

Research Paper

Limited changes in activities of daily life performance ability among people with schizophrenia at clinical settings and the factors moderating the changes



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ABSTRACT

Background: Impaired community functioning and functional ability are common among people with schizophrenia spectrum disorders (SSD). However, changes occurring in activities of daily life (ADL) ability through interventions provided at clinical settings have not been systematically examined in this population.

Methods: We retrospectively collated and analysed changes in ADL ability between admissions and discharges, measured utilising the Assessment of Motor and Process Skills (AMPS), among 72 people with SSD at a public inpatient treatment and rehabilitation facility in Western Australia. Clinical and demographic factors moderating the changes were also determined.

Results: The standardised AMPS motor ($p = 0.0088$) and process scores ($p < 0.0001$) improved significantly between admission and discharge. However, overall, the improvements were of small to moderate magnitude, and $> 60\%$ of participants did not experience significant or meaningful changes. Furthermore, mild to moderate impairment in the AMPS standardised motor (-1.3 SD), and process (-1.6 SD) ability was present at discharge. A logistic regression analysis revealed that low admission AMPS scores and duration of illness of more than five years predicted improvement of the AMPS motor score by discharge, but only the former predicted changes in the process scores. Other demographic, clinical, and treatment-related variables did not affect the outcome of the AMPS scores.

Conclusions: Impairment of ADL ability is recalcitrant in schizophrenia. The improvement was modest and occurred only in a proportion of participants. However, promisingly, chronic illness, low baseline ADL ability, treatment with clozapine and presence of treatment-resistant schizophrenia did not have an adverse effect on the outcome.

1. Introduction

Impaired functioning affecting multiple domains, including activities of daily living (ADL), is common among people with schizophrenia (Harvey and Bellack, 2009; Harvey et al., 2012; Samuel et al., 2018) and sustained recovery in functioning occurs in $< 15\%$ of this population (Jääskeläinen et al., 2013). Community functioning in people with schizophrenia is likely to be determined by a complex array of factors including the severity of symptoms, cognitive deficits, and psychosocial disadvantages and disincentives (Bechi et al., 2017; Gupta et al., 2012; Harvey and Strassnig, 2012; Leifker et al., 2009; Lepage et al., 2014; Lin et al., 2013; Reichenberg et al., 2014). Similarly, impaired ADL function such as shopping, cooking, cleaning, transport, and managing health, medications, and finances can contribute to low levels of independent living, employment and community participation (Harvey et al., 2012). Difficulties in reliably and cost-effectively assessing every day community functioning in this population, and the negligible chance of attaining significant functional milestones such as marriage and

employment within narrow time frames have generated considerable difficulties in measuring functional outcomes in short-term intervention studies in schizophrenia (Harvey et al., 2012; Mausbach et al., 2009; Moore et al., 2007). Hence, many researchers have advocated and implemented the use of functional capacity measures such as the University of California San Diego Performance-Based Skills Assessment (UPSA) (Patterson et al., 2001), its brief version UPSA-B (Mausbach et al., 2011) and Test of Adaptive Behaviour in Schizophrenia (TAB) (Velligan et al., 2007) as proxy measures of community functioning in research evaluating functional outcomes in schizophrenia (Mantovani et al., 2015; Patterson and Mausbach, 2010). Functional capacity can be defined as the skills and abilities people bring to execute a task in an optimal or standardised environment.

The UPSA, UPSA-B, and TAB utilise standardised role-play tasks of varying complexity in a contrived environment requiring participants to demonstrate abilities and knowledge to carry out tasks to evaluate their skills with comprehension, planning, finance, transportation, communication, and social activities. The Assessment of Motor and

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Process Skills (AMPS), on the other hand, is a standardised, reliable and valid observational performance analysis tool specifically designed to measure the person's ADL performance skills in natural environments (Fisher and Bray Jones, 2014). A trained occupational therapist measures the quality of a person's task performance as they carry out chosen, familiar and life relevant tasks such as showering, brushing teeth, dressing and eating; or domestic tasks, such as cooking, housework, and gardening and shopping. Thus, AMPS is likely to be measuring the ADL ability more accurately reflecting the real world situation. Ayres and John (2015) and Fossey et al. (2006) have previously demonstrated that a majority of people with schizophrenia admitted to treatment and rehabilitation facilities or living in supported residential rehabilitation settings have moderate to severe impairments of ADL ability as measured using the AMPS. However, to our knowledge, there are no published studies systematically evaluating changes in ADL performance skills following interventions among people with schizophrenia and the factors determining the changes. We aimed to evaluate whether: i) ADL performance ability improves among people with schizophrenia with concurrent pharmacological and psychosocial interventions provided at clinical settings ii) baseline clinical and demographic factors could predict improvement in ADL functioning in this population.

