The Missing Link in Language Assessment for Children who are deaf or hard of hearing

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Longitudinal study: Number of children with hearing loss identified between 1997-2003

- 65-70% of all possible participants
  - Infants identified with hearing loss in Colorado
  - Born 1997 through 2003
- All birthing hospitals in Colorado established universal newborn hearing screening programs by 1999

Best Practice Matters

- Colorado was the first state to institute best practice guidelines for screening, audiologic diagnostic evaluations, amplification fitting, medical intervention and early intervention services before the publication of JCIH 2000.

Intervention Matters

- Systems development that assures screening by 1 month, diagnosis by 3 months, amplification within a month of diagnosis, early intervention services by 6 months
- First contact and early intervention follow-through is delivered by professionals with specialty knowledge and skills in deafness and hearing loss, parent-infant intervention and developmentally appropriate practices.

Intervention Matters

- Developmental monitoring every 6 months assures families that early intervention strategies have the intended outcomes. A state-wide consistent protocol allows identification of system strengths and weaknesses
- Over 95% of identified children are enrolled in the Colorado Home Intervention Program (state-wide home-based parent-infant intervention)
- Early intervention providers have regular and consistent in-service education through workshops, consultation, and direct observations

Intervention Matters

- Parent-to-parent leadership partners with early intervention providers at every step in the process. (Hands and Voices – Guide By Your Side)
- Parent surveys are used to monitor the quality of the program
- Intervention decisions are data-driven and efficacy based
- Professionals who are deaf and hard of hearing are infused at all levels of the system

Guiding Principles

- Bringing back the joy of parenthood that diagnosis of hearing loss impacted- focus on emotional availability of parent to child and child to parent
- Emotional-availability of parent-child dyads similar to hearing dyads
- Parental Stress levels have same distribution as norming population
- Conversational strategies re: turn-taking ratios are similar to hearing dyads

Conversational strategies

- Parents are taught strategies related to imitation of the child, self-repetition, and expansion.
- Data is coded from half-hour videotaped interactions of parent and child from birth through 7 years of age and results are provided to parents every six months from birth through 3 years and annually thereafter.

Study 1: 48 to 87 months (Baca, Yoshinaga-Itano & Sedey)

- N= 135 children with longitudinal data (3 or more assessments) from 48 to 87 months of age
  - Children with non-verbal cognitive development within the normal range
  - English-speaking families
  - Hearing parents

4 to 7 year old study

- Four assessment occasions: 48, 60, 72, 84 (+/- 3 months)
- Median age of identification: 3 months
- Median age of intervention start: 8 months

Children with severe to profound HL: 48 to 87 mo.

- N= 87 had severe to profound HL
  - Children with cochlear implants (N=49)
    - Age of ID by 6 months: 55%
    - Age of ID by 12 months: 86%
  - Children with hearing aids (N=35)
    - Age of ID by 6 months: 68.4%
    - Age of ID by 12 months: 76%
- N=48 had mild to moderate HL

DO INDIVIDUAL CHILD CHARACTERISTICS SYSTEMATICALLY DIFFERENTIATE THE LANGUAGE TRAJECTORIES IN YOUNG CHILDREN WITH HEARING LOSS?

