies are always tested and not configurable.
- The inter-octave frequencies may be configured by selecting the desired frequencies. When the box is checked, they are only tested when the difference between the adjacent octaves are 20 dB or greater.
- If the box is not checked the selected inter-octave frequencies will always be tested.



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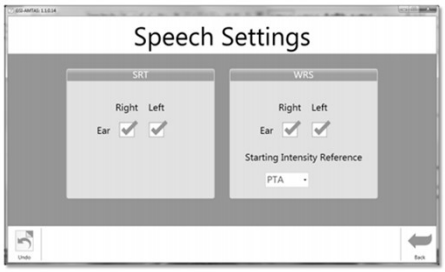
Speech Configuration

The options for the starting intensity for WRS

- SRT (speech recognition threshold),
- PTA (pure tone average)
- Fixedand Fixed.



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General Options

- Determines the required fields for the patient information entry
- Determines the fields that are included in the report, if and where reports are generated and stored
- Provides an option to add an image (logo) to the report.

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Patient Set UP – Bone Oscillator Placement

- Forehead placement.
- AMBAND

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Patient Set Up – Headphone Placement

- Circum-aural headphones
- HDA200 or DD450

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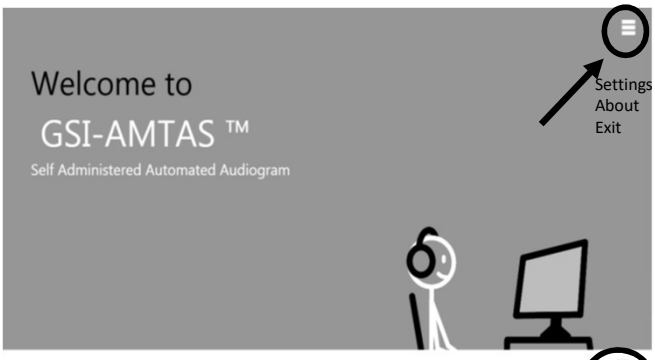

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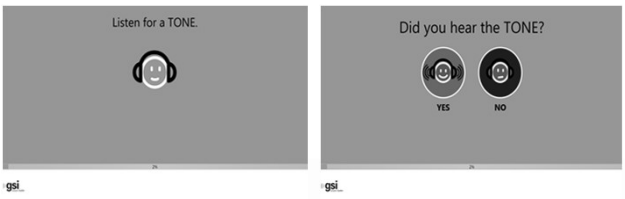
Simple Instructions

Pure Tone (AMTAS)



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Pure Tone Average (PTA)

- The average of the threshold for 500 Hz, 1000 Hz and 2000 Hz.
- The PTA is not calculated if more than one of the frequencies is a No Response (NR).
- If a single frequency is a No Response, then the PTA is calculated from the average of the 2 frequencies with a response.
- If there is a difference of 20 dB or greater between any 2 of the 3 frequencies then the PTA is calculated as the average of the best 2 frequencies.

Speech- Utilizes forced choice for SRT and WRS

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Speech Notes:

- Closed Set
- Spondee's for SRT; 25 Word List NU-6
- SRT or PTA selected at WRS, initial presentation level + 22dB, Discrim > 88% will increase to + 28 dB
- Speech WRS testing will not occur if:
  - SRT value > 68 dB
  - PTA value > 68 dB
  - Fixed value > 80 dB

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Thank you for completing the test.
Press the button below to conclude the test

Finish

* Contact your administrator

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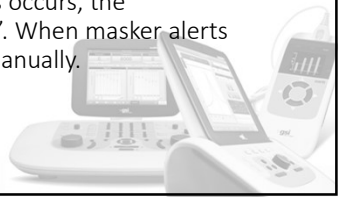
Testing Notes - Masking

- For pure tone air conduction testing, narrow band masking noise is presented to the non-test ear at –20 dB relative to the stimulus level in all cases.
- For bone conduction testing, narrow band masking noise is presented to the non-test ear at the same level as the stimulus level.
- For Speech testing, speech noise masking is presented to the non-test ear at –20 dB relative to the word level.
- When the test is completed, an analysis is performed of masker levels and thresholds of both ears to determine if overmasking or undermasking may have occurred. When this occurs, the thresholds are identified with "masker alerts". When masker alerts occur, those thresholds should be retested manually.