2. Methods

2.1. Setting and data collation

The study was conducted at a 12-bed, inpatient, medium length-of-stay, publicly funded psychiatric treatment and rehabilitation facility located in Perth, Western Australia. People with ICD-10 diagnosis of schizophrenia, schizoaffective disorder and unspecified non-organic psychosis who were admitted and discharged from the facility between December 2010 and December 2016 were considered for inclusion. After obtaining approval from the institutional ethics committee, we retrospectively acquired from the medical records, data of changes in ADL performance ability, measured using the AMPS, of participants with the afore-mentioned diagnoses admitted to the facility during the study period. As part of the usual pathway of clinical care, each person was offered an evaluation of their ADL performance using the AMPS along with other clinical assessments and standardised ratings on admission and at discharge. Integrated pharmacological and psychosocial interventions such as vocational rehabilitation, ADL skills training, cognitive training, physical exercise, illness management programs, and community-based leisure and social activities were provided, based on individualised management plans. We collated existing data of socio-demographic, clinical and treatment characteristics from the medical records, including age, gender, diagnosis, duration of illness, comorbidities, presence of treatment resistance, medications prescribed at discharge, ADL performance ability, employment, and living situation. Psychiatric diagnoses were made after detailed semi-structured clinical interviews by the senior psychiatrist of the team utilising the ICD-10 criteria. Treatment-resistance was defined clinically as lack of adequate response of positive symptoms to trials with two different antipsychotics at the usual clinically recommended dose for at least 6 weeks each (Suzuki et al., 2012). Information about ADL performance ability was extracted from the AMPS evaluations conducted by two senior occupational therapists who were trained and certified as reliable AMPS raters. Employment status before admission was coded into four categories: competitive work/formal study, non-competitive work, unpaid work and unemployed. Similarly, living situation immediately before hospitalisation was coded into categories adapted from Mausbach et al. (2011): 1. independent head of household; 2. semi-independent head of household, 3. not the head of household, but lives in the community such as in a group home, or as a dependent in the home of their parents or children; 4. residence in a hostel or treatment facility, and 5. homeless or in temporary crisis accommodation.

2.2. Instrument

AMPS is a standardised ADL performance ability evaluation measuring the quality of a person's task performance as they carry out chosen familiar and life relevant ADL tasks such as showering, brushing teeth, dressing, eating, cooking, housework, gardening, and shopping (Fisher and Bray Jones, 2014). AMPS has been standardised using a sample of 148,158 people of both gender aged 3–103. The sample included 9086 people with schizophrenia and 12,773 physically and psychiatrically healthy subjects. The AMPS trained occupational therapist observes and evaluates participants completing two or three life-relevant ADL tasks for increased effort, clumsiness, decreased efficiency, safety and need for assistance. In scoring the task performance, 16 different motor skills and 20 process skills were considered and given a raw score between markedly deficient (1) and competent (4). ADL motor skills are defined as the observable, goal-directed actions a person performs in order to move self or objects while interacting with the objects or environment as he or she performs an ADL task, such as walking, lifting, bending, reaching and manipulating. ADL process skills are defined as the observable, goal-directed actions a person performs as he or she a) selects, interacts with and uses task tools and materials; b) logically carries out individual actions and steps of an ADL task, and c) modifies his or her performance when problems occur. Process skill items include heeding instructions, attending to task, sequencing, organising and, adapting performance. Standardised age and gender-matched z scores for motor and process ability were obtained using the AMPS computer scoring software package version 9 (Fisher and Bray Jones, 2014) by converting raw scores into linear measures (logits) adjusted for the complexity of the ADL task and the stringency of the rater.

The AMPS has been demonstrated to be useful for determining changes in ADL task performance following interventions. The AMPS manual indicates that based on the standard error of measurement (*SE*) for the standardisation sample, a change of at least 2 *SE* (0.5 logits in motor ability or 0.4 logits in process ability), indicates a statistically significant change in most cases between the evaluations. Additionally, a change of at least 0.3 logits in motor or process ability is sufficient to be observable by the evaluating occupational therapist, and thus, the person's performance has changed in a practical and meaningful way (Fisher and Bray Jones, 2014). In this study, we calculated both the proportion of people who had statistically significant and practical and meaningful changes in ADL ability.