Rosalinda Baca, 2009

Intercept & Slope Definitions

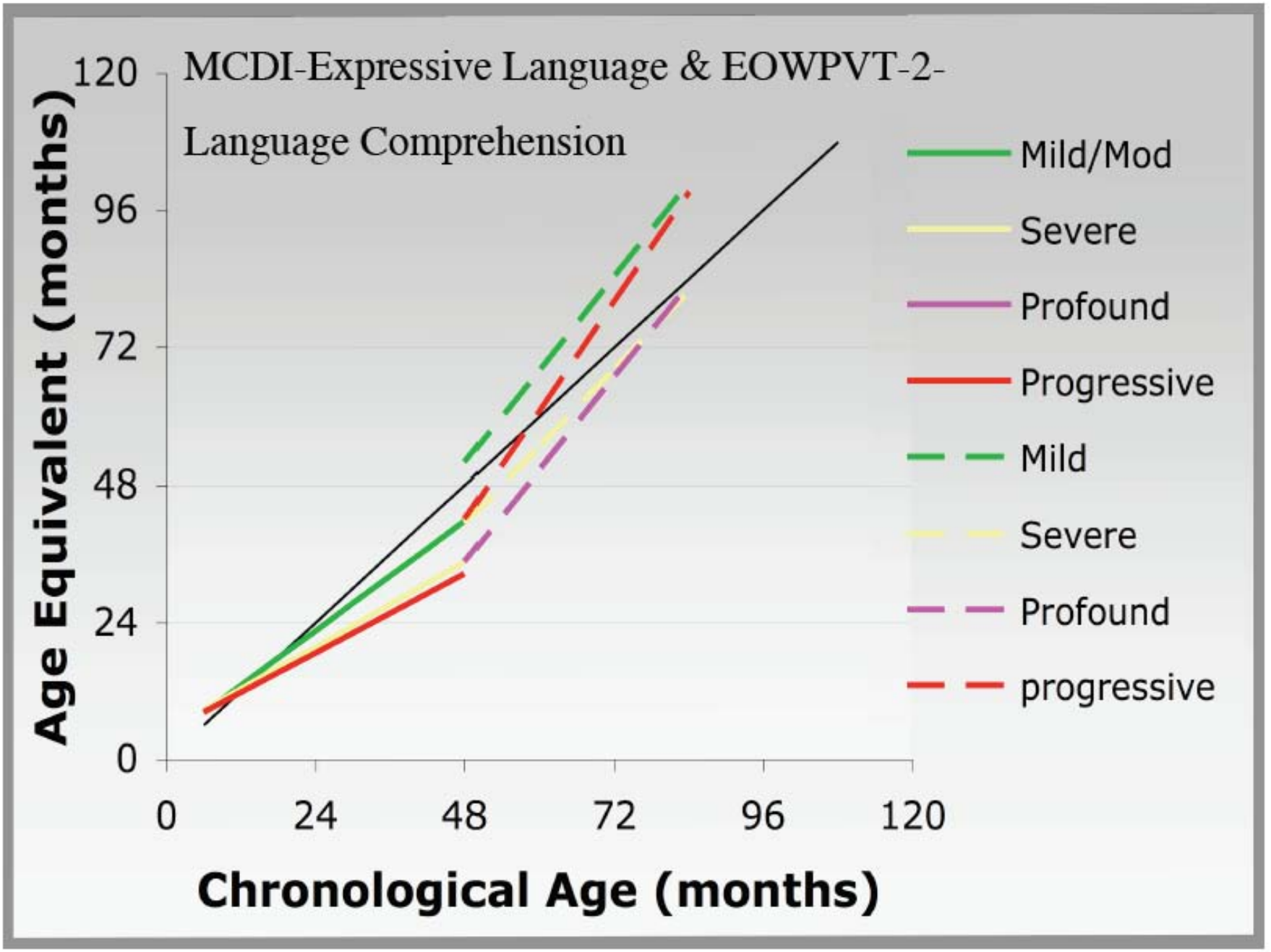
- Intercept: Language age equivalent at 84 months on EOWPVT-3
- Slope: Rate of language growth on EOWPVT-3

Final HLM Model

- EOWPVT
  - – Explained intercept 37% (language at 84 months) & 39% in slope
  - Non verbal cognitive development
  - Degree of Hearing Loss
  - Age of Identification
  - Maternal Level of Education

Final EOWPVT-3 model – 4 to 7 years

- INTERCEPT-prediction of vocabulary development at 84 months
  - – ***Severe, profound, or progressive HL (15, 31%)***
  - – Age ID by 3 months
  - – NVCQ
  - – M. EDU
- SLOPE: - prediction of rate of growth
  - – Excluded NVCQ


MCDI-Expressive Language & EOWPVT-2-
Language Comprehension
Age Equivalent (months)
120
96
72
48
24
0
0
24
48
72
96
120
Chronological Age (months)
Mild/Mod
Severe
Profound
Progressive
Mild
Severe
Profound
progressive

UNCHANGEABLE CHARACTERISTICS: DEGREE OF HEARING LOSS, NON-VERBAL COGNITIVE DEVELOPMENT, AGE OF IDENTIFICATION, MATERNAL LEVEL OF EDUCATION

Yoshinaga-Itano, Baca & Sedey, 2009

Degree of HL: HA/ CI comparison

- Children with HAs – N= 38
  - 60.5% had severe HL
  - 7.9% had profound HL
  - 31.6% had progressive HL
- Children with CIs – N= 49
  - 16.3% had severe HL
  - 34.7% had profound HL
  - 34.7% had progressive HL

