

Improving Diagnostic Audiology Reporting Using an Intelligent Document Processing Solution

EHDI Conference 2024

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Disclaimer

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Agenda

- Introductions
- Identification of the Problem
- Review of Artificial Intelligence and Machine Learning
- The Solution
- Projected Benefits
- Security and Cost
- How You Can Help
- Next Steps
- Questions

Introductions

Lura Daussat

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Kelly Dundon

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Amazon Web Services



Background

- 1 in 500 infants in the U.S. are born deaf or hard of hearing (DHH)
- EHDI programs rely on audiology providers to report results
- Reporting can be a time-consuming process
- Reporting can be a duplicative process



Pediatric diagnostic audiology reporting

Step 1

Document the visit
in the child's
health record

Yoda Ear Center • Audiology Department
123 Sesamee Lane, Galaxy City, DK 01427 #S31
754-139-8675 Fax 754-139-5309

Patient Name: Heather Hippo Medical Record #: 7536984126
Date of Birth: 9/15/2022 Age: 2 m.o.
Date of evaluation: 12/7/2022 Patient Type: Outpatient
Referring Provider: Robbins, Arizona, MD Audiologist: Lucy Brown, AuD

Audiology Evaluation: Non-Sedated Auditory Brainstem Response Evaluation (ABR)

HISTORY:

- Referred for an auditory brainstem evaluation following referred newborn hearing screen
- Birth Hospital: Seattle Grace Hospital
- Newborn Hearing Screening: Referred using OAEs, left ear x2 Passed right
- Paternal uncle, grandfather and great grandfather have a hearing loss
- Per mom, hearing loss is in the family
- Previous testing on 11/4/22 obtained present emissions right ear, absent cochlear emissions in the left ear
- AABR- pass right ear and refer left ear

IMPRESSIONS:

- **Right:** normal tympanogram with present cochlear emissions and ABR toneburst in the normal range for select tones.
- **Left:** normal tympanogram with absent cochlear emissions and ABR toneburst in the mild-moderate range consistent with a sensory hearing loss

RECOMMENDATIONS:

- Repeat ABR to further define hearing and to verify thresholds
- Otologic consultation with ENT secondary to newly identified hearing loss and to obtain medical clearance for amplification
- Hearing aid consultation, can be scheduled same day as repeat testing
- Referral to genetics to discuss/evaluate the potential for genetic etiology for hearing loss
- Recommended attending Yoda Ear Center's Deaf and Hard of Hearing (DHH) clinic which includes Audiology, ENT, Speech, Genetics
- DK State Department of Health's Early Hearing Detection & Intervention Program (EHDI) will be notified of these results

TEST RESULTS:

Otoscopy:
Right: Clear canal
Left: Clear canal

Middle Ear Studies: Tympanometry tested with a 1000 Hz probe tone
Right: Consistent with normal middle ear function
Left: Consistent with normal middle ear function

Cochlear Studies: Distortion Product Otoacoustic Emissions (DPOAEs): 2000-8000 Hz
Right: Present at tested frequencies
Left: Absent at tested frequencies
Present DPOAEs suggest good cochlear outer hair cell function and indicate hearing likely ranges from within normal limits to no worse than mild hearing loss in at least the frequencies assessed.
Absent or reduced DPOAEs suggests poor cochlear function and/or the presence of middle ear pathology, likely indicating a reduction in hearing thresholds at tested frequencies.

Auditory Brainstem Response (ABR): A single-channel montage (Fz - Aipsi), stimulus rate of 27.70 clicks per second, Blackman window, multiple recordings and insert earphones was used.
Threshold testing: ABR thresholds are generally closely correlated with behavioral hearing thresholds. It is important to corroborate findings with behavioral audiological testing as ABR is a measure of neural synchrony along the auditory pathway, not cortical auditory function.
Morphology and repeatability: good
Sleep state: good

Right:

Tonebursts (TB):
1000 Hz: 20 dB eHL (with +10 dB correction)
4000 Hz: 20 dB eHL

Left:

Tonebursts (TB):
1000 Hz: 20 dB eHL (with +10 dB correction)
2000 Hz: 40 dB eHL
4000 Hz: 30 dB eHL
8000Hz: no response at 60 dB , did not test at higher intensities

Neurodiagnostic Click: Recorded in response to rarefaction and condensation click stimuli with click stimulation at 60 dB eHL.

