



Assertive Community Programs for Patients with Severe Mental Disorders: Are Benefits Sustained After Discharge?

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Abstract

The benefits of assertive community treatment (ACT) on patients with severe mental disorders are well established over short or medium term. However, studies that investigate long term outcomes are remarkably scarce. Thus, this study aimed to evaluate patient's long term clinical and psychosocial evolution after discharge from ACT. An assessment was conducted on 29 patients characterized by inpatient facilities heavy use and refusal of care, who were included in an ACT program 8.7 (SD=0.7) years ago and discharged 6.3 (SD=1.8) years ago. Results of the follow up showed decreased rates of hospitalizations and symptomatology, as well as sustained improvement in adherence to care, in quality of life and in social functioning. This data suggests that ACT programs can help refractory to care patients to gain clinical and psychosocial improvement and lay foundation for better long-term adherence to care. Results also suggest that ACT didn't imply a lifetime treatment.

Keywords ACT · Assertive community treatment · Long term outcome · Severe mental illness · Discharge

Introduction

Assertive Community Treatment (ACT) was developed in the 1970s to treat patients with severe mental disorders in the community, in order to reduce hospital admission, increase continuity of care and improve psychosocial outcomes without shifting the burden of care to families (Gold Award 1974; Stein and Santos 1998; Marshall and Lockwood 2000; Dixon 2000). The model evolved over time and ACT has

become one of the few evidence-based practices for adults with severe mental disorders, with many studies describing its efficiency in ameliorating clinical, psychosocial and service use outcomes (Marshall and Lockwood 2010; Bond et al. 2002). Research highlights ACT's positive impact on number and length of inpatients stays (Huguélet et al. 2012), on retention in care with a better adherence to treatment (Drukker et al. 2014), an improved autonomy and stability in home (Marshall and Lockwood 2010) and a reduced risk of becoming homeless (Coldwell and Bender 2007). Controversy came with studies showing little or no effect of such programs in England (Burns 2010; Killaspy et al. 2009) and Netherlands (Systema et al. 2007), as compared with usual outpatients care. Yet this inconsistency has been related both to healthcare and social systems specificities in these countries whose standard care is especially assertive (Hoof et al. 2011), as well as clinical characteristics of patients (Burns et al. 2007; Huguélet et al. 2012).

Beneficial effects of ACT programs appear to be globally well established over short or medium term through numerous studies with follows-up ranging from 6 months to 2 years in many countries (Marshall and Lockwood 2010; Schottle et al. 2014), even with studies assessing mechanisms underlying this effectiveness (Schmidt et al. 2018). However, little is known about longer effects: studies that investigated long term clinical and social outcomes of

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patients who received ACT have been remarkably scarce so far, and to our knowledge, non-existent after patient's discharge from these programs.

Aagaard and Muller-Nielsen (2011; Halling-Hastrup and Aagaard 2015; Aagaard and Kolbaek 2016) carried out a case-control follow up study in Denmark of patients suffering from psychotic spectrum and bipolar disorders with either abuse of substances, forensic sanction, or high use of inpatient services. They compared treatment by ACT team to standard outpatient care, and published 2- and 4-year follow-up data. The 2-year follow up concluded to a significant advantage of ACT in reducing hospitalization, increasing adherence to outpatient services and improving patient's functioning. Yet, results of the four-year follow up were exclusively register-based and specifically aimed to assess costs and retention in mental health services, with a benefice of ACT teams concerning costs. Interestingly though, there was no significant differences concerning retention in care. To our knowledge only the REACT study, taking place in the UK, carried out long-term investigations on clinical and social outcomes of patients receiving ACT, with follow up data extension up to 10 years. This study, showing no effect of ACT programs compared to usual care in London after 18 months of follow up (Killaspy et al. 2006), still showed no benefit after 3 years (Killaspy et al. 2009) and 10 years (Killaspy et al. 2014). However, assessment of ACT in the UK, due to standard care (Glover 2007) and clinical characteristics of patients is scarcely generalizable to other countries.

Thus, the question of long term outcomes of patients treated by ACT teams remains: to date, it's necessary to assess whether the support and intensive care delivered by ACT teams may lay foundation for better long-term adherence to care, and better clinical and psychosocial evolution.