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Testing Notes – "Time Out"

- If the patient does not respond within 10 seconds, a warning message will be presented to the patient and a timeout occurs. If three timeouts occur at any time during the pure tone testing, the application will end the test and proceed to the Finish screen.
- A timeout during speech test is treated as an incorrect response. For the spondee test that would result in raising the level which will eventually hit the max and abort if there are no correct responses.

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Testing completed…Now what?

Interpretation

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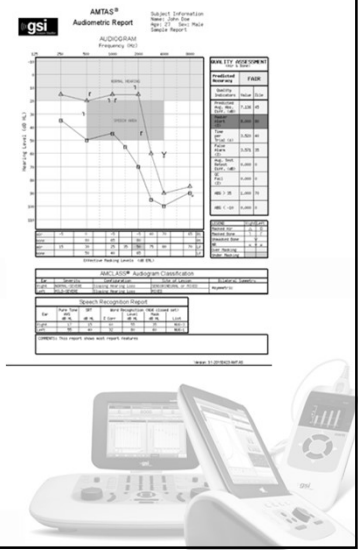
Automated Report

- Patient Information
- Audiogram
- Audiogram Symbol Legend
- Masking Level Table
- Quality Assessment Table
- Audiogram Classification Table
- Speech Recognition Table
- Comments



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Qualind™: A Method for Assessing the Accuracy of Automated Tests. Margolis, et al,2007, JAAA, 18: 78-89.

- Patented method for determining the accuracy of a test results
- Data was collected at three sites from a wide range of settings, patient demographics, and hearing loss characteristics.
- Large subject sample (n = 120), a strong relationship was found between predicted and measured accuracy.
- Method may be useful for automated test procedures when skilled professionals are not available to provide quality assurance.

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9 Quality Indicators (Qualind)

	QUALITY ASSESSMENT (Air & Bone)		
①	**Predicted Accuracy**	**GOOD**	
	Quality Indicators	Value	Zile
②	Predicted Avg. Abs. Diff. (dB)	5.287	0
③	Masker Alert (Z)	0.000	0
④	Time per Trial (S)	2.698	0
⑤	False Alarm (Z)	3.846	35
⑥	Avg. Test Retest Diff. (dB)	5.000	46
⑦	QC Fail (Z)	0.000	0
⑧	ABG > 35	0.000	0
⑨	ABG < -10	0.000	0

LEGEND	Right	Left
Masked Air	△	□
Masked Bone	⌐	[

- **Predicted Accuracy** (Overall Quality -Good, Fair, Poor)
- **Predicted Average Absolute Difference** –Difference between automated and manual thresholds
- **Masker Alerts**-thresholds where masking may have been too high or low
- **Time per Trial** - average time from stimulus to patient response
- **False Alarm Rate** – number of times patient responded with no stimulus presented divided by number of trials when no stim present
- **Average Test-Retest Difference** – average difference between 1 KHz test and retest in right and left hear
- **Quality Check Fail Rate** – number of times patient did not respond to stimulus above threshold divided by the number of measured thresholds
- **Number of Air / Bone Gap > 35 dB** – number of air bone gaps that exceed 35 dB
- **Number of Air / Bone Gap < -10 dB** – number of air bone gaps that are less than 10db

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9 Quality Indicators (Qualind)

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LEGEND	Right	Left
Masked Air	△	□
Masked Bone	⌐	[

- **Predicted Accuracy** (Overall Quality - Good, Fair, Poor)
  - "reliability" judgment found on audiogram forms assumes that a skilled audiologist can observe certain patient behaviors and characteristics that predict accuracy.

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9 Quality Indicators (Qualind)

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①	**Predicted Accuracy**	**GOOD**	
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LEGEND	Right	Left
Masked Air	△	□
Masked Bone	[	]

- **Predicted Average Absolute Difference** –Difference between automated and manual thresholds
- Derived from study 2 data
- Helps establish confidence in the patient responses and accuracy of thresholds.

