Trends in BCI Meeting Abstracts on Research Participant Categories and Descriptions between 1999 and 2013

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Introduction

- International BCI Meeting attendance has grown from 22 research labs in 1999 to 188 labs in 2016, likely reflecting a growth in collaborating disciplines [1].
- Diversity in clinical backgrounds working with people with disabilities (PWD) may contribute to changes in recruited study participants and variations in how study participants are described.

OBJECTIVE: Report on trends regarding intended end-users, study participants, and descriptions of participant diagnoses and functional impairments.

- Reported here are abstracts from BCI Meeting years 1999, 2002, 2005, and 2013.
- Rating and analysis is ongoing for 2010 and 2016 abstracts.

Methods

- Rating tool developed to characterize elements of studies (see Rating Criteria below).
- Only abstracts describing participants controlling a BCI system were included.
- International BCI Meeting abstracts rated:
  - (n=20 of 22) 1999 First Meeting
  - (n=17 of 36) 2002 Second Meeting
  - (n=72 of 120) 2005 Third Meeting
  - (n=179 of 185) 2013 Fifth Meeting

Interrater Agreement:

- Abstracts divided equally and randomly assigned to two trained raters
  - 25% of abstracts for each Meeting are randomly assigned for double-entry
  - Interrater agreement assessed, revisions made if necessary, process is reiterated for each year

Rating Criteria

Level of Diagnosis Description

Raters could select multiple categories:
Specific: includes location or onset type
Basic: mention of a diagnostic label without a location or onset.
Vague: no mention of a diagnostic label.
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Level of Functional Impairment Description

Raters could select multiple categories:
Specific: indicates area(s) of functional impact with a degree of impairment.
Basic: indicates area(s) of functional impact without a degree of impairment.
Vague: no reference to functional impairment.

Discussion

PWD Participation:

- This study reveals a decline in percentage of abstracts reporting PWD participation from 1999 to 2013.
  - BCI performance for controls does not always predict performance with end-users. [3]
  - Critical that PWD are involved in BCI research.

Description of participants who are PWD:

- Despite growing variety of diagnoses reported, there is a decline in the percentage of abstracts that received a specific rating for diagnosis description.
- May compel new guidelines for BCI Meeting submissions.

References

[1] Müller-Putz, G, et al. (2016). Proceedings of the Sixth International Brain-Computer Interface Meeting: BCI Past, Present, and Future. DOI: 10.3217/978-3-85125-467-9
[2] Wolpaw, JR, et al. (2000). Brain-computer interface technology: a review of the first international meeting. IEEE Trans Rehab Eng, 8(2), 164-173. DOI: 10.1109/TRE.2000.847807
[3] Oken, BS, et al. (2014). Brain-computer interface with language model-electroencephalography fusion for locked-in syndrome. Neurorehabil Neural Repair, 28(4), 387-394. DOI: 10.1177/154

Results

PWD as Target Users and Study Participants

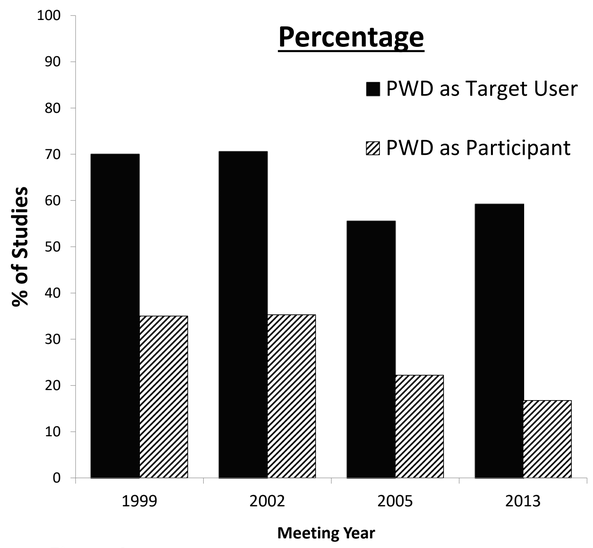

Figure 1. Percentage of studies (i.e., (number of studies/[total number of studies - perspective studies])*100) by meeting year.

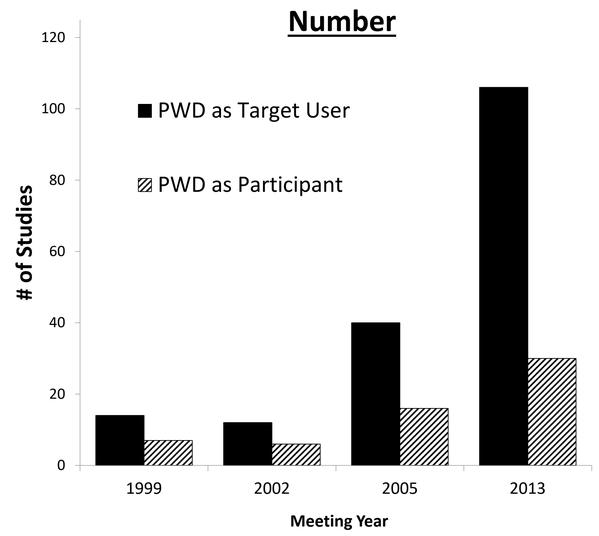

Figure 2. Number of studies (i.e., total number of studies - perspective studies) by meeting year.

