

# POWERED MOBILITY FOR USERS WITH MINIMAL PHYSICAL ACCESS: From Trials to Funding

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# INTRODUCTION

- Wheelchair users with minimal physical strength or movement present challenges for access to powered mobility
- Success may be dependent on dual or multiple access methods
- Most likely, driver controls will need to be integrated with computer access, AAC and environmental controls to provide independence
- Systematic evaluation and trials increase the likelihood that funding will be secured

# OBJECTIVES

1. Identify 3 switch types for unconventional switch use for users with reliable movement at 1 or more switch sites and limited physical strength
2. Provide rationale for dual driver control methods to obtaining funding approval within guidelines for private insurance, Medicaid and Medicare
3. Identify physical requirements and potential for eye gaze as a method of driver control, positioning independence and environmental control

# BACKGROUND

- I have been a school based physical therapist since 1980, and am currently working for Northern Suburban Special Education District (NSSED)
- NSSED is a co-operative of local school districts in the Northern suburbs of Chicago, formed in response to Public Law 94-142, re-authorized as the Individuals with Disabilities Education Act (IDEA)
- One of the components of service offered through the co-op is the Assistive Technology Team composed of educators, speech and language pathologists, an occupational therapist and a physical therapist
- We have developed an extensive lending library of equipment for trial across all domains of technology



# OUR STUDENTS

- Our students come from the member districts and attend school programs within their own districts or within early childhood or life skills classes administrated through NSSED
- Students with physical disabilities and limited access for powered mobility have included children with:
  - Cerebral palsy
  - Muscular dystrophy
  - Spinal muscular atrophy
  - Brain tumor/Traumatic Brain Injury

# OUR STUDENTS, Cont'd.

- Leukodystrophies
- Rett Syndrome
- Hypotonia with Developmental Delay
- Spinal Cord Injury
- Locked-In Syndrome, post Brain Stem Aneurysm

# POWER WHEELCHAIRS AND ACADEMIC NEEDS

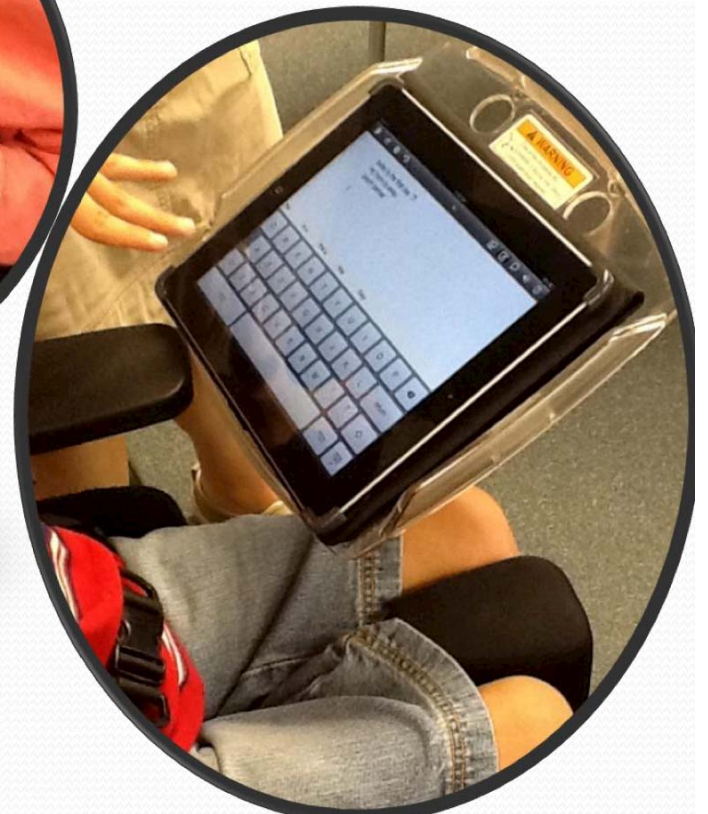
- Greater than 90% of our students who use power wheelchairs rely on assistive technology for access to academic materials
  - Accessibility features within computer or device program
  - Writing software to improve speed of production
  - On-screen keyboards
  - Text-to-speech
  - Kurzweil or similar programs for note taking, editing and reading of any text material