Right:

- Absolute and interpeak latencies: Within normal limits
- Wave V did not reverse with change in polarity, suggesting true neural response as opposed to auditory neuropathy spectrum disorder

Left:

- Absolute and interpeak latencies: Within normal limits
- Wave V did not reverse with change in polarity, suggesting true neural response as opposed to auditory neuropathy spectrum disorder

Thank you for allowing us to participate in care. If you have any questions or concerns, please feel free to contact me at 754-139-8675 or email me at lbrown@yodaearcenter.org.

Lucy Brown, AuD
Doctor of Audiology

Pediatric diagnostic audiology reporting

Step 2

Report results to EHDI

If reporting electronically:

- Login to EHDI-IS
- Search for child
- Enter results

If paper-based:

- Locate proper form
- Fill out form
- Fax/secure email form

The screenshot shows a web-based reporting interface for pediatric diagnostic audiology. At the top, there are fields for 'Child's Name', 'DOB', 'ClientID', and 'DiagnosticID 98505'. The form is divided into several sections:

- Appointment Information:** Includes fields for Date, Facility, Audiologist, and Phone, each with a red asterisk and 'Please enter' prompt.
- Completed Appointment Details:** Contains dropdown menus for 'Overall Findings' and 'Degree of Loss' (both marked as required), and input fields for 'Typanometry', 'OAE', and 'AABR'.
- Test(s) Performed:** A list of checkboxes for various tests: A-ABR, ABR-bone, ABR-click, ABR-toneburst, Acoustic reflex, ASSR, Behavioral, OAE, and Typanometry.
- Diagnostic Notes:** A large text area for notes, with a '+ Report' button and a 'View Report' button below it.
- Follow Up Recommendations:** A list of checkboxes for: Follow Up Appointment, Medical Evaluation Referral, Audiology Referral Out, Early Intervention Referral, Guide By Your Side Referral, CaCoon Referral, and No Follow Up Needed.
- Reason Not Performed:** A list of checkboxes for: Canceled, No Show, Medical Reasons, Moved out of State, Refused, Rescheduled, and Unable to contact.
- Rescheduled Date:** A date input field.
- Relevant Details:** A large text area for additional information.
- Medical Evaluation Referral To:** A field for 'Enter PCP or ENT name'.
- Audiology Referral To:** A field for 'Enter Audiology Facility'.

How can we improve pediatric diagnostic audiology reporting?

