Learned communicative non-use is a reality in very early aphasia recovery: Preliminary results from an ongoing observational study

Background:

Recent neurorehabilitation literature in animal motor models suggests very early (before day five post-stroke) intensive (over 300 repetitions) leads to histological damage (Krakauer et al, 2012) and late rehabilitation (commenced after day 30 post-stroke) is much less effective than intervention started earlier in recovery. The intricacies of directly applying animal models of stroke recovery and rehabilitation to human language have been well documented (Varley, 2011). In humans, the first 90 days post-stroke however, are believed to be the "window of opportunity" (Meyer et al., 2010) for neuronal changes to occur as part of neuroplasticity. Research investigating human stroke recovery models, indicates that the timing of commencement of therapy combined with therapy intensity are likely to be pivotal elements in overall stroke recovery (Kerr et al, 2011).

Therapy intensity to facilitate stroke recovery in humans is noted to be far less than that in animal models (Krakauer at al., 2012). Research investigating overall activity levels in stroke survivors in the acute recovery demonstrated that patients spent only 13% of their time engaged in activity and spent 60% of the time alone (Berhardt et al, 2004). Further research showed that task specific movement practice occurred in only 51% of sessions during acute and sub-acute therapy sessions (Lang et al., 2009). Similarly, aphasia research in early stroke recovery demonstrated that on average stroke survivors received between 14 minutes (Godecke et al, 2011) and 1.3 hours (Bowen et al, 2012) of therapy per week during the first month post-stroke. To better understand the interactions that occur in early stroke recovery, this study focused on observed communicative activities that may underlie the neuroplasticity principles of "**use it or lose it**", and "**learned non-use**" (Kleim 2011).

Aim:

This study aimed to determine if PWA had equivalent general and communicative activity as PWoA in the acute hospital setting during very early stroke recovery.

Method:

Participants:

Six participants with acute aphasia (any type/severity) and eight participants without aphasia were observed. *Inclusion criteria*: Hospitalised patients with acute stroke; acute aphasia following stroke, medical stability within 14 days post-stroke and corrected hearing/vision. *Exclusion criteria*: previous aphasia, previous head injury, a diagnosis of major depression, or a progressive neurodegenerative condition. All PWA were assessed with Western Aphasia Battery (Aphasia Quotient) within three days of the observation session.

Participants were observed and video recorded in hospital over a single day (7.5 hours). The video camera was fixed on a transportable tripod and was moved as required. The observer was not known to the participants, their family/friends or the hospital staff. Observational snapshots were recorded at 10 minute intervals equating to 45 observations for each participant. The snapshot activity was defined as the activity within the first minute of each 10 minute interval. These snapshots included all communication and general activities. Data were collected on weekdays and weekends.

Results:

The stroke and demographic characteristics for the fourteen participants are presented in Tables 1 and 2. The NIHSS stroke severity of PWA and without aphasia was compared using non-parametric statistics and was non-significant, U=9.84, z = 1.82; p=0.068.

Fourteen stroke survivors were observed over a total of 105 hours, providing 630 single snapshots. The activities were predominantly carried out in the participants' bedroom (86.3%). The remainder of the participants' time was spent in therapy areas (4.6%), off-the-ward: other procedures (5.1%) and the corridor (2.2%).

Physical activity

The physical activity data were categorised as either "activity" based actions which included assessment, therapy, medical examination, social visit, reading, eating, or other; or "inactivity" based actions which included sitting in bed, resting, sitting in a chair or sleeping. The combined cohort was *inactive* for 49% of their time. The proportion of time spent in each activity for those with aphasia and without aphasia is shown in Figure 1. PWA (63.3%) had significantly more *inactive* time than PWoA (44%); $X^2(1)=10.1$;$p<0.0002$ and PWA had more time in assessment/therapy (8.15%) than PWoA (3.61%). PWA (10.74%) spent less time in social visits with family and friends than PWoA (30.28%).

Communication opportunity

Overall, the 14 participants in this study spent 40.2% of their day communicatively engaged. PWA spent significantly less time (28.15%) communicatively engaged than PWoA (53.06%); $X^2(1) = 39.2$, $p<.001$ with an Odds Ratio of 2.88 indicating that PWoA were nearly three times more likely to be communicatively engaged throughout the day than PWA (Figure 2).