Maternal Level of Education: HA/CI comparison

- Children with HAs
  - 5.3% - Less than 12 years
  - 44.7% - 12 years (high school diploma)
  - 13.5% - 13 – 15 years (some post-secondary)
  - 36.8% - 16 years or greater (Bachelors +)
- Children with CIs
  - 8.2% - Less than 12 years
  - 26.5% - 12 years
  - 18.4 - 13 – 15 years
  - 46.9% - 16 + years

Intercept & Slope

- EOWPVT III Slope – Rate of Language Development
  - HA = 1.15 CI = 1.33
- EOWPVT III Intercept – Language Age at 84 months
  - HA = 73.8 months CI = 80 months

Final HLM Model

- EOWPVT
- Explained intercept – language age at 84 months: 37%
- Explained slope – rate of language development from 4 to 7 years: 39%

Model A

- Age of Identification
- Degree of Hearing Loss
- Non-verbal cognitive Quotient

- Mothers level of education and Number of Parent Words not included in Model A
- Model A accounts for 26.3% of the variance of the intercept- language age at 84 months on the EOWPVT
- Model A accounts for 33.5% of the variance of the slope – rate of language from 4 to 7 years of age.

Model B1 – Add High Maternal Level of Education to Model A

- Number of Parent Words not included

- Model B1 accounts for an additional 10.81% of the variance of the intercept and 7.48% of the variance of the slope
- Total Variance accounted for by Model A + Model B1
- 37.14% of the intercept
- 40.98% of the slope

Model B2 – Adds Total Number of Parental Words to Model A

- High Maternal Level of Education not included in Model B2
- Model B2 accounts for an additional 11.07% of the intercept and 14.04% of the slope

- Total variance accounted for by Model A + Model B2
- 37.5% of the intercept
- 47.54% of the slope

Relationship Maternal Level of Education and Number of Parental Words

- Amount of variance accounted for by the variables High Maternal Level of Education and Number of Parental Words spoken to the Child appear to be accounting for overlapping variance
- Number of Parental Words accounts for more variance

Model C= Model A + Maternal Level of Education + Number of Parental Words

- Accounts for 16.38% more variance of the intercept and 13.71% of the slope than Model A alone

- Total variance accounted for by Model C
- 42.7% of the intercept (language at 84 months)
- 47.1% of the slope (rate of language development)

Maternal level of education and other socio-economic factors- birth through 36 months

- Colorado studies indicate that Maternal level of education does not predict language outcomes of children with hearing loss – birth through 36 months

Maternal level of education is more accurately measured as number of Parental Words at 84 months

- Maternal level of education emerges as a significant predictor of language outcome at 84 months of age
- Number of parental utterances in the birth through 48 month age group is a significant predictor of language outcome at 84 months of age and rate of language growth from 4 to 7 years of age

- One hypothesis is that in parent- infant intervention, parent-child conversational strategies are emphasized and after 36 months of age – parent education ceases – it may be difficult for parents to continue these strategies without additional support
- huge differences between parents with less than high school and parents with college education or greater are evident

EOWPVT differences by Maternal Level of Educational Level (Baca, 2009)

- 35 month language age difference at 84 months of age between group with mean age level for mothers with educational level less than 12 years (HS grad) as compared to group for mothers with educational level 16 years or greater (college)

- 55.75 months versus 91.33 months

Considerations for use with Deaf/Hard of Hearing infants/Children

- Automatic Calculations
- Percentile Ranking and Standard Scores
  - Adult Word Count – How many words are directed to the child and how loud are they?
  - Child Vocalizations – how does the amount of adult words impact the amount of child vocalizations – with recordings can also look at quality of adult language
  - Conversational Turns - can assure that an adult dominance doesn't happen – quantity with sufficient turn-taking
  - Estimated MLU – for children with hearing loss – is likely highly related to MLU
  - AVA (Automatic Vocalization Analysis) Developmental Age- diversity of the phonology of the child's utterance
  - % time in Silence, Noise, Distant Language, Meaningful Language
  - Developmental Snapshot – should be used only in conjunction with other assessments