# POWER WHEELCHAIRS AND AAC/COMPUTER NEEDS, Cont'd.

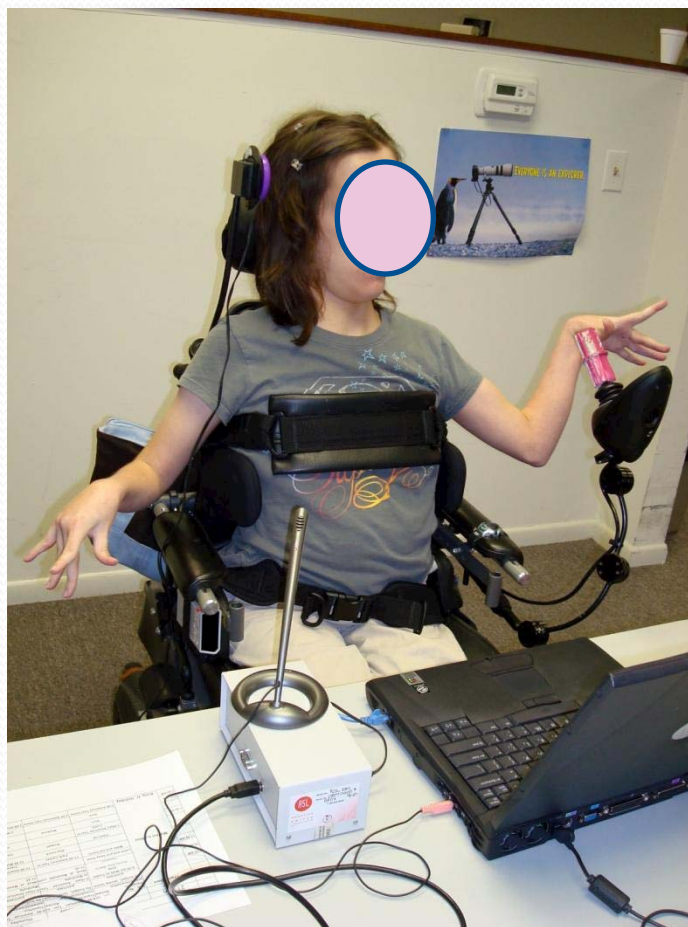
- Greater than 50% of our students who use power wheelchairs rely on AAC devices, computers and tablets for expressive communication
  - Dedicated devices with full computer function
  - District supported computers (includes chrome books, laptops and access to district networks and desk top systems) through 1:1 initiatives
  - Tablet technologies, primarily iPad and mini iPad
  - Most systems utilize alternate controls (switches, integration with driver controls, alternative keyboards, alternative mouse pads or joysticks) and interface boxes or software



# MOUNTING DEVICES



# COMPUTER ACCESS



# NSSSED INTEGRATED TECHNOLOGY APPROACH

- Evaluation of student needs with all areas of the educational setting
- Team assessments by speech and language pathologist, educators, occupational and physical therapist
- Review of academic performance and current curriculum to determine discrepancies
- Consideration of technologies, physical abilities, current equipment used by student

# NSSSED INTEGRATED TECH APPROACH, Cont'd

- Extended trials including of power chairs, data and outcome presentation with team, family
- Team decision on further trials, next steps, recommendations
- Power wheelchair evaluation with wheelchair supplier
- Determination of funding (insurance, Medicaid, school district)
- Documentation, ordering, delivery, follow-up training with student, family and educational team as needed

# NSSSED's AT LENDING LIBRARY

- Currently includes 4 power wheelchairs (2 small power chairs, 1 rear (18" W) and 1 mid wheel (16" W) power chair, all with enhanced electronics
- 4 Invacare joysticks and 3 head ASL head arrays
- Switch boxes and interfaces for alternate switches
- Multiple switches (wired and wireless) of varying degrees of pressure and activation distance
- AMDI fiber optic and peizo-electric switches
- Ablenet ribbon, leaf, micro-light, squeeze, pillow, string and spec switches
- TASH penta, tip and lever switches

# NSSSED LENDING LIBRARY

- Mercury tip switch
- Adaptivation Mini touch pad
- Words Plus infra red sensor
- A variety of mechanical switches in dimensions from 1-5” in diameter
- 6 external joysticks for computer mouse and click
- 3 Trackball external joysticks
- Multiple AAC devices and tablets with cases
- Daessy-Daedalus mounting assessment kit and parts
- TASH mouse emulators (3)

# ADDITIONAL RESOURCES

- Local wheelchair suppliers and manufacturers from Invacare, Permobil, Quantum, ASL, Switch-It, Stealth
- Local and regional suppliers of seating system components for postural supports
- National manufacturers of switches, joysticks, head arrays and electrical components
- Manufacturers and suppliers of AAC devices
- Lift equipped vehicles for transportation of power wheelchairs as needed