2.3. Participants

There were 180 people with a diagnosis of schizophrenia, schizoaffective disorder, or unspecified non-organic psychosis admitted to the facility during the study period. Of these, 72 people underwent the AMPS evaluation at both admission and discharge (AMPS completers), whose data were included for all analyses. Of the rest (AMPS non-completers), 70 had completed the AMPS evaluation on admission, 3 on discharge, and 35 did not undergo AMPS evaluation. Refusal by participants was the most common reason for the AMPS evaluation not being carried out, followed by non-availability of the AMPS trained therapist, very short admission and, the severity of clinical symptoms. AMPS evaluation was not repeated at discharge when participants were not keen for undergoing AMPS evaluation again and or it was clinically deemed as not required.

2.4. Data analysis

Socio-demographic and clinical characteristics of those who completed the AMPS and those who did not were compared using two-sample *t*-tests for continuous variables and logistic (binomial or multinomial) regression for categorical variables. Statistical significance of AMPS changes between admission and discharge in both the raw (logit)

Table 1
Demographic and clinical profile of people with schizophrenia who were admitted to the facility.

Characteristics		AMPS Completers (N = 72)		AMPS Non-completers (N = 108)		p-Value	
Demographic factors							
Age (in years)		Mean	SD	Mean	SD	0.4283	
		31.8	10.2	33.1	10.3		
Gender		Frequency	%	Frequency	%	0.4164	
	Male	47	65	77	71		
	Female	25	35	31	29		
Employment on admission	Competitive work/formal study	5	7	4	4	0.1076	
	Non-competitive work	3	4	0	0		
	Unpaid work	1	1	2	2		
	Unemployed	63	88	102	94		
Accommodation on admission	Household head - Independent	17	24	15	14	0.1979	
	Household head - Semi-Independent	4	6	12	11		
	Semi-supported in community	29	40	41	38		
	In fully supported facility	9	13	11	10		
	Homeless	13	18	29	27		
Clinical factors	Diagnosis	Schizophrenia	64	89	85	79	0.0884
		Schizo-affective disorder	4	6	14	13	
		Unspecified psychosis	4	6	9	8	
			Mean	SD	Mean	SD	
	Length of stay (in days)	144.5	83.0	94.7	60.5	< 0.0001	
	Duration of illness (in years)	9.7	8.2	7.9	7.1	0.1277	
		Frequency	%	Frequency	%		
Duration of illness categories	< 2 years	7	10	16	15	0.6440	
	2–5 years	19	26	25	23		
	> 5 years	46	64	67	62		
Treatment resistant	Yes	63	88	75	69	0.0065	
	No	9	13	33	31		
Treated with clozapine	Yes	51	71	60	56	0.0402	
	No	21	29	48	44		
Had cognitive training	Yes	45	63	43	40	0.0031	
	No	27	38	65	60		
Substance abuse							
Alcohol		Frequency	%	Frequency	%	0.4902	
	Yes	25	35	43	40		
	No	47	65	65	60		
Stimulants	Yes	15	21	32	30	0.1901	
	No	57	79	76	70		
Cannabis	Yes	22	31	57	53	0.0036	
	No	50	69	51	47		
Other drugs	Yes	3	4	18	17	0.0178	
	No	69	96	90	83		
Any substance	Yes	30	42	65	60	0.0154	
	No	42	58	43	40		

measures and standardised (z score) forms was evaluated using paired t-tests. Once these changes were demonstrated to be statistically significant, generalized linear modelling was employed to assess the statistical significance of the participants' characteristics as potential predictors of the change. Categories of changes (i.e., statistically significant change, clinically observable change or no change) were also documented.

Statistical significance was set at $\alpha = 0.05$. Thus, estimates of effect sizes are accompanied by respective 95% confidence intervals (CIs). Data analysis was conducted in SAS (Statistical Analysis System) software version 9.3 (SAS Institute, Cary NC).

3. Results

3.1. Sample characteristics

The mean age of the 72 participants who completed the AMPS both on admission and discharge was 32 years (*SD* 10.2), with 65% being males (Table 1). The baseline demographic characteristics such as age, gender, occupational and accommodation status of the AMPS completers and non-completers were comparable. The clinical characteristics of our sample ($n = 72$) such as the high proportion of participants with treatment-resistant schizophrenia (88%), being treated with clozapine (71%), using illicit drug use (42%), and being unemployed (88%) reflected the severe nature of the illness (Table 1). There were some indications that those who completed the AMPS possibly had a

more severe clinical profile than non-completers of the AMPS as shown by their increased length of stay, higher proportion with treatment resistance status, and being treated with clozapine. Furthermore, the AMPS motor z score (mean -0.94 , *SD* 0.96) on admission of those who were evaluated using the AMPS only on admission ($n = 70$) was significantly higher ($t = 3.62$, $p = 0.0004$) than that of the completers, (i.e., who completed the evaluation both on admission and at discharge: mean -1.56 , *SD* 1.07). Similarly the process z score was significantly higher ($t = 2.95$, $p = 0.0037$) in the admission-only group (mean -1.53 , *SD* 1.04) compared to the completer group (mean -2.05 , *SD* 1.06). The AMPS completers were less likely to use illicit drugs and participated more in cognitive training compared to the rest of the participants.