The present study sought further understanding on this issue by evaluating the evolution of patients who were treated by an ACT team in Geneva since its implementation in 2007, and who therefore participated at that time in an initial study on the effect of the program (Huguelet et al. 2012). Main objectives were to assess, years after their discharge from ACT, patient's clinical and psychosocial outcomes. More specifically, we evaluated their rates of hospitalizations after ACT discharge, their current adherence to care and to medication, as well as their current symptomatology, quality of life, social functioning, and degree of recovery.

Methods

Context

An ACT team is implemented in Geneva, Switzerland, since 2007. Given the wide range of care devoted to psychiatry

and addictive disorders offered in the area and the results of a retrospective study in Lausanne, Switzerland (Bonsack et al. 2005), Geneva's ACT mobile team has been designed, since its creation, to be specific and transitory: it aims to exclusively reach patients suffering from severe and persistent mental illness who are refractory to care, difficult to engage or to maintain in treatment programs; patients who therefore remain careless or subject to frequent hospitalizations (the so-called 'revolving-door' patients) thus requiring a different care model. Through intensive care in the community, ACT team objectives are multiple: to relieve symptoms; psychosocial dysfunctions and families' burden, to avoid hospital admission and to reconnect patients with social network and with usual outpatients' facilities. Care is provided as long as needed on a time-unlimited basis. However, a key work of ACT team program is to engage patients who are refractory to usual care and allow a transition to outpatient psychiatric care by helping patients create links. That goal is attained when the need for intensive professional care is lower and the risk of disengagement becomes less important. Thus, the degree of fidelity to ACT model, assessed using the Dartmouth index (Teague et al. 1998) is moderate, i.e. 3.82. One main difference with ACT model is that, due to the specific and wide range of addiction services in the city, patients with substance use disorders treated by Geneva's ACT team were actually marginal. Therefore, ACT program criteria concerning individualized substance abuse treatment provided directly by a program member is not strictly followed, according to similar care implemented in comparable setting, e.g. in Lausanne, Switzerland (Bonsack et al. 2005). Also because of the wide range of psychiatric services in the city, Geneva's ACT team don't need to offer 7/7 and 24/24 care.

Subjects

During the ACT team's implementation in Geneva, an open study aiming to describe the impact of the new program on patients and their families took place from the 1st of October 2007 to the 20th of August 2009. Data was gathered for all patients from the beginning of the program, both at inclusion and after 6 months. Fifty-five patients consented to be included in this initial study whose detailed methods and results are reported elsewhere (Huguelet et al. 2012). All patients who participated in the initial study were consecutively recalled for the long term follow-up, which began on the 1st of September 2016 and ended on the 31st of August 2017. All patients received detailed information about the study and gave their written consent. The study was approved by the ethics committee of the University Hospitals of Geneva. From the 55 patients who participated at baseline, 15 refused participation, 3 definitively left the

country, 2 were unreachable and 6 patients died. Hence 29 patients were enrolled in the follow up study.

Data Collection and Assessment

In order to allow comparison; patients' symptoms, psychosocial functioning and quality of life were assessed using the same scales as those administered in the initial study. We therefore used the Brief Psychiatric Rating Scale (BPRS) (Overall and Gorham 1962; Koperlowicz et al. 2008) to assess intensity of current symptoms, the Alcohol Use Scale (AUS), the Drug Use Scale (DUS) and the Substance Abuse Treatment Scale (SATS) to investigate alcohol and drug consumption (Drake and Wallach 1989; Drake et al. 1990; McHugo et al. 1999); and the Medication Adherence Rating Scale (MARS) (Thompson et al. 2000; Fialko et al. 2008) to assess patients' compliance with pharmacological treatment.

Quality of life was measured with the World Health Organization Quality of Life (WHOQOL-BREF) (WHOQOL Group 1998), and we used the Multnomah Community Ability Scale (MCAS) (Barker et al. 1994a, b; Corbière et al. 2002; Bassani et al. 2009) to evaluate patient's social functioning in the community. In addition, patients were invited to rate their personal confidence and hope, their willingness to ask for help, their reliance on others and their domination by symptoms through the Recovery Assessment Scale (RAS). (Corrigan et al. 2004; Roe et al. 2012).

To assess psychiatric level of care since discharge from ACT, we extracted data from psychiatric register of the city hospital, which contains information on publicly owned hospitals including inpatient and outpatient treatments and visits at emergency wards. Thus, data on number and duration of voluntarily and involuntarily hospitalizations were obtained. Participants were directly asked to obtain data about services delivered by private professionals and admission in private clinics. All discharges from public hospital, in which this information often appear, were also systematically reviewed.