# THREE STUDENTS WITH DIVERSE NEEDS

- 1<sup>st</sup> student is 14 year old female with diagnosis of schizencephaly, high muscle tone, limited range of motion, minimal strength (grade 2-3 biceps/triceps) increasing fatigue through day
- Originally using secondary joystick for dedicated AAC device
- Added TASH mouse mover and separate switch for clicks for AAC through her computer (Macbook) using her wheelchair joystick
- Step-by-Step communicator for quick greetings
- Power wheelchair driver for 7 years with decreasing ability to maintain forward motion due to increased m. tone during day and fatigue



# 1<sup>st</sup> STUDENT, Cont'd.



# EVALUATION FOR NEW POWER WHEELCHAIR

- Identified goals:
  - Reduce fatigue for transition to high school/larger environment
  - Maintain AAC and computer competence
  - Integrate new system
  - Improve comfort
  - Improve postural alignment by supporting curvatures in upright
  - Provide on/off and mode changes for independence
  - Position all controls within her reach (approx. 4" x 6")
  - Trial of alternate controls

# FINAL DECISIONS

- Quantum Q6 Edge with enhanced electronics and multiplier harness
- Custom molded seating
- Dual methods of driver control following trial: Q-Logic stand alone joystick and Switch-It head array
- Q-Logic Enhanced visual display
- Gatlin swing-away mount
- Ablenet spec switches
- Power tilt
- Mount clamp for existing computer mount

# CUSTOM MOLDING



# DOCUMENTATION FOR FUNDING (INSURANCE AND GOVERNMENT COVERAGE)

- Detailed letter of medical necessity, reviewing physical assessment, prior use of equipment, data from trials, medical history and justification of power chair and each item
- Photos of student (posture supine and sitting, current equipment and trial equipment)
- Data for driving and computer access with joystick
- Data for driving with head array
- Approval received in 2 months, delivery 3 ½ months from evaluation

## 2<sup>nd</sup> STUDENT

- 21 year old student with diagnosis of DMD and progressive loss of strength/endurance/range of active movement
- Prior driving experience of 14years with excellent navigation skills indoors and outdoors
- Used joystick for driving, tilt, recline, leg elevation and as mouse for computer on-screen keyboard and internet navigation
- Could access all joystick functions once hand was placed on joystick

# 2<sup>nd</sup> STUDENT PWC EVAL.

- Student goals:
  - Comfort with independent positioning (back and leg pain, numbness in legs)
  - Control of driving and seat positions as well as computer access through driver control
  - On/off independently
  - Consider standing as a position change
  - Ability to drive throughout the day

# FINAL DECISIONS

- Quantum Q6000Z with enhanced electronics
- Q-Logic EX joystick with driver controls and seat functions
- Q-Logic Enhanced display with multiplier harness
- Switch-It drive station controller with dedicated seat functions and driving capabilities
- Motion Concepts TRx Ultra-Low seat frame with tilt, recline, leg elevation functions
- No standing



# DOCUMENTATION FOR FUNDING (INSURANCE AND MEDICAID)

- Detailed letter of medical necessity, reviewing physical assessment, prior use of equipment, data from trials, medical history and justification of power chair and each item
- Data for driving and computer access with joystick
- Detailed information on his use of drive station controller for gaming
- Approval received in 3 months (one denial), delivery 5 ½ months from evaluation

# 3<sup>rd</sup> STUDENT

- 19 year old male who sustained a brain stem stroke during the repair of an aneurysm, resulting diagnosis is quadriplegia and locked-in syndrome
- Active movements limited to eyebrow, flexion of 3<sup>rd</sup> finger right hand and occasional biceps flexion on right for muscle strength grade 2 and limited endurance
- No active head or trunk control
- Manual wheelchair user, dependent propulsion

# PATRICK



## 3<sup>rd</sup>. STUDENT, Cont'd

- Returned to school following 14 mos. rehab (Jan. 2011)
- AAC through Dynavox Vmax, eye gaze and single switch on splint positioned near 3<sup>rd</sup> finger right hand
- Uses color coded spell board and eyebrow movement for partner assisted communication
- Personal goal of independent mobility