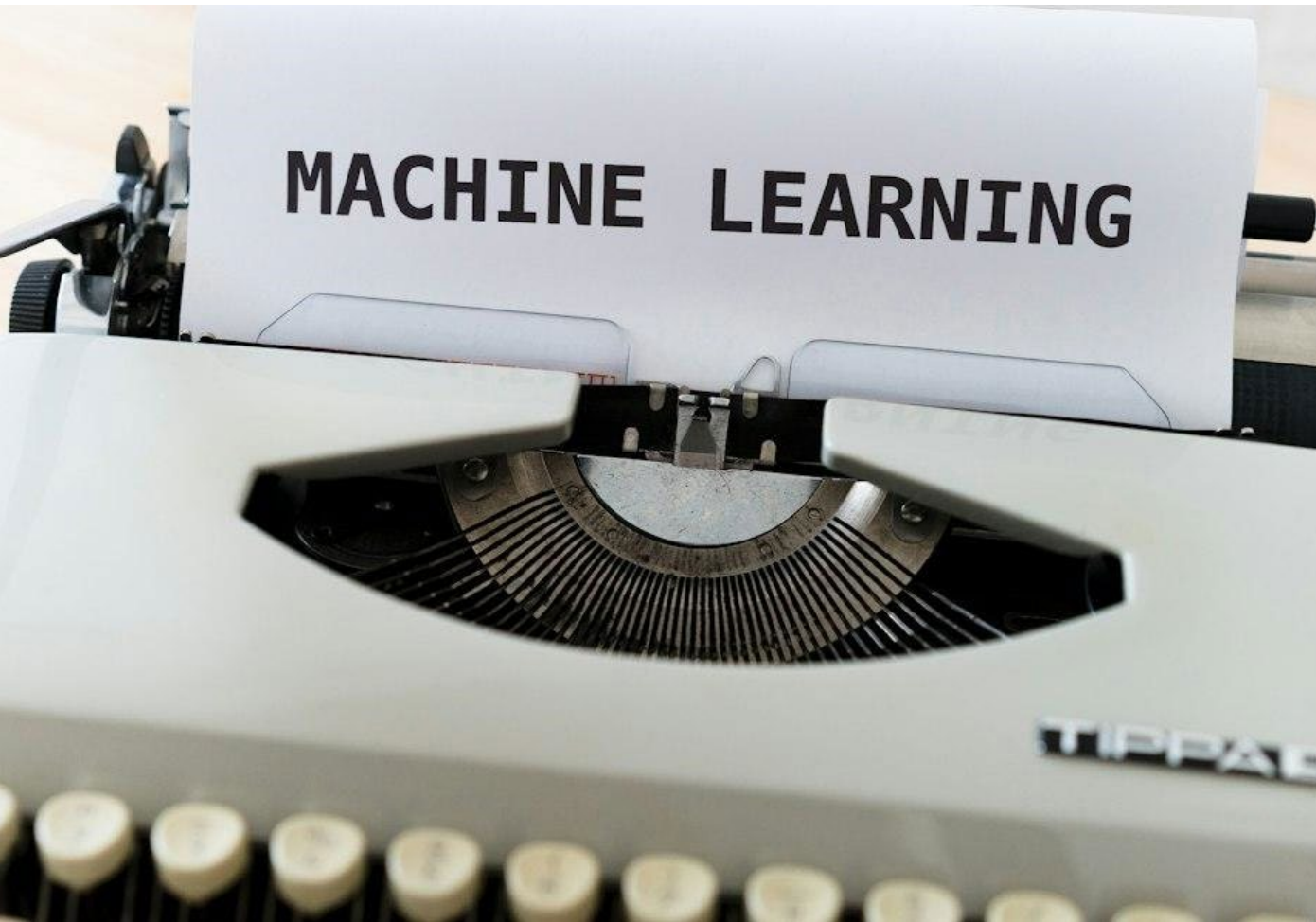


Explore the latest data science and information technology to mine clinical diagnostic reports and extract key concepts for public health reporting



“The term ‘artificial intelligence’ means a machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations or decisions influencing real or virtual environments.”

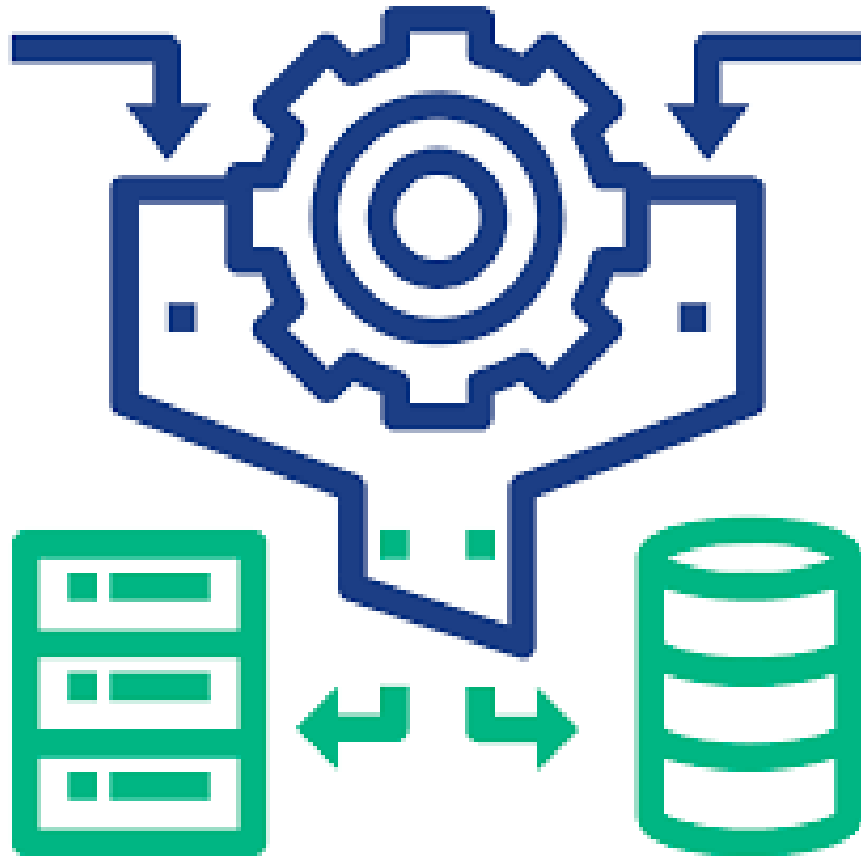
National Artificial Intelligence Act of 2020