Data Analysis

Between-group analysis of baseline characteristics were performed using ANOVA and X^2 as appropriate. All statistics on demographical and clinical characteristics were computed using SPSS version 22 (IBM Corporation, Armonk, NY).

For the 29 patients accepting to participate to the last assessment, we used linear mixed models with fixed effect of time (at baseline, at 6 months and at discharged) and a random effect of individual, fitted with maximum likelihood with additional fixed effects (adjustment on) of age, gender, and baseline severity of each individual scales, time elapsed since discharge of the ACT, and time spent in ACT to analyze if ACT was significantly associated with improvement in intensity of symptoms (BPRS), adherence to treatment

(MARS), quality of life (WHOQOL-BREF), social functioning (MCAS) and stage of recovery (RAS). The results of regression models are presented as standardized regression coefficients (β) with 95% confidence intervals which can be interpreted as effect size. Stata V13 was used for these analyses.

Results

Baseline and 6 Month Assessments of Patients: Clinical and Demographic Characteristics

Baseline assessments took place at ACT program inclusion, and patients were assessed again after 6 months of treatment. Fifty-five of the first treated patients consented inclusion in the research. Table 1 presents their baseline clinical and demographical characteristics, as well as overall scores of scales at baseline and after 6 months of treatment.

Patients who participated in the long term follow up ($n=29$) and patients who did not ($n=26$) didn't differ in any baseline characteristic. In terms of treatment response at the 6 first month assessments (symptoms, quality of life, social functioning, recovery and adherence to treatment) there was no significant difference between the two groups.

The mean duration of ACT treatment was 25.8 months ($SD=16$), with significantly briefer treatments among patients who did not participated in the long term follow up (mean = 20.8, $SD=13$) compared to long term follow up participants (mean = 30.2, $SD=17$) ($p=0.03$).

Clinical and Socio-demographic Characteristics of Patients at Follow Up

The current socio-demographic and clinical characteristics of the 29 follow up participants are shown in Table 2. The mean duration of ACT program was 30.2 months, with interventions shorter than 2 years for 51.7% of the 29 patients.

In total, the mean number of years from inclusion in the ACT program until long term follow-up was 8.7 years, and the mean number of years after ACT discharge was 6.3. Changes in diagnostics occurred over this time: Four patients who were diagnosed as "other psychotic disorders" (one with delusional disorder and three with unspecified psychosis) received afterwards the diagnostic of schizophrenia paranoid type; and three patients, two diagnosed with schizophrenia paranoid type and one with bipolar disorder, received the diagnostic of schizoaffective disorders.

All patients were currently in contact with psychiatric services, either treated in inpatients services ($n=2$) or by an ACT team again ($n=4$), or treated by standard outpatients care ($n=8$) or by private psychiatrists ($n=15$). Among the two patients receiving inpatient care, one was hospitalized

Table 1 Baseline and 6 months assessments of the 55 patients: comparisons between patients who participated to the entire study (n=29) and patients who did not (n=26)