# COMMUNICATION METHODS



DYNAVOX Vmax with Eyemax and Partner assisted spell board

# THE CHALLENGES

- 2 reliable active movements (left eyebrow/eyelid, flexion of 3<sup>rd</sup> digit right hand) and sporadic control of 4<sup>th</sup> and 5<sup>th</sup> digits, biceps and shoulder elevation on right
- Strength of movements in grades 1-2 with ranges limited to approximately 1/2"
- Limited endurance
- Acceptance of current level of ability
- Research and internet overload

# THE PLAN

- It evolved, to put it mildly
- We assessed all movements for strength, range and planes of movement
- We took inventory of our lending library
- We researched access methods (switches, track pads, infra-red sensors) Chart to follow on next slides
- We learned his system and equipment, benefits and limits
- Contacted local wheelchair manufacturers to arrange trials

# DRIVER CONTROLS FOR USERS WITH MINIMAL OR PROGRESSIVE LOSS OF STRENGTH

\* Indicates items trialed with student

ACCESS METHOD	REQUIREMENTS	CONSIDERATIONS
Ablenet Micro-light *	0.4 oz. pressure	Grade 2/5 strength
ASL Ultra-light *	7.0 oz. pressure	Grade 3-4/5 strength
Ablenet Ribbon	4.0 oz. pressure	Grade 2-3/5 strength
Ablenet Leaf *	1.8 oz. pressure	Grade 2/5 strength
AMDI Piezoelectric *	Vibration	Grade 1/5 strength
AMDI Fiber Optic	Fiber Optic Mvt. Sensor	Grade 2/5 strength
ASL Proximity	Minimal Mvt. Sensor	Grade 2/5 strength
Ablenet Squeeze	11 oz. pressure	Grade 3-4 strength
TASH Penta	4.5 oz. pressure	Grade 2-3 strength



# DRIVER CONTROLS cont'd

ACCESS METHOD	REQUIREMENTS	CONSIDERATIONS
TASH Lever	1.75 oz. pressure	Grade 2/5 strength
SCATIR (self calibrating auditory tone infrared)	Eye Blink	Grade 1-2/5 strength
Ablenet Spec *	3.0 oz. pressure	Grade 2-3 strength
Words-Plus Infrared/Sound/Touch *	Infra red sensor for any movement	Grade 1-2/5 strength
Mercury Tip Switch *	No pressure, small mvt.	Grade 2/5 strength
ASL Micro Mini joystick *	0.4 oz. pressure	Grade 2/5 strength
SwitchIt Micro Pilot Joystick *	0.352-0.62 oz. pressure	Grade 2/5 strength
ASL MicroExtremity Joy*	4.0 oz. pressure	Grade 2-3/5 strength
TASH Mini joystick	7.0 oz pressure	Grade 3-4/5 strength

# DRIVER CONTROLS, cont'd

ACCESS METHOD	REQUIREMENTS	CONSIDERATIONS
Stealth Mushroom joy	14.4 oz. pressure	Grade 4/5 strength
Switch-It PS game control		Grade 2/5 and 1" mvt.
Mini Touch Pad *		Grade 2-3 and ½" mvt.
Visual Display/Single switch scan	Any single switch	Switch and Site Dependent
Sip and Puff	Pressure variation	Breath Support
Rolltalk *	Eye Gaze	Switch/Site Dependent
Permobil Magic Drive Touch	Touch Screen, Switches, USB keypad	Driver Control switches
Tongue Controlled Joy	Tongue Stud	Grade 2-3 strength, ¼-1/2" mvt. of tongue
Brain/Machine Interface	EEG controlled	Experimental to date

# ACCESS METHOD TRIALS

ACCESS METHOD	LOCATION	RESULTS
Ablenet Micro-Light	3 <sup>rd</sup> digit, R hand on splint	Consistent Success
ASL Ultra-Light	3 <sup>rd</sup> digit, R hand on splint	Unable to activate
Ablenet Leaf	3 <sup>rd</sup> , 4 <sup>th</sup> digits R on mount	Inconsistent
AMDI Piezoelectric	R hypothenar muscles	Freq. over activation
Ablenet Squeeze	R palm, 3 <sup>rd</sup> , 4 <sup>th</sup> digit flexors	Partial activation, but inconsistent
Ablenet Spec	3 <sup>rd</sup> , 4 <sup>th</sup> digits R hand on splint	Partial compression, no activation

