

Measuring the impact of tilt-in-space wheelchairs on health, activity and participation



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The significance of measuring health, activity, and participation among wheeled mobility users

- 1) Increased participation for people with disabilities is a goal of the Americans with Disabilities Act (ADA) and the New Freedom Initiative.
- 2) Wheelchair features such as TIS, power assist, & standing are prescribed for benefits that have not been adequately studied.

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Research Design

- Pre-post study of full-time, upright power wheelchair users who were prescribed a new tilt-in-space power wheelchair.
- Post assessment at 3 months after receipt of new tilt-in-space wheelchair.

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Health, Activity and Participation Research Questions

- How did the subject use his/her wheelchair?
 - How much time did they spend in their wheelchair?
 - How many mobility bouts did they have?
 - What was the overall distance traveled in their wheelchair?
- What was the nature of subjects' trips taken outside the home?
 - How many community destinations did they visit?
 - In what types of community activities did they participate?
 - What was the average number of hours per day spent at destinations?
- What was the self-perceived physical, emotional, and mental health status of subjects?

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Wheelchair Activity Monitoring Instrument (WhAMI)

A methodology to measure activity and participation among wheelchair users. It combines activity monitoring instruments (such as occupancy monitor, wheel revolution counter, seat position sensor, GPS) with self-report measures.

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Activity monitoring technologies included:

Occupancy switch
Wheel revolution counter
Seat position sensor
GPS

Self-reports included:

Health questionnaire
SF-8 (8 question self assessment of health status)
Prompted recall interview (PRI)
CPPRS

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WHAMI measurements over a 2 week monitoring period captured diverse mobility patterns

- Total wheel revolutions every 2 seconds.
 - distance wheeled
 - Number of mobility bouts
- Occupancy
- Tilt System Use — Monday 10:30 to 11:45 a.m. Regency C
- GPS and Prompted Recall
 - Number of destinations visited
 - Type of activity performed at each destination

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Mobility Bouts

Mobility bouts are intentional segments of movement.

“The bout definition was optimized to include travel between intentional activities so the end of a bout marked the beginning of a stationary task.”*

*S. E. Sonenblum, S. Sprigle, F. H. Harris, and C. L. Maurer. Characterization of Power Wheelchair Use in the Home and Community. Archives of physical medicine and rehabilitation 89 (2008).

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Mobility Bouts

- In a larger study (n=25) - of which these 5 subjects are a subset) - the majority of bouts take place in the home.
- Homes contain smaller, more purposeful spaces (e.g., kitchen) in which key daily activities occur. The frequency of bouts tends to reflect transitions between these activities.

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Results

- 5 subjects recruited from local acute rehabilitation hospital (1 male, 4 female)
- Age range 36-60 years
- Diagnoses: SCI, CP, Dystonia, MS, MD
- Reason for prescription: pressure reliefs and increased postural stability & comfort.

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Results

- Wheelchair use metrics varied pre and post for all 5 subjects with no consistent trend.
 - Distances wheeled increased in 3 of 5 subjects during post assessment.
- For most subjects (4 out of 5) there was little difference in # or type of destinations visited pre and post.
- Self perceived health status increased during post assessment in all subjects.

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Table 1: Daily wheelchair use before and after receipt of TIS wheelchair

Subject	Occupancy Time (hours)		Distance Wheeled (m)		# Bouts	
	Pre	Post	Pre	Post	Pre	Post
A	11.9	10.2	1247	1439	212	189
B	n/a	15.7	3795	1395	119	106
C	n/a	12.6	999	1188	69	102
D	11.6	12.5	571	319	140	82
E	13.9	11.4	776	1151	100	133