“Machine learning (ML) is using computers to identify patterns in datasets and make predictions on what the computer learns from those patterns.”

ML is a specific type of AI

What is intelligent document processing?

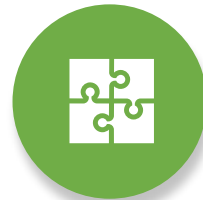


The use of advanced technologies, such as artificial intelligence (AI) and machine learning (ML), to extract meaningful information from structured, semi-structured and unstructured data contained in documents



The Challenge

Underreporting or delayed reporting to EMDI programs



The Solution

Intelligent document processing (IDP)



The Benefits

Efficient and timely reporting and interventional follow-up

Partners



PUBLIC HEALTH
INFORMATICS
— INSTITUTE



The Solution

QDOX Intelligent Document Processing



Extracted data elements

- Demographic details
 - Infant's name* and DOB*
- Diagnostic testing date
- Test results:
 - Type and severity of hearing loss for right ear
 - Type and severity of hearing loss for left ear
- Clinician details



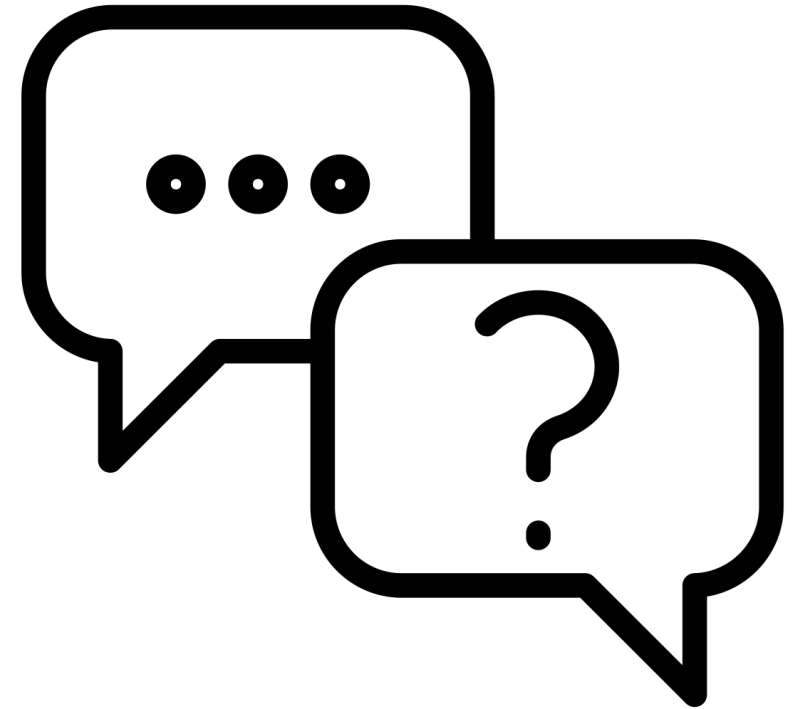
**PHI can be removed currently during the testing phase; all diagnostic audiology reports can be anonymized*

The Proposed Workflow



Common Questions

- Where can the solution be hosted?
 - An AWS environment hosted by your state IT
 - Hosted by a trusted 3rd party
- What are the costs to consider?
 - Licensing fees for the Quantiphi application
 - Management of the system
 - Pay as you go



Security, Governance, and Compliance

Your data are private

- AWS does not touch your data
- Only authorized users see and edit the data
- Data are encrypted in transit and in storage