	Baseline assessments				6 months assessments			
	Long term follow-up participants (n=29)	Long term follow-up Non participants (n=26)	Stat	p value	Long term follow-up participants (n=29)	Long term follow-up non participants (n=26)	Stat	p value
Female % (n)	44.8 (n=13)	42.3 (n=11)	$X^2=0.35$	ns				
Age (mean, SD)	40.4 (11.8)	42.3 (13.2)	$F=0.3$	ns				
Living alone % (n)	65.5 (n=19)	65.4 (n=17)	$X^2=0.0$	ns				
Age at onset of disorder mean (SD)	22.6 (9.2)	25.9 (13.6)	$F=1.1$	ns				
Number of hospitalizations prior to ACT admission (mean, SD)	8.1 (10.8)	5.3 (6.1)	$F=1.3$	ns				
Alcohol abuse or dependence % (n)	10.3 (n=3)	15.4 (n=4)	$X^2=0.3$	ns	0 (n=0)	11.5 (n=3)	$X^2=0.2$	ns
Drogue abuse or dependence % (n)	13.8 (n=4)	19.2 (n=5)	$X^2=0.3$	ns	10.3 (n=3)	7.7 (n=2)	$X^2=0.9$	ns
Any substance abuse or dependence %	24.1 (n=7)	30.8 (n=8)	$X^2=0.3$	ns	10.3 (n=3)	19.2 (n=5)	$X^2=0.6$	ns
DSM IV diagnoses, % (n)								
Schizophrenia (any type)	48.3 (n=14)	38.5 (n=10)	$X^2=0.54$	ns				
Other psychotic disorders	27.6 (n=8)	23.1 (n=6)	$X^2=0.15$	ns				
Schizoaffective disorders	10.3 (n=3)	3.8 (n=1)	$X^2=0.86$	ns				
Bipolar and major depressive disorders	13.8 (n=4)	34.6 (n=9)	$X^2=3.3$	ns				
Psychiatric symptomatology, mean (SD)								
BPRS global score	72.4 (22.5)	74.5 (20.3)	$F=0.13$	ns	47.7 (18.8)	53.4 (17.7)	$F=1.10$	ns
Treatment adherence, mean (SD)								
MARS global score	4.5 (2.6)	3.9 (2.9)	$F=0.48$	ns	5 (3.7)	6.4 (2.3)	$F=1.71$	ns
Quality of life, mean (SD)								
WHOQOL global score	79.6 (20.1)	70.2 (20)	$F=2.3$	ns	90.1 (17.7)	89.3 (13.7)	$F=0.02$	ns
Social functioning, mean (SD)								
MCAS global score	44.9 (12.1)	43.5 (9.4)	$F=0.25$	ns	59.5 (11.8)	63.1 (10.2)	$F=1.25$	ns
Recovery factors, mean (SD)								
RAS brief version global score	71.1 (15.6)	63.3 (13.4)	$F=2.93$	ns	77.3 (10.3)	79.2 (12.5)	$F=0.21$	ns

DSM-IV Diagnostic and Statistical Manual of Mental Disorders, 4th edition, BPRS Brief Psychiatric Rating Scale, MARS Medication Adherence Rating Scale, WHOQOL World Health Organization Quality Of Life, MCAS Multnomah Community Ability Scale, RAS Recovery Assessment Scale Brief Version

Table 2 Current sociodemographic and clinical characteristics of patients (n = 29)

Socio-demographic parameters	
Age (mean, SD)	48.8 (10.6)
Has a disability pension (n, %)	24 (82.8)
Living alone (n, %)	18 (62.1)
Married (n, %)	0
Clinical parameters	
Psychiatric diagnoses (DSM IV)	
Schizophrenia (n, %)	16 (55.2)
Other psychotic disorders (n, %)	4 (13.8)
Schizoaffective disorders (n, %)	6 (20.7)
Bipolar or major depressive disorder (n, %)	3 (10.3)
Current substance abuse or dependence (n, %)	6 (20.7)
Current psychiatric care	
Treatment in inpatients' facilities (n, %)	2 (6.9)
Treatment by an ACT team (n, %)	4 (13.8)
Treatment in outpatients' facilities (n, %)	8 (27.6)
Treatment by private professionals (n, %)	15 (51.7)
N of patients currently taking medication (%)	24 (82.8)
Psychiatric symptomatology	
BPRS global score (mean, SD)	45.7 (11.8)
Treatment adherence	6.3 (2.8)
MARS global score (mean, SD)	
Quality of life	88.9 (17.4)
WHOQOL global score (mean, SD)	
Social functioning	60.8 (11.4)
MCAS global score (mean, SD)	
Recovery factors	76.8 (9.4)
RAS brief version global score (mean, SD)	
Treatment after ACT discharge	
Duration of ACT intervention, in months (mean, SD)	30.3 (17.0)
Years after discharge (mean, SD)	6.3 (1.8)
Hospitalizations after discharge (mean, SD)	3.2 (5.6)
Involuntary admissions (mean, SD)	1.2 (2.1)
N of patients with involuntary admission (%)	11 (37.9)
Voluntary admissions (mean, SD)	2.1 (4.6)
N of patients with voluntary admission (%)	17 (41.4)

DSM-IV Diagnostic and Statistical Manual of Mental Disorders, 4th edition, *BPRS* Brief Psychiatric Rating Scale, *MARS* Medication Adherence Rating Scale, *WHOQOL* World Health Organization Quality of Life, *MCAS* Multnomah Community Ability Scale, *RAS* Recovery Assessment Scale Brief Version

in usual public inpatients facilities and one in a forensic psychiatric clinic.