# ACCESS TRIALS, Cont'd

Words-Plus Infrared	Glasses, left side	Interfered with spell board communication
Tip Switch – Mercury	R hand and 3 <sup>rd</sup> digit	Inconsistent mvt.
ASL Micro-Mini	Mounted below R 3 <sup>rd</sup> digit	Inconsistent for mvt. In all directions
Switch-It Micro Pilot	Mounted below R 3 <sup>rd</sup> digit	Inconsistent for mvt. In all directions
ASL Micro Extremity joy	Mounted below R 3 <sup>rd</sup> digit	Unable to activate
Mini Touch Pad	On splint, held and mounted	Unable to move 3 <sup>rd</sup> or 4 <sup>th</sup> digit due to traction of pad
Rolltalk with Eye gaze	Mounted on pwc	Successful for driving from initial trial

# THE TIMELINE

- Aneurysm occurred October 2010
- Student re-entered school January 2012
- First power trial, 1/25-3/8/2012
  - Permobil C400
  - Switch It Micro Pilot joystick



# SECOND POWER TRIAL

- 2<sup>nd</sup>. Trial from 3/14-6/30/2012 and again 5/10-17/2013
  - Invacare TDX, mid-wheel drive
  - ASL Micro-Mini joystick



# COMPARISONS/CHOICES

- Patrick determined he felt most stable in front wheel drive chair
- Clear need for tilt, recline, leg elevation for positioning and postural supports
- Standing considered as an option 9/2012
  - Permobil C500 V
  - Invacare FDX with Motion Concepts MPS seat frame
- Optimal head control and least physiological stress going through supine to stand

# THINGS GET COMPLICATED

- Closing the Gap Conference October 2012. CTG is an educationally oriented assistive technology conference, held annually in Minneapolis
- ASL presentation with Lisa Rotelli and Karen Kangas on the Rolltalk Nova with Intelligaze as a method of AAC, fully functional Windows based computer with capabilities to interface with power wheelchairs for driving and independent adjustment of seat functions