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9 Quality Indicators (Qualind)

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LEGEND	Right	Left
Masked Air	△	□
Masked Bone	[	]

- **False Alarm Rate**
  - Catch trials are presented randomly throughout the test to allow a quantitative measurement of false-alarm rate.
  - Patients can get into a “rhythm”
  - Software delivers a message designed to keep them on task

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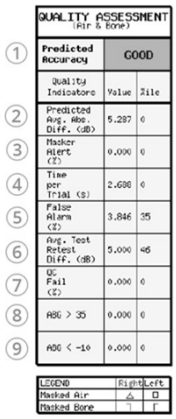
9 Quality Indicators (Qualind)



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9	ABG < -10	0.000	0

LEGEND	Right	Left
Masked Air	△	□
Masked Bone	[	]

- **Quality Control Fail Rate**
  - number of times patient did not respond to stimulus above threshold divided by the number of measured thresholds
  - QC check is performed after each threshold determination by presenting a stimulus with a higher intensity than the threshold level.
  - A "No" response to that stimulus is a "Quality Check Fail."

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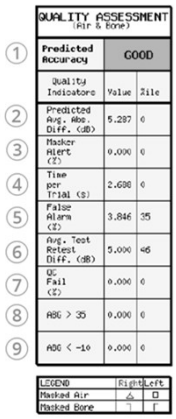
9 Quality Indicators (Qualind)



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- **Predicted Accuracy** (Overall Quality -Good, Fair, Poor)
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Audiogram Classification (AMCLASS)

- Audiogram is given three descriptive categories based on
  - Configuration: Normal, Flat, Sloping Hearing Loss, Rising, Trough, Peaked, and other
  - Severity: Normal, Mild, Moderate, Severe, Profound
  - Site of Lesion: Conductive, Sensory, Mixed
- Audiogram is analyzed for interaural asymmetry.

AMCLASS® Audiogram Classification

Ear	Severity	Configuration	Site of Lesion	Bilateral Symmetry
Right	MODERATE	Flat Hearing Loss	MIXED	Symmetric
Left	MODERATE	Flat Hearing Loss	MIXED	

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Interpretation

- Must be done by an audiologist
- Next step needs to be determined by using Qualind, and AMCLASS
  - Middle Ear analysis
  - OAE's
  - QuickSIN / BKB-SIN
  - Hearing Aid Evaluation
  - Counseling

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Data Management

Reporting / GSI Suite / Noah

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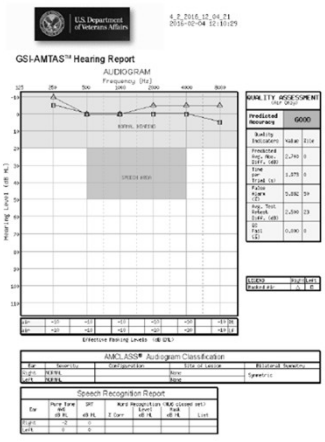
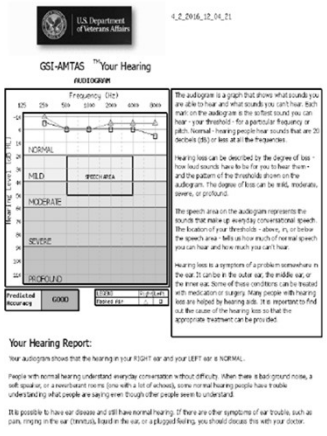
Reporting Options

Audiometric



Patient



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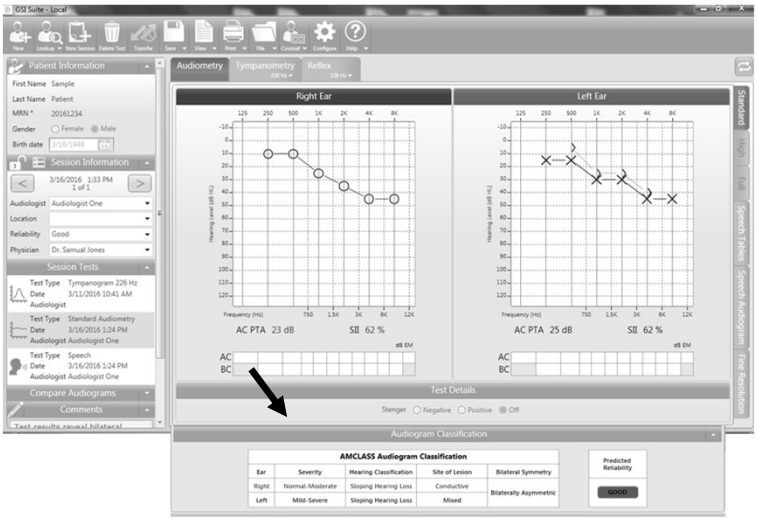
Data Transfer

- AMTAS session data will be displayed with A_Date + Time. Click on that session.



