FROM COLORADO TO GUAM:
Infant Diagnostic Hearing Evaluations over the Internet*

Elaine Eclavea, M.Ed.
Guam EHDI
University of Guam - CEDDERS
Deborah Hayes, Ph.D.
Children’s Hospital Colorado
University of Colorado - Denver

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PURPOSE OF THIS PRESENTATION

- Describe the Guam Early Hearing Detection and Intervention Program (EHDI) - Eclavea
  - Explain how lack of infant diagnostic audiological evaluation (DAE) services prevented timely provision of hearing aids and enrollment in early intervention
- Present an internet-based solution for infant diagnostic audiological evaluations - Hayes
  - Identify technology needed for internet-based DAE
  - Explain advantages, disadvantages, and outcomes of internet-based DAE
- Describe how internet-based DAE has impacted the Guam EHDI program - Eclavea
Guam

- Hospitals
  - GMHA - 2500 Births a Year
  - US Naval Hospital
    - 500 births

- Saguamano Birthing Center
  - 500 births

2011 Live Births 3301
Initial Hearing Screening

Percent Screened at Initial Screen

<table>
<thead>
<tr>
<th></th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Screened</td>
<td>99%</td>
<td>99%</td>
<td>99%</td>
</tr>
<tr>
<td>Benchmark</td>
<td>95%</td>
<td>95%</td>
<td>95%</td>
</tr>
</tbody>
</table>
Out Patient Rescreens

Total Infants Failing Initial Screen

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Screened</th>
<th>Total FIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>3006</td>
<td>390</td>
</tr>
<tr>
<td>2009</td>
<td>2953</td>
<td>442</td>
</tr>
<tr>
<td>2010</td>
<td>2890</td>
<td>231</td>
</tr>
<tr>
<td>2011</td>
<td>2752</td>
<td>125</td>
</tr>
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</table>
Loss to Follow-up at DAE

Percent LFU at DAE

<table>
<thead>
<tr>
<th>Year</th>
<th>Percent LFU</th>
<th>Benchmark</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>7%</td>
<td>0%</td>
</tr>
<tr>
<td>2010</td>
<td>18%</td>
<td>0%</td>
</tr>
<tr>
<td>2011</td>
<td>43%</td>
<td>0%</td>
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</table>
Issues in Completing DAE

- Lack of Audiologist comfortable in testing newborns
  - Repeated AABR screens
- Equipment
- Parent refusal
  - Process taking too long
- Parents seeking testing off-island
- Lack of enrollment into early intervention programs
Referrals For Early Intervention

Table 3: Status of Infants Referred for DAE

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Referred for DAE</th>
<th>Total with Normal Hearing</th>
<th>Total with Hearing Loss</th>
<th>Total with DAE or subsequent rescreen before 3 Months</th>
<th>Total DAE via Teleaudiology</th>
<th>Total Receiving EI Services</th>
<th>Total Receiving EI Services with 6 Months</th>
<th>Total Pending DAE</th>
<th>Total Deceased</th>
<th>Total Relocating/Refusing Services</th>
<th>Total LFU</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>21</td>
<td>8</td>
<td>11</td>
<td>18</td>
<td>0</td>
<td>11</td>
<td>11</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2009</td>
<td>14</td>
<td>8</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2010</td>
<td>14</td>
<td>6</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2011</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
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Possible Solutions

- Find an audiologist on island or within the Pacific region
- Option of teleaudiology
Impact

- Babies the fail outpatient rescreen are tested prior to 2 months of age.
- Early Intervention Providers were trained and training is ongoing on how to prepare babies for the DAE
- Strong collaboration with Part C Early intervention
Impact

- Connection with the infants medical home
- Enrollment into early intervention
The concept of providing infant DAEs over the internet to babies in Guam emerged from a presentation and subsequent discussion with EHDI coordinators from the Pacific Rim including Guam, Palau, Federated States of Micronesia, Saipan, Commonwealth of Northern Mariana Islands.