- About 1/3 (1999: 32%, 2013: 40%) did not specify intended end-users.
- Controls were the most common study participant (1999: 12 or 60%, 2013: 122 or 68%).

Participant Diagnostic and Functional Descriptions

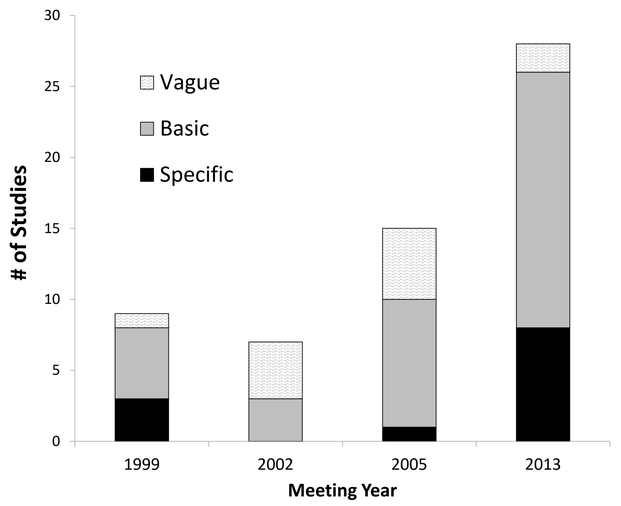

Figure 3. Number of studies by meeting year (1999: n = 7; 2002: n = 6; 2005: n = 16; 2013: n = 30). Interrater agreement: 1999: 82%; 2002: 90%; 2005: 93%; 2013: 98%.

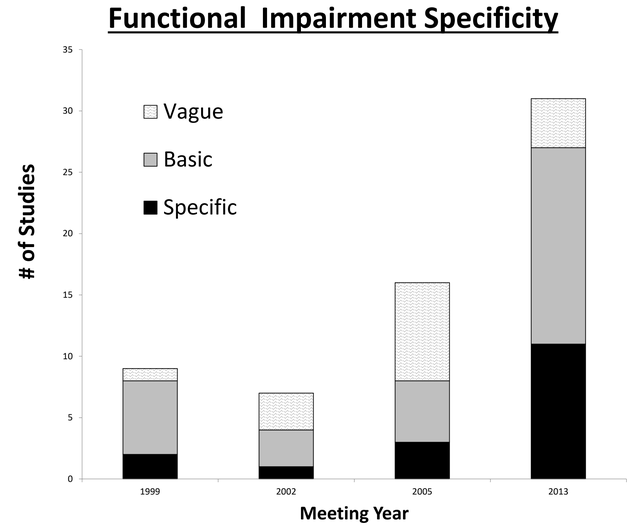

Figure 4. Number of studies by meeting year (1999: n = 7; 2002: n = 6; 2005: n = 16; 2013: n = 30). Interrater agreement was as follows: 1999: 91%; 2002: 90%; 2005: 87%; 2013: 94%.

- Decreased percentage of abstracts that provided specific participant diagnosis (e.g. ALS onset type, lesion location): 43% (1999) to 27% (2013). (Figure 3)
- Increased percentage of abstracts that provided description with specific level of impairment: 28% (1999) to 37% (2013). (Figure 4)

- Increase in number of different diagnoses reported among PWD study participants from 1999 (7 diagnoses) to 2013 (16 diagnoses). (Figure 5)
- The majority of participant impairments were physical each year (i.e., not sensory, cognitive, speech/language, consciousness)

Participant Disabilities by Meeting Year

Year	Amyotrophic lateral sclerosis	Amputation	Brainstem stroke/lesion	Cerebral brain injury (i.e., TBI, stroke)	Cerebral palsy	Disorder of consciousness	Muscular dystrophy	Locked-in syndrome	Multiple sclerosis	Neuromuscular disorder (unspecified)	Paralysis/paresis	Post-polio syndrome	Progressive supranuclear palsy	Spinal cord injury	Spinal muscular atrophy	Spinocerebellar ataxia
1999	■	■	■		■						■	■		■		
2002						■		■			■				■	
2005				■			■	■			■			■		
2013	■	■	■	■	■	■	■	■	■	■	■		■	■	■	■

Figure 5. Participant disabilities by meeting year (1999: n = 7; 2002: n = 6; 2005: n = 16; 2013: n = 30). Interrater agreement: 1999: 90%; 2002: 90%; 2005: 83%; 2013: 89%.