Communication partners

Overall, the stroke survivors spent 36.19% of their time alone. PWA spent 44.4% of their time alone compared to 30% for PWoA; $X^2(1)=13.9$, $p=.000$. Nurses contributed to 14.4% of the communicative interactions for PWA compared to 19.4% for PWoA and family and friends (14.07%) spent significantly less time with PWA than those PWoA (38.06%); $X^2(1)=44.3$, $p<.000$. Doctors, Physiotherapists, Occupational Therapists and Speech-Language Pathologists (combined) spent almost double the amount of time with PWA (15.2%) compared to PWoA (7.8%) (Figure 3).

Discussion

This study is the first to observe and compare general activity and communication opportunities in stroke survivors in very early recovery. This cohort is heterogeneous in age, stroke type and severity and aphasia type and severity. Participants in this study spent a similarly high proportion (85%) of time in or beside their beds as that reported in Bernhardt et al (2004). Overall, stroke survivors in this study spent more time (50% compared to 40%) engaged in activity than those in the previous study (Bernhardt et al, 2004). This may be due to greater time spent in social contact with family and friends or it could be a true reflection of increased general activity in stroke services over the last decade. However, when comparing the activity levels of people with and without aphasia, PWA are considerably less active despite similar levels of stroke severity. Given the recent evidence indicating that increased activity in early stroke recovery is beneficial, these results suggest that PWA are disadvantaged with regard to engaging in optimum levels of activity.

Further evidence indicates that PWA spent significantly less time engaged in communication interactions and more time alone than those without aphasia. Nursing staff were the most frequent communication partners for PWA whereas family and friends were the most frequent

communication partners for PWoA. Therapy staff and medical staff (combined) represented less than 11% of all communicative interactions in this study. These data do not include any analyses of the quality of the communication interactions, nor the degree to which the interactions were shared.

These important data support the notion that PWA are disadvantaged due to their communication difficulties and are presented with significantly less "everyday" communicative interactions. Thus the reduced communication interaction gives rise to a perpetual cycle of less opportunity to practice everyday communication or "less experience-dependent plasticity" (Kerr et al, 2011).

The potential for bias in this study is acknowledged. These data included all communication interactions with the observer. These data increased the overall communication opportunities for all participants however, when these interactions were removed, analyses revealed no change in the results.

Conclusions

The uniqueness of this study lies in the comparison of general and communicative activities of people with and without aphasia in very early stroke recovery. These data suggest that communicative inactivity in early stroke recovery may be a substantial factor in "learned communicative non-use" for PWA.

Preference for method of presentation: Platform

Tables and Figures.

Table 1. Participant demographic and stroke characteristics at hospital admission for people with aphasia

Participant	4	5	8	10	11	12
Age (years)	68	54	58	69	46	50
Gender (%)	M	F	M	M	F	M
Previous Stroke	No	Yes	No	Yes	Yes	Yes
Stroke type^	H	I	I	I/H	I	I
Stroke classification*	N/C	PACI	PACI	TACI	PACI	PoCI
Stroke Hemisphere	L	L	L	L	L	L
NIHSS Score	13	5	11	18	24	8
mRankin Score	4	4	4	5	5	3
AQ Score – WAB	47	62	34.1	9.2	9.3	73.8
Time to Obs'n (days)	14	11	2	17	8	8

^ Stroke type: I - Ischaemic; H - Haemorrhagic

* Oxford Stroke Classification System: PACI: partial anterior circulation infarct; TACI: total anterior circulation infarct; PoCI: posterior circulation infarct
LACI: Lacunar infarct; Non-classified = haemorrhage

Table 2. Participant demographic and stroke characteristics at hospital admission for people without aphasia

Participant	1	2	3	6	7	9	13	14
Age (years)	81	85	74	49	70	48	62	61
Gender (%)	M	M	M	F	F	M	M	F
Previous Stroke	No	No	No	No	Yes	No	No	No
Stroke type^	I	H	I	H	I	I	I	I
Stroke classification*	PoCI	N/C	PoCI	N/C	PACI	TACI	PoCI	PACI
Stroke Hemisphere	L	R	R	R	R	R	L	R
NIHSS Score	7	17	9	12	12	16	7	16
mRankin Score	4	5	4	4	2	5	4	5
Aphasia	No	No	No	No	No	No	No	No
AQ Score – WAB	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Obs'n (days)	15	7	8	9	3	17	15	14