3.2. Changes in ADL ability

Standardised ADL ability measures of the AMPS completers on admission (mean motor z score -1.6 *SD*; process z score -2 *SD*) revealed moderate deficits compared to normative data (Table 2). Both the ADL motor and process ability measures improved significantly by the time of discharge with the improvements in process skills being particularly remarkable, with a moderate effect size (Cohen's $d = 0.45$). Improvement in the ADL motor score, though significant, was more modest with a small effect size (Cohen's $d = 0.25$). However, impairments in ADL performance ability persisted at discharge with a mean motor z score of -1.3 and process z score of -1.6 .

Table 2
Distribution of AMPS scores at admission, discharge, and their changes among the AMPS completers (N = 72).

	Admission/baseline		Discharge		Discharge – admission difference		
	Mean	SD	Mean	SD	Mean (95% CI)	p-Value	Cohen's d
Motor - raw (logit)	2.15	0.52	2.26	0.47	0.11 (0.02–0.2)	0.0185	0.22
Motor - standardised	–1.56	1.07	–1.31	0.98	0.25 (0.07–0.44)	0.0088	0.25
Process - raw (logit)	1.16	0.43	1.35	0.44	0.19 (0.11–0.27)	< 0.0001	0.43
Process - standardised	–2.05	1.06	–1.59	0.99	0.46 (0.27–0.65)	< 0.0001	0.45

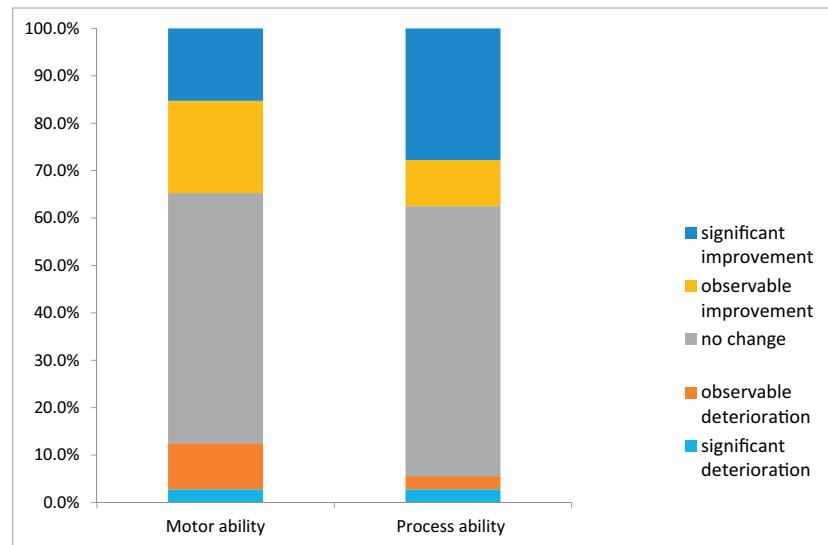


Fig. 1. Categories of changes: significant, observable and no changes in the AMPS motor and process scores from admission to discharge among participants.

Changes in ADL measures were also categorised as statistically significant improvement, improvement observable by the trained clinician, no change, observable deterioration and statistically significant deterioration (Fig. 1). > 60% of participants did not show improvement in ADL motor or process ability by the time of discharge, while approximately one-third had observable or statistically significant improvements in motor and process z scores. Deterioration of ADL ability was observed among a minority of participants (12.5% on motor ability and 5.6% on process ability).

3.3. Predictors of changes in ADL ability

Tables 3 reveals a strong baseline effect for both standardised motor and process score changes during the hospital stay. Specifically, for every 1-point increment in the participant's baseline motor or process score, the magnitude of their improvement was lessened by 0.36 on both motor and process scores at discharge. Duration of illness was also a significant predictor of standardised motor score change, but not process score change. Those who had been ill for five years or less, on average, benefited a lesser improvement in the motor score at discharge, by 0.4 points, compared to their peers who had been ill for more than five years. When the duration of illness was considered together with baseline motor score as co-predictors, although both remained statistically significant, the baseline effect dominated, as indexed by the r^2 measure. No other measured clinical (diagnosis, comorbid substance abuse, length of admission, presence of treatment-resistant schizophrenia, treatment with clozapine, participating in cognitive training) or demographic (age, gender, occupation and accommodation) variables had significant effect on either motor or process score changes.