Your data are secure

- Data maintained in a private network with isolated connections
- Audit trails allow you to see who accessed what information, and when
- Define alerts for unusual activity

Compliance with many standards

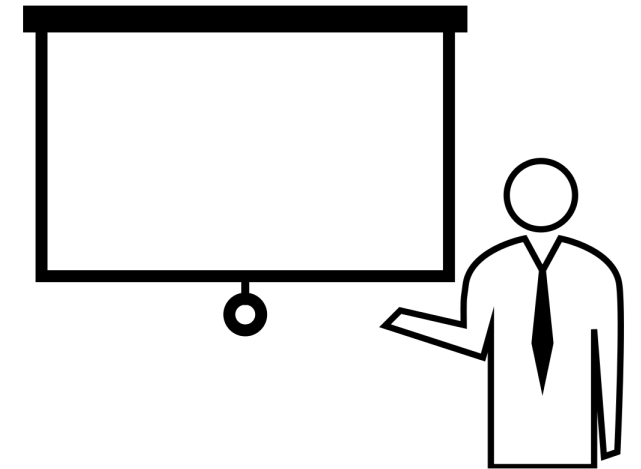


...and more



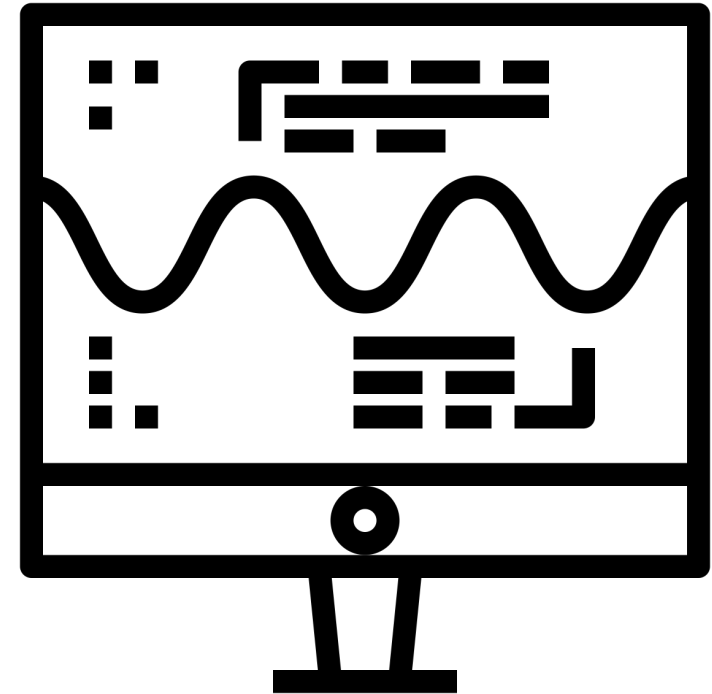
Projected Benefits

- Increased audiologist reporting to state EHDI programs by reducing reporting burden
- Decreased loss-to-documentation from screening to diagnosis
- Increased number of DHH children referred to appropriate intervention



Where are we now?

- Currently in the development phase
- Drafted evaluation questions
- Documented workflows



Quantiphi's Anonymizer

| Anonymize Data | | |
|----------------|--------------------------------|------------------------------|
| Entity Name | Detected Text | Anonymized Text |
| DATE_TIME | October 25, 2018 | 1997-03-18 |
| ADDRESS | 1600 Pennsylvania Ave Washingt | 866HeatherAvePaulfurt,NV9698 |
| PHONE | (202) 456-1111 | +1-466-306-178 |
| NAME | Teddy Roosevelt | Patrick Jordan |
| DATE_TIME | Oct 27, 1910 | 2000-05-22 |
| ADDRESS | 1900 Pennsylvania Ave | 969StokesAve |
| ADDRESS | Manhattan, NY | EastIL |



Demonstration of IDP for pediatric audiology

Quantiphi, CDC, PHII, and AWS

[link](#)

How can you help now?

- Contribute diagnostic reporting forms
- Connect with interested parties and identify project champions
- Connect with AWS and Quantiphi

We want your input!

Please use this QR code to answer some questions on AI/ML.

We appreciate you sharing your thoughts with us.



Questions?



Thank you!

phii.org

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