^ Stroke type: I - Ischaemic; H - Haemorrhagic

* Oxford Stroke Classification System: PACI: partial anterior circulation infarct; TACI: total anterior circulation infarct; PoCI: posterior circulation infarct
LACI: Lacunar infarct; Non-classified = haemorrhage

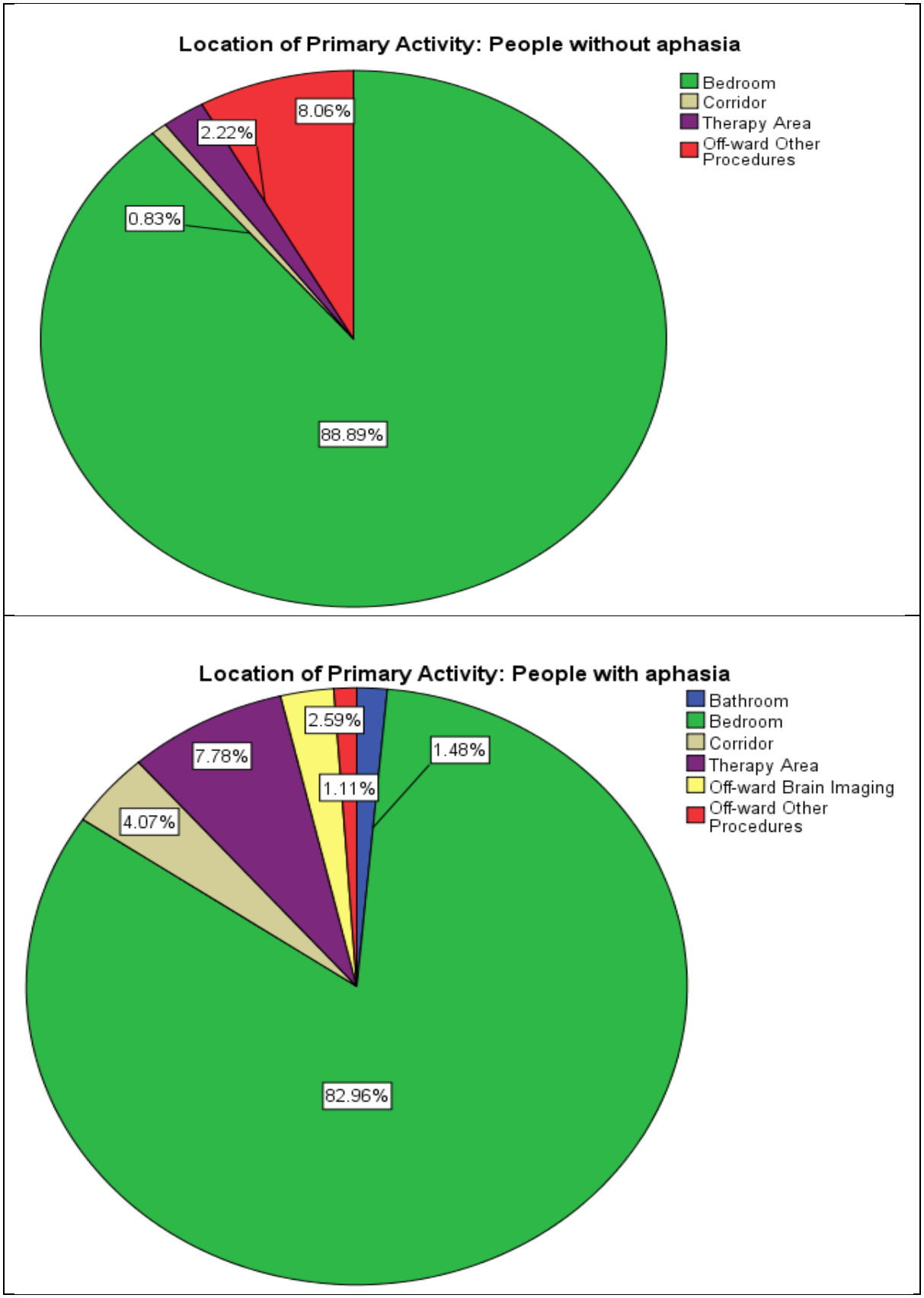

Figure 1. The location of primary activities for people with and without aphasia

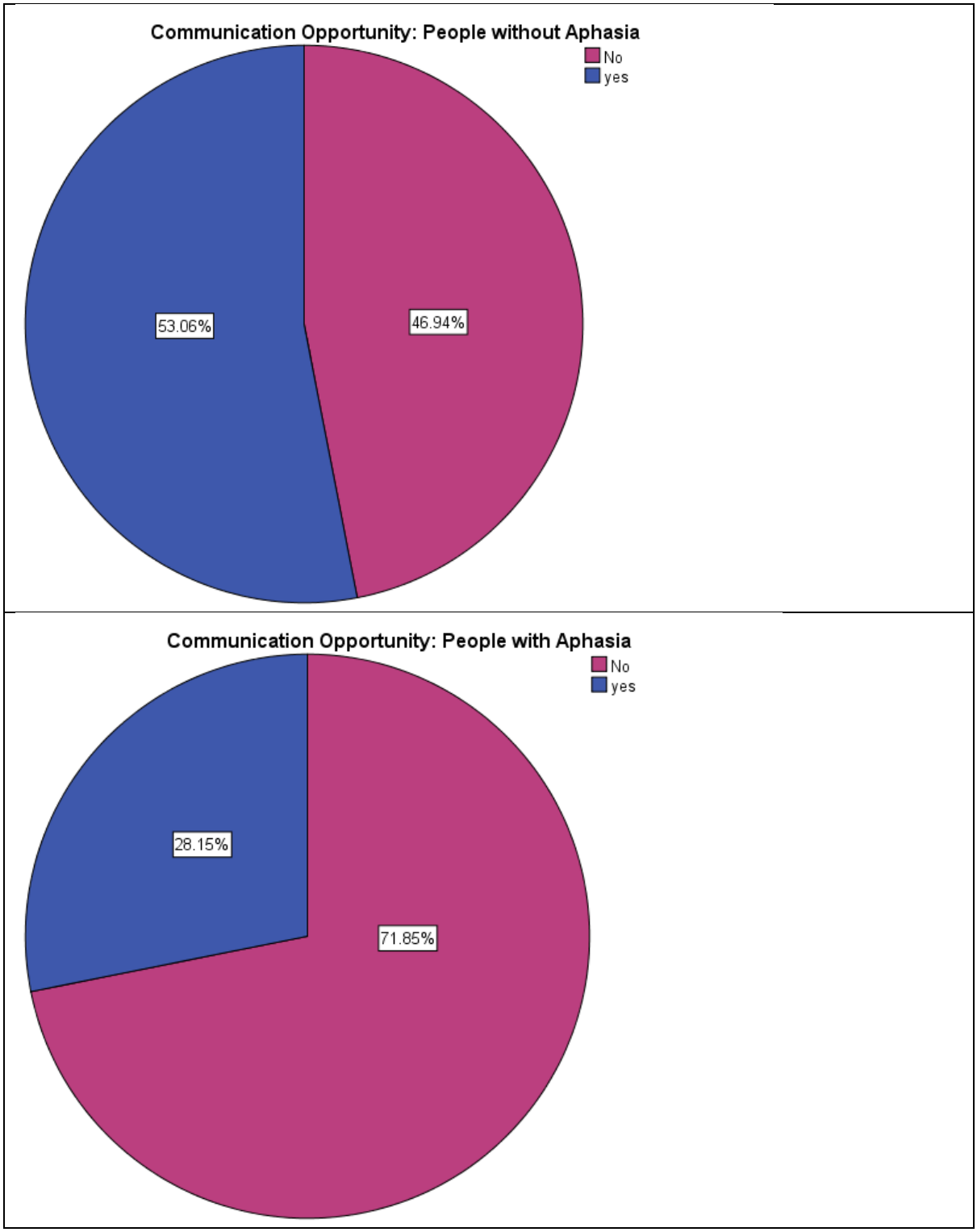