Reliability of scores

- Average of three recordings of 16 hours each day resulted in stability of scores for normal hearing dyads– i.e. avoiding the Hawthorne effect
- Reliability not yet demonstrated with deaf and hard of hearing children
  - Could hypothesize that reliability is better because families and children are accustomed to video and audio recordings
  - In our research laboratory we are currently collecting data for check on reliability
- Interactor/s would need to be similar, i.e. parents with multiple recordings versus day care or school
  - Language levels can differ dramatically for the same child, in the same week in different language environments –
  - i.e. with parents or in daycare

How Language was defined by Infoture for Developmental Snapshot

- Preschool Language Scale –expressive language in early years is highly loaded with symbolic gesture - children with hearing loss typically have no deficits in their development of symbolic gesture and this provide spuriously high language scores in the early years
- REEL-3 (highly auditory loaded) would yield a significantly lower language score for children using visual communication
- Child Development Inventory formerly Minnesota
- Developmental Snapshot scores should be used in conjunction with other language measures

Norms for typically developing children

The computer counts as meaningful sounds that are 35 dB HL or greater.

With children who have hearing loss with appropriate amplification, we typically use 50 dB HL as meaningful volume.

It is possible that LENA may overestimate the number of words that are auditorially accessible for a child with hearing loss

dB HL versus dB SPL

With the research software, it is possible to determine the dB HL levels of each utterance and to determine the percentage of vocalizations that are less than a 50 dB HL loudness level.

dB in the research software is reported in SPL and must be converted

Ability to determine dB SPL levels

- The research software can provide information about the dB SPL levels of each adult word counted in the recordings.
- For children wearing amplification technology, intensity levels determined to be "meaningful" for hearing children may not be "meaningful" for children with hearing loss because they are too soft. This could reduce the percentile rank and standard score.
- dB SPL levels provide information about whether or not adult language is loud enough for the child, i.e. in day care facilities.

LENA Calculations

- LENA norms are not intended to be able to look at the validity of a single half hour or hour segment.
- Reliability of the percentile ranking is based upon 10+ hours of recording
- However, across any 16 hour day, it is possible to identify trends in the data such as periods of the day with the highest quantities of any of the calculations

LENA Research

Client Manager | LENA Reports | Developmental Snapshot | Digital Language Processor