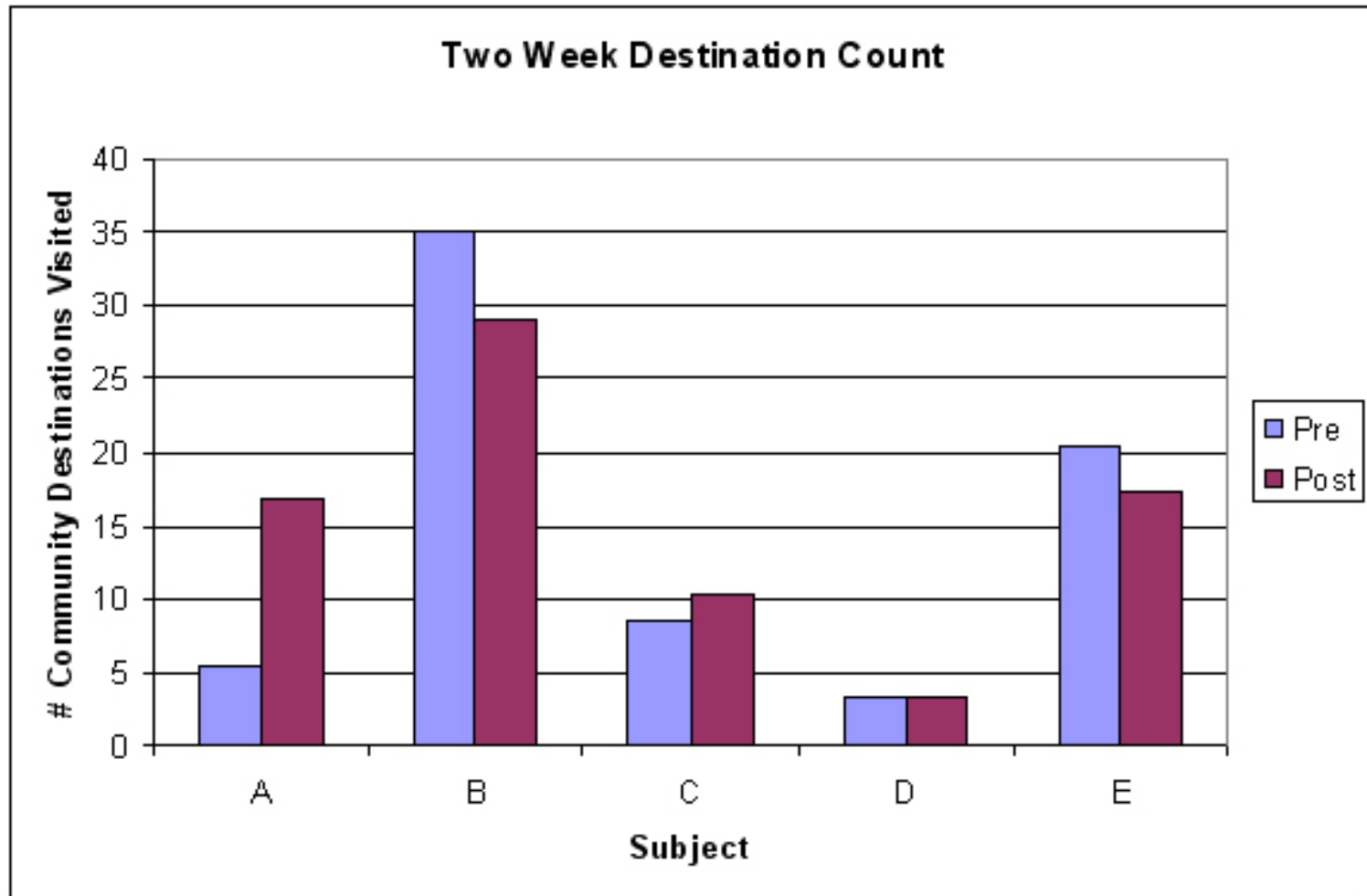
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Tilt Use by Subjects

	Typical Position	# Tilts ($>5^\circ$) per day
A	7	84
B	16	12
C	8	71
D	1	14
E	27	53