4. Discussion

We evaluated changes in ADL performance ability and the factors associated with improvement among a sample of patients with schizophrenia-spectrum disorders drawn from an everyday clinical setting. While the sample was not consecutively recruited and included only 40% of eligible admissions with these conditions, the demographic and clinical characteristics of those who completed two AMPS evaluations were mostly similar to those who did not complete the assessments. Furthermore, comparison of the baseline AMPS scores of our sample with those who did only one AMPS assessment indicated that the sample included in the analysis had more severe ADL ability impairments. Our participants had very high rates of treatment resistance, clozapine treatment, and comorbidities, and thus can be considered as broadly representative of people with schizophrenia spectrum disorders admitted to medium-length-of-stay treatment and rehabilitation facilities of public mental health services in Western countries. To our knowledge, this is the first published study explicitly looking at changes in ADL motor and process performance ability and the factors predicting those changes using standardised instruments such as the AMPS among people with severe mental illnesses such as schizophrenia.

Our finding of significant improvement in both the ADL motor and process ability among this group of people with severe schizophrenic illness is remarkable and encouraging. Very low rates of sustained functional recovery among people with schizophrenia have been reported through meta-analysis and reviews (Harvey and Bellack, 2009; Jääskeläinen et al., 2013). However, while there was a statistically significant change in the motor and process ability measures at discharge compared to admission, the effect sizes were in the small to moderate range. Furthermore, the majority of the participants (> 60%) did not achieve statistically significant or practically meaningful improvement in ADL functioning. However, it is remarkable that even

Table 3
Factors associated with changes at discharge compared to admission in standardised AMPS motor and process scores (N = 72).

Factor	Comparison	Motor scores				Process scores				Other factors concurrently considered
		Effect				Effect				
		Estimate	95% CI	p-Value	r ²	Estimate	95% CI	p-Value	r ²	
Univariate models										
Baseline score	1-point increment in score	-0.36*	-0.52, -0.2	< 0.0001	0.231	-0.36*	-0.52, -0.2	< 0.0001	0.218	None
Age	> 30 years v ≤ 30 years	0.28	-0.1, 0.66	0.1412	0.031	-0.22	-0.61, 0.16	0.2488	0.019	None
Gender	Female v male	-0.03	-0.42, 0.37	0.8960	0.000	0.06	-0.35, 0.46	0.7792	0.001	None
Diagnosis	Schizophrenia v unspecified psychosis	0.28	-0.56, 1.11	0.5116	0.007	-0.07	-0.92, 0.78	0.8735	0.000	None
	Schizoaffective v unspecified psychosis	0.18	-0.97, 1.32	0.7610		-0.08	-1.24, 1.09	0.8983		None
Length of stay	1 extra day of stay	0.00	0, 0	0.7520	0.001	0.00	0, 0	0.2858	0.016	None
Duration of illness	≤ 5 years v > 5 years	-0.40*	-0.79, -0.02	0.0388	0.060	-0.11	-0.51, 0.29	0.5984	0.004	None
Treatment resistant	Yes v no	0.25	-0.32, 0.82	0.3796	0.011	-0.17	-0.76, 0.41	0.5668	0.005	None
Used any drug/alcohol	Yes v no	-0.17	-0.55, 0.21	0.3843	0.011	-0.12	-0.51, 0.28	0.5597	0.005	None
Treated with dozapine	Yes v no	-0.09	-0.5, 0.33	0.6794	0.002	0.01	-0.42, 0.43	0.9684	0.000	None
Employment on admission	Yes v no	-0.20	-0.77, 0.37	0.4830	0.007	-0.09	-0.68, 0.49	0.7481	0.001	None
Accommodation on admission	Home v unstable ^a	-0.36	-0.85, 0.12	0.1430	0.038	-0.07	-0.57, 0.43	0.7832	0.017	None
	Community v unstable ^a	-0.31	-0.76, 0.14	0.1684		0.18	-0.29, 0.64	0.4475		None
Cognitive training	Yes v no	0.02	-0.37, 0.41	0.9192	0.000	-0.21	-0.61, 0.18	0.2840	0.016	None
Cognitive training hours	1 extra hour	0.00	-0.01, 0.01	0.9087	0.000	-0.01	-0.02, 0	0.1113	0.036	None
Multivariate model						Not applicable				
Baseline score	1-point increment in score	-0.35*	-0.5, -0.19	< 0.0001	0.227					Duration of illness
Duration of illness	≤ 5 years v > 5 years	-0.34*	-0.68, 0	0.0489	0.055					Baseline score

* Effect significant with p < 0.05.