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How does AMTAS fit with current practice?

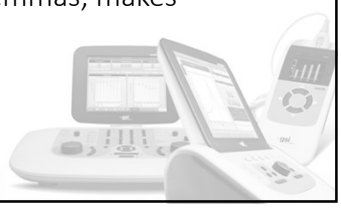
57

Does AMTAS replace the Audiologist?

NO!!

AMTAS is only a hearing test.

Audiologist counsels, fits hearing aids, performs other necessary tests like Tympanometry and OAE, re-tests the patient that is inconsistent, masking dilemmas, makes recommendations, etc.



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Advantages of Automation

- Optimize use of audiologists' time
- Standardization
- Quantitative quality assessment
- Decrease errors
- Decrease cost
- Increase access
- Telemedicine

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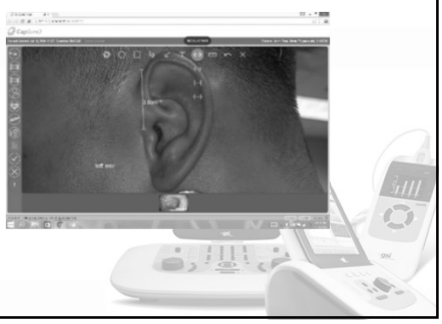
AMTAS – Current Use

- Developed by Dr. Robert Margolis after commission from the VA
  - Currently being used in a "store and forward" paradigm



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Other Uses

AMTAS frees up more time for

Walk-Ins

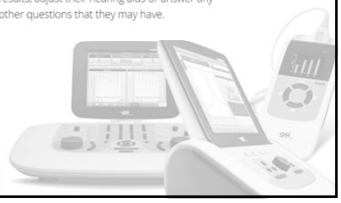
In a field that continues to get busier, AMTAS allows you to have one patient working through their audiogram, while you can attend to walk-ins and other patients that otherwise may have long waiting times.

Cleans and Checks

When your patient returns for an annual evaluation, you get them started on AMTAS while you clean and check their hearing aids.

Counseling

One patient can work on AMTAS, while you meet with another patient to counsel them on their test results, adjust their hearing aids or answer any other questions that they may have.



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What patients would Benefit?

- Originally designed for Veterans Administration (VA)
- Busy audiology departments
- Busy ENT practices with limited staff
- School systems
- Satellite clinics
- Community outreach

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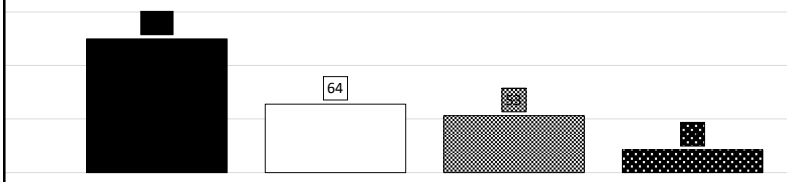
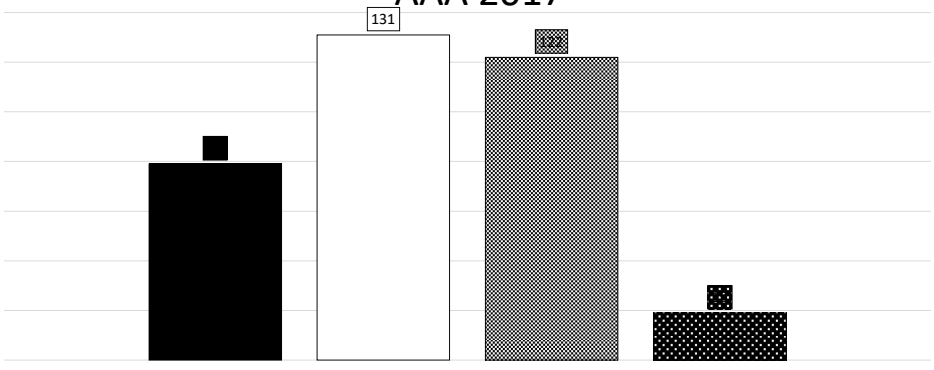
Q1. Where could you imagine AMTAS being used in your current position?
263 Surveyed
AAA 2017



Q2. What do you think are the benefits to implementing AMTAS in your facility?
351 Surveyed
AAA 2017



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Questions?

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