Guam was selected as the pilot site because:
- Sufficient birthrate to ensure enough babies to test the concept
- Availability of organized screening and early intervention programs
- Adequacy of internet and travel services to facilitate communication and interaction
STEPS IN THE PROJECT

- Developing of a Memorandum of Understanding outlining each party’s responsibilities
- Visiting site of teleaudiology in Guam by Children’s Hospital Colorado staff
  - Evaluate test environment and equipment
  - Train Guam-based audiometrists
  - Develop procedures jointly
- Acquiring Guam audiology licensure
- Identifying HIPAA-compliant software for remote control of Guam diagnostic audiometric equipment and videoconferencing
- Testing/retesting software solutions
- Ensuring a successful first teleaudiology test
  - Scheduling a Children’s Colorado audiologist on Guam for “Go Live”
In Guam:
- Bio-logic® Navigator® PRO (NavPRO) for auditory brainstem response, otoacoustic emissions, auditory steady state response
- GSI TympStar and Interacoustics Titan for tympanometry and middle ear muscle reflexes
- Laptop for videoconferencing

In Colorado:
- Desktop PC for remote control operation of NavPRO
- Laptop for videoconferencing
Netop Remote Control software for audiologist in Colorado to “take control” of Guam NavPRO

- Colorado is “guest” and logs into Guam NavPRO through public IP address
- Guam is “host” and allows Colorado to take control of NavPRO
- No infant identifying information is transmitted during testing

Nefsis videoconferencing software

- Guam holds Nefsis videoconferencing license
- Colorado connects to videoconference established by Guam via secure website
First “Go Live” in Guam

Venerannda Leon Guerrero holds her infant prior to undergoing teleaudiology testing to determine whether or not her infant has a hearing loss. Technology enabled Dr. Ericka Schicke (on computer screen upper left) at Children’s Hospital-Colorado to operate the diagnostic audiological equipment remotely from Colorado, after Bobbie Maguadog (center), Department of Education audiometrist, and Dr. Susan Dreith (left), audiologist, Children’s Hospital-Colorado, prepared the parent and infant for testing on Guam. (Photo credit: University of Guam)

From ScienceDaily (Oct. 27, 2011)
TELEAUDIOLOGY RESULTS TO DATE

- 5 test sessions completed to date (March 12, 2012)
  - 4/5 infants received complete diagnostic assessment; 1 infant received partial ABR but did not sleep for remaining tests
    - Otoscopy (by Guam audiometrist)
    - Tympanometry
    - Otoacoustic emissions
    - Auditory brainstem response (air and bone conduction as needed)
    - Auditory steady state response (air and bone conduction as needed)
  - Diagnosis and recommendations provided to family by testing audiologist
  - Formal report generated by testing audiologist for family and primary medical provider
  - Audiological diagnosis facilitated referral for medical services for two infants
  - 2 additional infants scheduled for April 2012
CHALLENGES TO TELEAUDIOLOGY

- Identifying an appropriate test environment
- Identifying and training support personnel
- Scheduling appointments across time zones (16 hour difference between Colorado and Guam)
- Interruption of internet services during testing
- Measuring effectiveness of family counseling delivered by videoconferencing
- Integrating infant DAE services into full EHDI program to attain quality outcomes
- Sustaining services beyond pilot phase
WHAT WE HAVE LEARNED

- Infant diagnostic audiological evaluations can be effectively provided over the internet
- Site visit(s) is/are critical to success of teleaudiology
- Software solutions must meet contemporary standards for infant and family privacy and confidentiality
- Teleaudiology is optimally delivered within the context of comprehensive services for the infant or patient and family
- Teleaudiology can be a successful approach for providing services in rural and remote communities
COST OF THE PROJECT TO DATE ~ COLORADO

- Remote control software licenses $366
- Guam audiology licenses (N=2) $520
- Audiologist salary while in Guam $3,800
- Travel expenses for 2 visits to Guam $8,370
  (2 person on 1st visit; 1 person on 2nd)
- TOTAL $13,056

- Other costs; technical support (~40 hours), project leadership time (~80 hours), audiologist evaluation time via teleaudiology (2-3 hours/baby)
Blossoms on the “Flame Tree” in Guam