^a 'Unstable' accommodation includes: In fully supported facility, homeless, or in acute inpatient facility.

among our sample drawn from a public mental health service catering for the more severe end of the spectrum of schizophrenia illness, with a high proportion of treatment resistance and comorbidities, a significant proportion achieved improvement in ADL functional ability. The changes in AMPS measures required to achieve a clinically significant improvement in ADL ability among people with severe form of schizophrenia have not been well-researched.

The magnitude of improvement in the ADL process score observed in our study was more substantial compared to the motor score. Motor and process scores evaluate different aspects of ADL performance skills. The goal-directed actions a person performs moving him/herself or moving objects is evaluated as part of motor skill assessment; process skill items include heeding instructions, attending to task, sequencing, organising and adapting performance (Fisher and Bray Jones, 2014). It is reasonable to speculate whether the interventions provided at our service had a differential effect on the motor and process abilities and improved the process ability better. It is also possible that the anti-psychotic and other psychotropic medications generated sedation, weight gain, and extrapyramidal effects, and thus had a detrimental effect on motor abilities, preventing a more robust improvement in this area. Overall, our study demonstrates that concurrent short-term administration of evidence-based psychopharmacological and psychosocial treatments at everyday clinical settings provide a small but significant benefit to the ADL performance ability of people with schizophrenia spectrum disorders. However, the nature of our study precludes us from ascertaining the differential effect of various interventions on ADL performance abilities.

The persistence of mild to moderate impairments in both motor and process ability at discharge further corroborate that ADL functional impairments are intractable in many people with schizophrenia and would require longer-term interventions. While we have not come across similar interventional studies evaluating the improvement in ADL ability utilising AMPS, short-term randomised controlled trials of pharmacological and non-pharmacological interventions in schizophrenia employing role play instruments such as the UPSA and UPSA-B have yielded inconsistent findings, with either improvement of small magnitude (Bowie et al., 2014; Harvey et al., 2013; Javitt et al., 2012) or no changes (Buchanan et al., 2011; Mendella et al., 2015; Murthy et al., 2012; Walling et al., 2016) being observed. Deterioration of AMPS scores was observed among a minority of participants with motor abilities deterioration (12.5%) being larger than process abilities (5.6%). The aetiology of this deterioration among a subgroup of participants is unclear and could be due to the natural course of the illness, limited motivation with the assessment process, lack of compliance with interventions, the ineffectiveness of treatment provided, or secondary to the side effects of antipsychotics or other medications.

The average length of stay of our participants was approximately five months. While there is no evidence from our study to suggest that the length of stay moderated improvement in ADL ability, it is not possible to rule out whether additional benefits would have accrued in some participants with more extended periods of interventions. Furthermore, while many researchers have suggested utilising functional capacity measures as proxy measures for community functioning in schizophrenia, doubts have been raised recently whether functional capacity would correlate robustly with real-world functioning. Severity of negative, positive and other symptoms and various psychosocial factors in schizophrenia are likely to have an important role in mediating the transfer of improved ADL ability to changes in real-world functioning (Bechi et al., 2017; Gupta et al., 2012; Leifker et al., 2009; Lin et al., 2013). In this study, we have not examined how the changes in ADL ability translate into real-world community functioning outcomes.

Baseline score was the only significant predictor of improvement in the AMPS motor and process scores among the various clinical, demographic, and treatment-related variables we evaluated. Though chronicity (duration of illness of more than five years) also predicted

improvement on the motor score, the effect of low baseline score predominated. Interestingly, treatment with clozapine, the presence of treatment-resistant schizophrenia, participation in the cognitive training program, or different diagnostic categories did not differentially predict improvement in either motor or process scores. It is heartening to note that neither low baseline ADL ability scores nor chronicity of illness, which can generate pessimism among clinicians and care providers, had a negative effect on the outcome among our sample of people with schizophrenia. While it could be speculated that those with lower baseline scores have potentially more room for improvement, it could also be argued that those with more severe impairments are likely to have more difficulty with skill acquisition and to demonstrate improvement in functioning. Thus the more significant improvement noted among those with low baseline score cannot be readily dismissed as an artefact of measurement.