Figure 2. Communication opportunities for people with and without aphasia

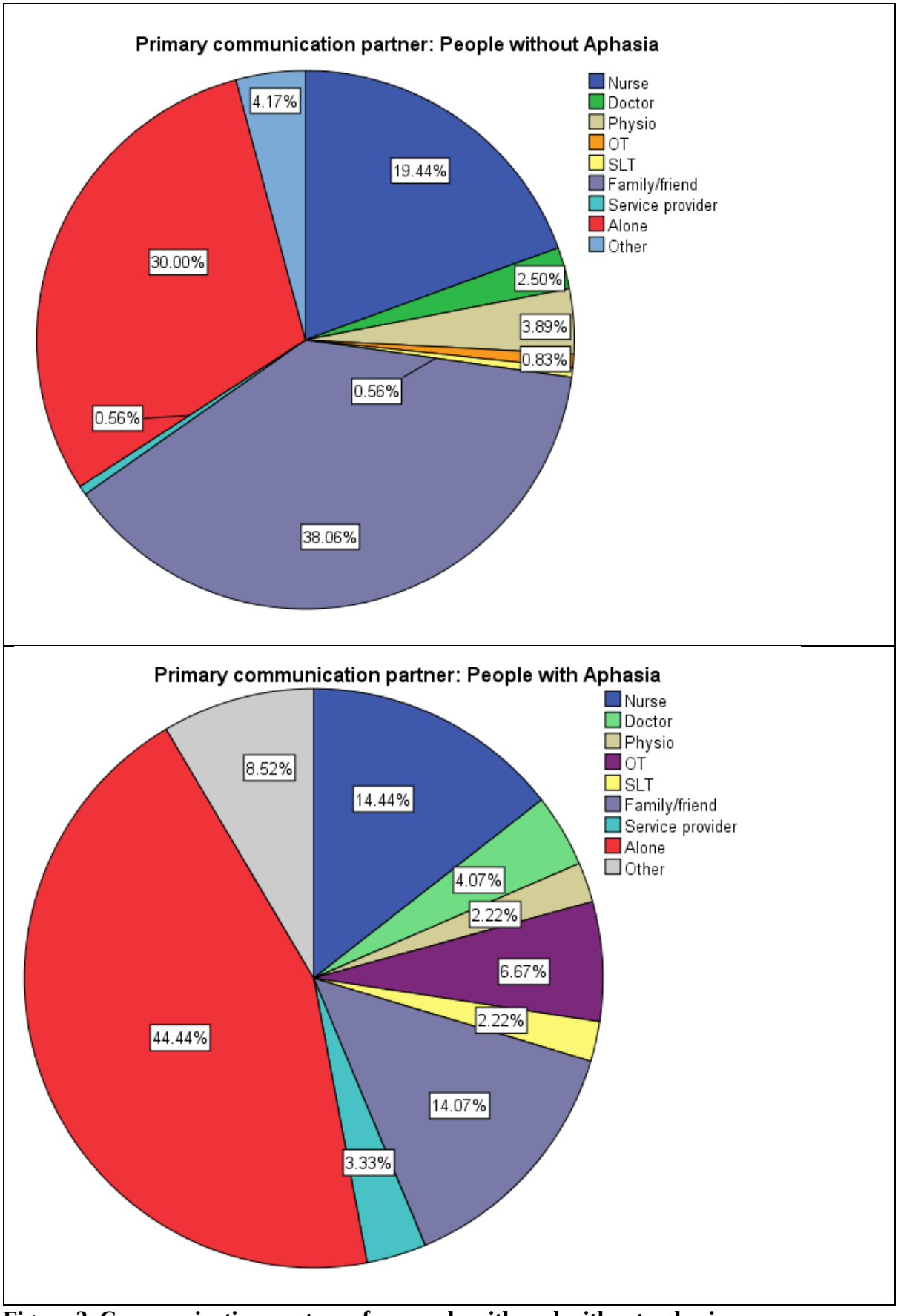

Figure 3. Communication partners for people with and without aphasia

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