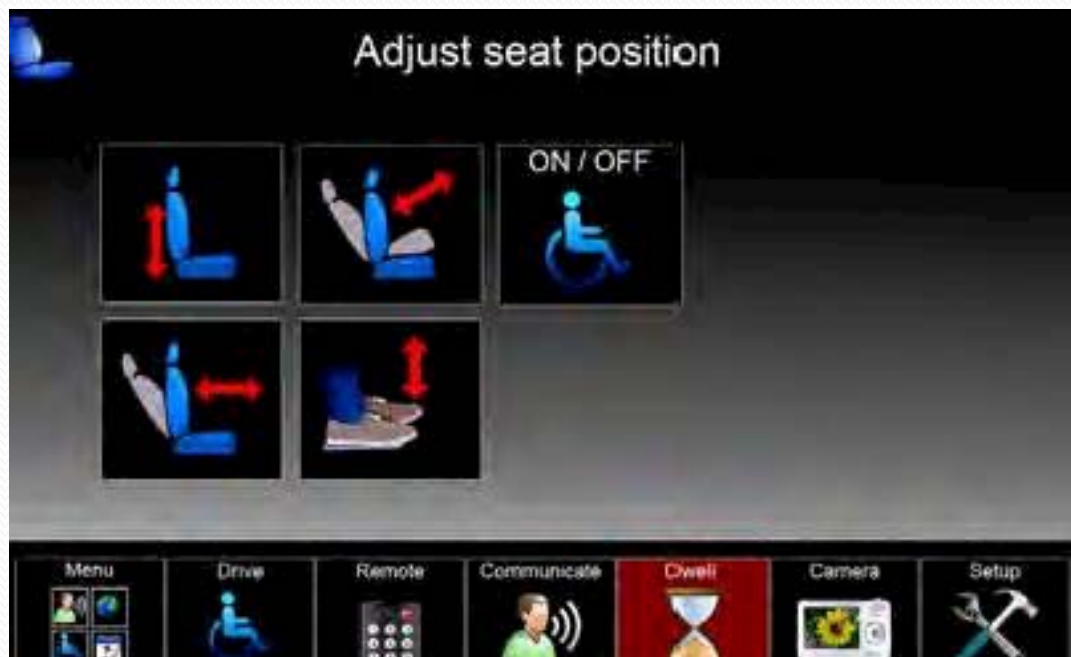
# ROLLTALK NOVA



# DRIVE SCREEN



# SEAT FUNCTIONS



# COMMUNICATION

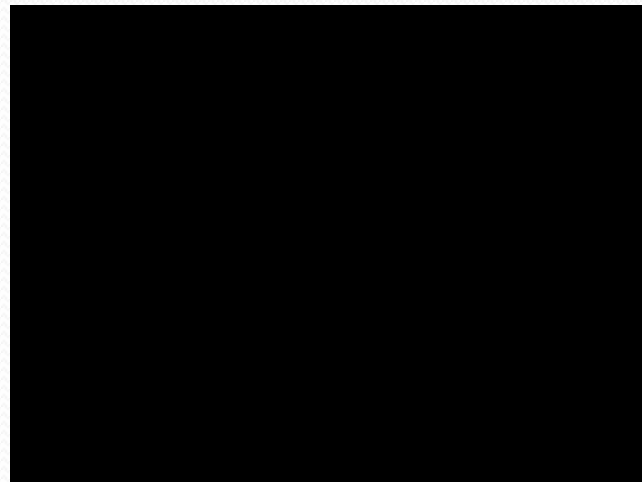
This screenshot shows a communication application interface. On the left, there are three small icons labeled 'Head', 'Front', and 'Back' next to a larger central image of a person's face. To the right of the face is a vertical color-coded bar with levels: 'No' (green), 'Slight' (light green), 'Uncomfortable' (yellow), 'Strong' (orange), and 'Intolerable' (red). Further right is a grid of text options: 'Aching', 'Burning', 'It hurts', 'It itches', 'No', 'Please call my doctor', 'Stinging', 'Throbbing', and 'Yes'. At the bottom, there is a row of icons for 'Menu', 'Drive', 'Remote', 'Communicate', 'Dwell', 'Camera', and 'Setup'.

This screenshot shows a virtual keyboard interface. At the top, there is a text input field containing the letter 'd'. Below the input field is a grid of letters: 'a' through 'z'. To the right of the letters are function keys: 'Smileys', 'Show', and 'Edit'. At the bottom, there are more function keys: 'Menu', 'SMS', 'E-mail', '123', 'Dwell', 'Sentences', and 'Show'. The 'Dwell' key is highlighted with a red border.

This screenshot shows a 'Sentences' application screen. The title is 'Sentences (1/8)'. On the left, there is a 'Categories (2/2)' sidebar with 'Camera' and 'Drive' listed. The main area displays a list of phrases in a grid: 'Can you get the door please?', 'Can you mow that, please?', 'Can you please move?', 'I need some help, please', 'No problem', 'OK', 'Sorry!', and 'Thank you'. On the right side, there are icons for 'Search', 'Insert', and 'Edit'. At the bottom, there is a row of icons for 'Menu', 'Drive', 'Remote', 'Communicate', 'Dwell', 'Camera', and 'Setup'.

# FIRST ROLLTALK TRIAL

- December 19, 2012
- Invacare FDX



# ROLLTALK AND PERMOBIL TRIAL, April 8, 2013



# DECISIONS

- Comparisons of Dynavox VMax with Eyemax vs. Rolltalk Nova with Intelligaze
  - Communication ease
  - Software compatibility
  - Service (US vs. Norway with ASL in US)
  - Ease of usage
- Defining driver control parameters
  - Rolltalk
  - Micro joystick
  - Both

# FINAL EVALUATION

- July 2012
- Determination of all items to be included in LMN and order
- Decisions on paperwork
  - LMN
  - Illinois Department of Healthcare and Family Services Evaluation form (hfs3701h)
  - Video clips
  - Data on trials



# DOCUMENTATION TO APPROVAL AND DELIVERY

- Documentation completed and mailed with jump drive video clip footage August 2013

- Insurance and Medicaid approval October 2013

<https://www2.illinois.gov/hfs/SiteCollection/Documents/hfs3701h.pdf>

- Delivery December 20, 2013

# POST-DELIVERY

- Ongoing follow-ups for Rolltalk mounting, staff training, positioning, transit safety problems, programming of drive speeds, compatibility of all electronics for wheelchair, attendant control Rolltalk (drive and seat functions) and working towards mounting of ASL Micro Mini alternative joystick drive method

# TRANSITION TO ADULT SERVICES

- School related services end on day before 22<sup>nd</sup> birthday in Illinois
- Ongoing needs across all areas of Assistive Technology to benefit from the technologies he has in place
- Potential for new technologies with time, changing needs
- Transition to Assistive Technology Unit at University of Illinois at Chicago

# CONCLUSION

- Hands-on opportunity to trial Rolltalk Nova features
- Discussion/Questions
- Contact info: Mary Bacci, PT, MS  
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*THANK YOU FOR COMING AND PARTICIPATING*