4.1. Limitations

There are some limitations to this study. Being a retrospective naturalistic study, we could not control for many clinical and treatment variables, hence the effect of individual treatments cannot be discerned. Based on standard clinical practice, treatments were provided through management plans constructed on each person's needs, preferences, and willingness to accept treatment. Adherence to psychopharmacological treatments was ensured through supervision and dispensing of medication by nursing staff. Though participation in at least 2 h of a variety of psychosocial programs was vigorously encouraged and supported by the staff, the extent of participation varied. We did not evaluate the severity of negative and positive symptoms exhibited by the participants either at admission or at discharge. The use of an instrument such as the Positive and Negative Symptom Scale (PANSS) and ascertaining the relationship between changes in the symptom score and the AMPS score would have provided additional useful information. Furthermore, this is a short-term study, and it is unclear whether the ADL performance ability of participants would have continued to improve with ongoing interventions or whether the improvement in functioning will be sustained after discharge from the facility. The generalizability of the findings to other settings such as outpatient and community settings cannot be guaranteed. The relationship of cognition to AMPS score and the role of the AMPS scores in predicting discharge accommodation and employment are not addressed in this study and will be reported in a separate paper. It can be argued that some of the improvement in the AMPS scores observed at discharge in this study could be partially due to practice effect secondary to re-administration of the evaluation. However, validation studies of the AMPS have demonstrated that practice effect is negligible with repeat administration of the instrument and the AMPS has also been used to study changes in ADL performance ability in the physically ill population (Fisher and Bray Jones, 2014).

In conclusion, our study demonstrates that it is possible to achieve small to moderate improvement of ADL motor and process ability among a significant proportion of people with schizophrenia spectrum disorders provided clinical care at public mental health services. Furthermore, baseline severity of ADL ability impairments and chronicity of illness do not preclude improvement with interventions.

Conflict of interest

All authors have no conflict of interest to declare.

References

- Ayres, H., John, A.P., 2015. The Assessment of Motor and Process Skills as a measure of ADL ability in schizophrenia. *Scand. J. Occup. Ther.* 22 (6), 470–477.
- Bechi, M., Bosia, M., Spangaro, M., et al., 2017. Exploring functioning in schizophrenia: predictors of functional capacity and real-world behaviour. *Psychiatry Res.* 251, 118–124.
- Bowie, C.R., Grossman, M., Gupta, M., Oyewumi, L.K., Harvey, P.D., 2014. Cognitive