Adult Words

HOURLY

September 17, 2009

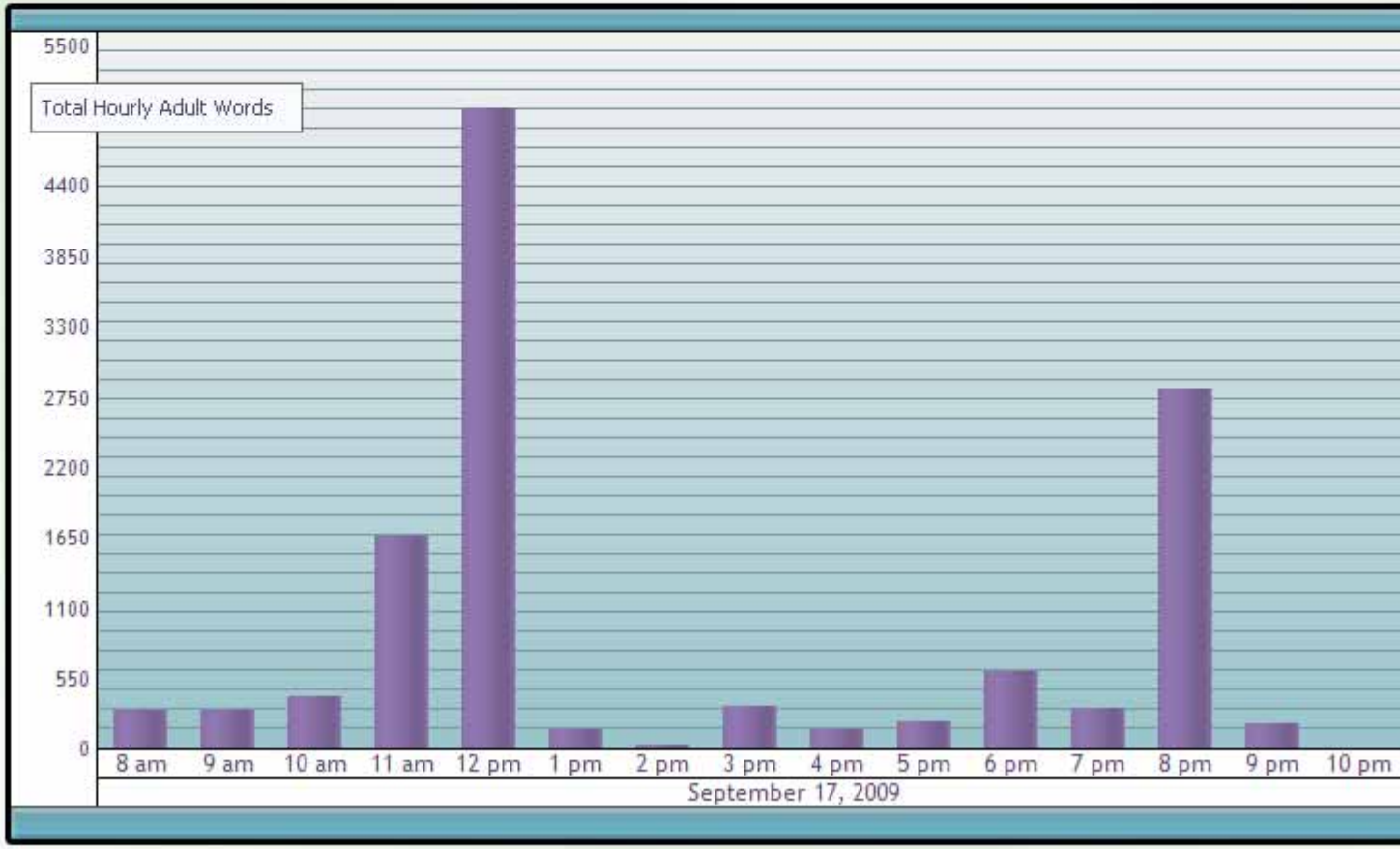
(C007) - xxxxxx, xx

The Adult Words report displays number of words spoken to and in the vicinity of the child during the course of a recording.

Roll over data bars, data points, or legend icons for more detail.

Please see User Guide for additional information.

View Adult Word Normative table and Average Daily Pattern of Talk table here.



Total Hourly Adult Words

Adult Words | Conversational Turns | Child Vocalizations | Audio Environment | Composite View | Report Li

What do we know about children with hearing loss

- Language development for many children with hearing loss may be multi-modality
- Focus exclusively on vocal/verbal language development as an index of language skills can significantly underestimate the language skills of the child if the child also uses a visual communication system or communicates exclusively through a visual communication system

Research possibilities with LENA

- Provides an easy and quick indicator of the amount of adult language that is accessible to the child – some adaptation for children with hearing loss may need to occur if dB levels of adult input are too quiet.
- Provides an important piece of information about the language environment of the child when not in therapy.

Research potential with LENA

- Provides a vehicle that can compare the impact of different language environments upon the child's expressive spoken language.
- The amount of child vocalization is directly related to the language environment in which the child lives.
- Therefore, the same child could demonstrate significantly different language dependent upon the conversational partners in the environment or the style of interaction used by the conversational partner

Comparisons of different environments

- Child in daycare
- Child at home with parents
- Child in therapy
- Child in preschool or toddler group
- Child at a family gathering
- Child in noisy environments

Research possibilities

- LENA analysis could provide parents with sufficient feedback that they will increase the amount of meaningful adult conversation with their child.
- LENA data indicates that parents increased their average use of meaningful conversation using LENA recordings and analyses.

Implementation of new interventions

- LENA may be used as an assessment to compare a new intervention strategy with traditional strategies by examining the change in the child's vocalizations, conversational turns, and diversity of their vocalizations.
- LENA is particularly useful when comparing short-term interventions (i.e. 6 weeks), durations not long enough to show change in standardized clinical assessments.
- LENA could also demonstrate the difference between a child's functioning within the intervention session and in a normal conversational interaction that is not therapeutic.

For intervention purposes: Assessing the child's "Auditory Diet"

- Robyn Cantle Moore, University of Newcastle, (2009) proposes using LENA to investigate the "auditory diet", exposure to spoken language in the daily routine of children with hearing loss.

Research on CAPD/CALD/ANSD

- LENA can be used to investigate the language environment and its relationship for children with auditory neuropathy spectrum disorder, children with auditory processing disorders and children with auditory language disorders.
- LENA is being used to study the language development of children with autism and other speech/language disorders, such as specific language impairment

Email contact

- Reliability study now being conducted.
- Christie.Yoshi@colorado.edu