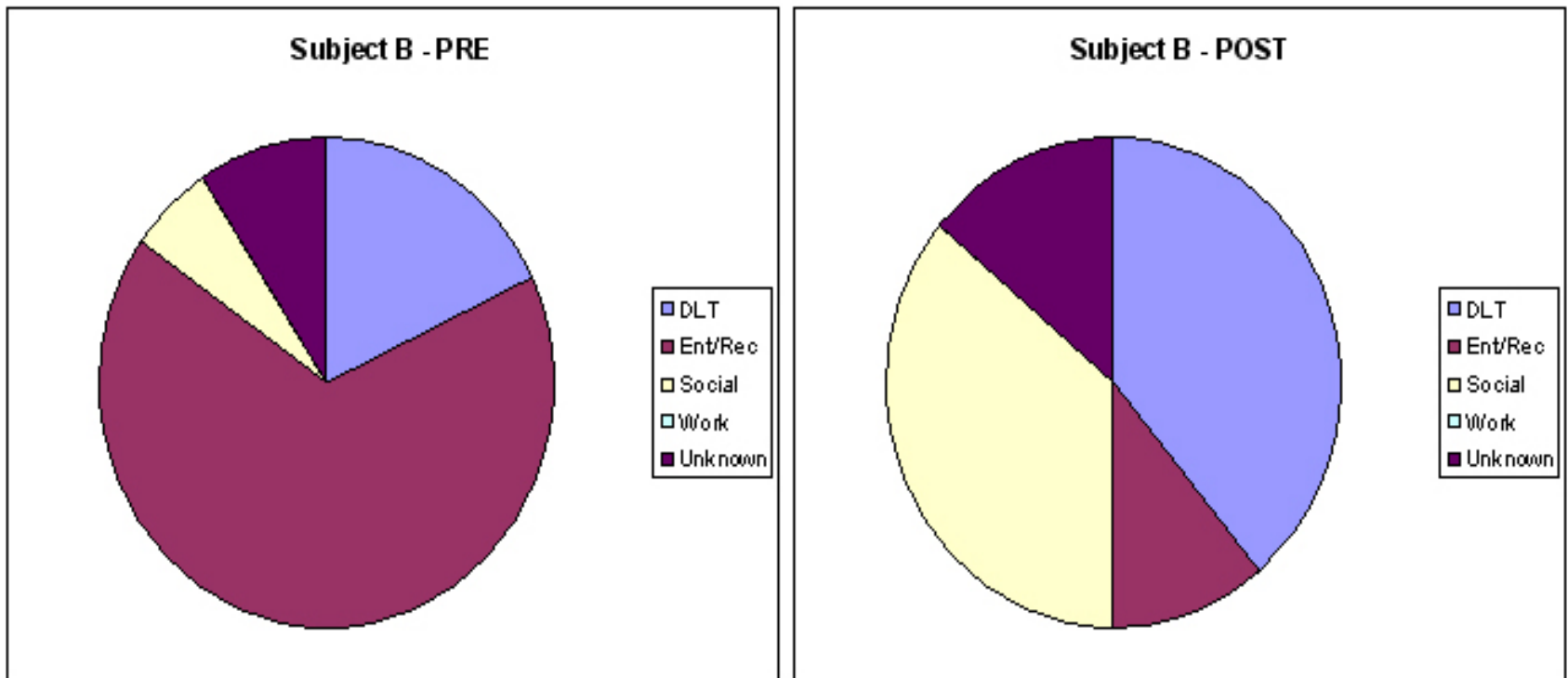
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Number of community destinations visited by subjects pre and post



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Breakdown of activity type for Subject B pre and post



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Table 2: SF8 Scores Pre and Post

	Physical Score			Mental Score		
	Pre	Post	Change*	Pre	Post	Change*
A	48.62	33.52	-15.1	54.5	48.51	-5.99
B	60.74	56.9	-3.84	54.14	54.09	-0.05
C	33.21	38.13	4.92	48.37	43.38	-4.98
D	32.62	30.94	-1.68	29.24	27.65	-1.59
E	32.87	32.72	-0.15	51.95	54.51	2.55

*Lower score indicates improved health status

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Conclusions

Although 'n' is too small to generalize results, study demonstrates complex relationship between:

- wheelchair use metrics (distance, occupancy, bouts)
- community participation as measured by number of trips and types of activities, and
- self-assessed health status.

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Conclusions

- Objectively derived mobility data can be used by health professionals to compare clients' perceptions of wheelchair use (e.g., tilt feature) against clinical expectations. May help both clients and professionals to better anticipate clinical needs.

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