- remediation in schizophrenia: efficacy and effectiveness in patients with early versus long-term course of illness. *Early Interv. Psychiatry* 8 (1), 32–38.
- Buchanan, R.W., Keefe, R.S., Lieberman, J.A., et al., 2011. A randomized clinical trial of MK-0777 for the treatment of cognitive impairments in people with schizophrenia. *Biol. Psychiatry* 69 (5), 442–449.
- Fisher, A.G., Bray Jones, K., 2014. *Assessment of Motor and Process Skills Volume 1: Development, Standardisation, and Administration Manual*, eighth edition. Three Star Press, Fort Collins, Colorado, USA.
- Fossey, E., Harvey, C., Plant, G., Pantelis, C., 2006. Occupational performance of people diagnosed with schizophrenia in supported housing and outreach programmes in Australia. *Br. J. Occup. Ther.* 69 (9), 409–419.
- Gupta, M., Bassett, E., Iftene, F., Bowie, C.R., 2012. Functional outcomes in schizophrenia: understanding the competence-performance discrepancy. *J. Psychiatr. Res.* 46 (2), 205–211.
- Harvey, P.D., Bellack, A.S., 2009. Toward a terminology for functional recovery in schizophrenia: is functional remission a viable concept? *Schizophr. Bull.* 35 (2), 300–306.
- Harvey, P.D., Strassnig, M., 2012. Predicting the severity of everyday functional disability in people with schizophrenia: cognitive deficits, functional capacity, symptoms, and health status. *World Psychiatry* 11 (2), 73–79.
- Harvey, P.D., Heaton, R.K., Carpenter, W.T., Green, M.F., Gold, J.M., Schoenbaum, M., 2012. Functional impairment in people with schizophrenia: focus on employability and eligibility for disability compensation. *Schizophr. Res.* 140 (1–3), 1–8.
- Harvey, P.D., Siu, C.O., Hsu, J., Cucchiaro, J., Maruff, P., Loebel, A., 2013. Effect of lurasidone on neurocognitive performance in patients with schizophrenia: a short-term placebo- and active-controlled study followed by a 6-month double-blind extension. *Eur. Neuropsychopharmacol.* 23 (11), 1373–1382.
- Jääskeläinen, E., Juola, P., Hirvonen, N., et al., 2013. A systematic review and meta-analysis of recovery in schizophrenia. *Schizophr. Bull.* 39 (6), 1296–1306.
- Javitt, D.C., Buchanan, R.W., Keefe, R.S.E., et al., 2012. Effect of the neuroprotective peptide davunetide (AL-108) on cognition and functional capacity in schizophrenia. *Schizophr. Res.* 136 (1), 25–31.
- Leifker, F.R., Bowie, C.R., Harvey, P.D., 2009. Determinants of everyday outcomes in schizophrenia: the influences of cognitive impairment, functional capacity, and symptoms. *Schizophr. Res.* 115 (1), 82–87.
- Lepage, M., Bodnar, M., Bowie, C.R., 2014. In review neurocognition: clinical and functional outcomes in schizophrenia. *Can. J. Psychiatr.* 59 (1).
- Lin, A., Wood, S.J., Yung, A.R., 2013. Measuring psychosocial outcome is good. *Curr. Opin. Psychiatry* 26 (2), 138–143.
- Mantovani, L.M., Teixeira, A.L., Salgado, J.V., 2015. Functional capacity: a new framework for the assessment of everyday functioning in schizophrenia. *Rev. Bras. Psiquiatr.* 37 (3), 249–255.
- Mausbach, B.T., Moore, R., Bowie, C., Cardenas, V., Patterson, T.L., 2009. A review of instruments for measuring functional recovery in those diagnosed with psychosis. *Schizophr. Bull.* 35 (2), 307–318.
- Mausbach, B.T., Depp, C.A., Bowie, C.R., et al., 2011. Sensitivity and specificity of the UCSD Performance-based Skills Assessment (UPSA-B) for identifying functional milestones in schizophrenia. *Schizophr. Res.* 132 (2–3), 165–170.
- Mendella, P.D., Burton, C.Z., Tasca, G.A., Roy, P., St Louis, L., Twamley, E.W., 2015. Compensatory cognitive training for people with first-episode schizophrenia: results from a pilot randomized controlled trial. *Schizophr. Res.* 162 (1–3), 108–111.
- Moore, D.J., Palmer, B.W., Patterson, T.L., Jeste, D.V., 2007. A review of performance-based measures of functional living skills. *J. Psychiatr. Res.* 41 (1–2), 97–118.
- Murthy, N.V., Mahncke, H., Wexler, B.E., et al., 2012. Computerized cognitive remediation training for schizophrenia: an open label, multi-site, multinational methodology study. *Schizophr. Res.* 139 (1–3), 87–91.
- Patterson, T.L., Mausbach, B.T., 2010. Measurement of functional capacity: a new approach to understanding functional differences and real-world behavioral adaptation in those with mental illness. *Annu. Rev. Clin. Psychol.* 6 (1), 139–154.
- Patterson, T.L., Goldman, S., McKibbin, C.L., Hughes, T., Jeste, D.V., 2001. UCSD Performance-Based Skills Assessment: development of a new measure of everyday functioning for severely mentally ill adults. *Schizophr. Bull.* 27 (2), 235–245.
- Reichenberg, A., Feo, C., Prestia, D., Bowie, C.R., Patterson, T.L., Harvey, P.D., 2014. The course and correlates of everyday functioning in schizophrenia. *Schizophr. Res. Cogn.* 1 (1), e47–e52.
- Samuel, R., Thomas, E., Jacob, K., 2018. Instrumental activities of daily living dysfunction among people with schizophrenia. *Indian J. Psychol. Med.* 40 (2), 134–138.
- Suzuki, T., Remington, G., Mulsant, B.H., et al., 2012. Defining treatment-resistant schizophrenia and response to antipsychotics: a review and recommendation. *Psychiatry Res.* 197 (1), 1–6.
- Velligan, D.I., Diamond, P., Glahn, D.C., Ritch, J., Maples, N., Castillo, D., Miller, A.L., 2007. The reliability and validity of the Test of Adaptive Behavior in Schizophrenia (TABS). *Psychiatry Res.* 151 (1), 55–66.
- Walling, D., Marder, S.R., Kane, J., et al., 2016. Phase 2 trial of an alpha-7 nicotinic receptor agonist (TC-5619) in negative and cognitive symptoms of schizophrenia. *Schizophr. Bull.* 42 (2), 335–343.