The mean number of hospitalizations per year after discharge was 0.5 (SD = 0.8); and the mean number of total admissions during the 6.3 years after discharge was 3.2 (SD = 5.6), with a mean of 1.2 involuntary (forced) admissions involving 11 patients, and 2.1 voluntary admissions (i.e. decided by the patient) involving 17 patients. After ACT discharge, 11 patients had no hospitalization over follow-up

length, 7 patients had one, and 9 patients had more than two admissions.

Changes in Clinical and Social Variables over Time

The difference between the mean number of hospitalizations in the year preceding ACT inclusion (mean = 1.6; SD = 1.8) compared to the mean number of hospitalizations per year after ACT discharge (mean = 0.5; SD = 0.8) was highly significant ($p < 0.001$).

Figure 1 presents standardized overall scores of scales assessing symptoms, recovery, quality of life, adherence to treatment and social functioning across time (BPRS, RAS-B, WHOQOL-BREF, MARS and MCAS).

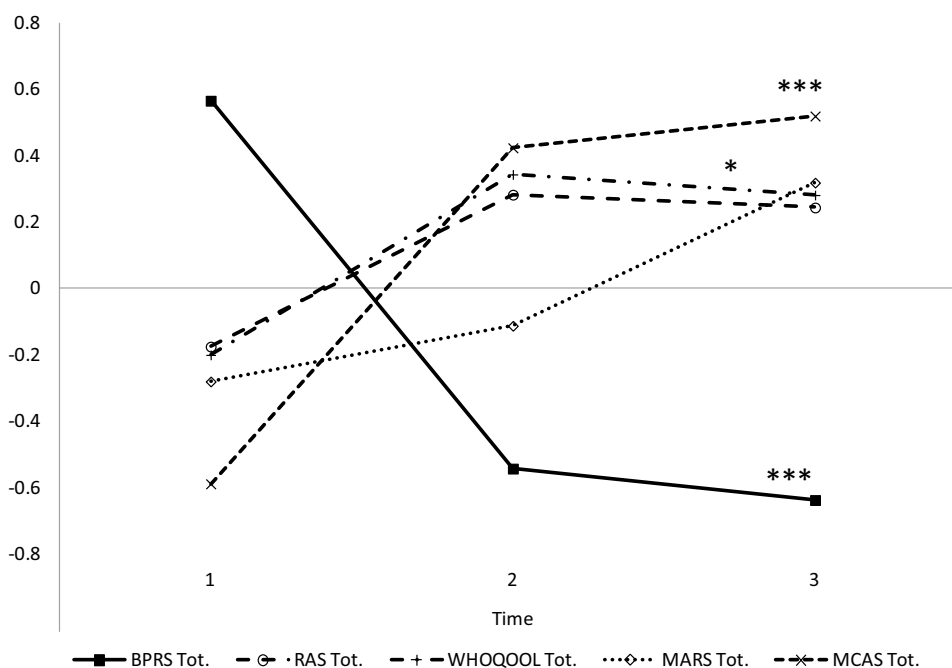
After adjustment on age, gender, the duration of ACT treatment, the time after ACT discharge, treatment (medication) adherence, and baseline score of the outcome of interest, there was a significant decrease in BPRS global score ($b = -0.57$; $p < 0.0001$; 95% CI from -0.75 to -0.39). This was explained by a reduction of all dimensions of the BPRS, excepting depression/anxiety scores ($b = -0.30$; $p = 0.004$; 95% CI from -0.50 to -0.09 for positive symptoms; $b = -0.34$; $p = 0.014$; 95% CI from -0.61 to -0.07 for negative symptoms; $b = -0.76$; $p < 0.0001$; 95% CI from -0.91 to -0.61 for agitation/mania; and $b = -0.15$; $p = 0.13$; 95% CI from -0.34 to 0.04 for depression/anxiety) (see supplementary data: Fig. 1).

Concerning recovery, we observed a non-significant increase in the RAS global score ($b = 0.11$; $p = 0.215$; 95% CI from -0.06 to 0.28). When looking at the different dimensions, we found the same non significant trend for each of the sub-scales (willingness to ask for help: $b = 0.13$; $p = 0.146$; 95% CI from -0.04 to 0.30 ; personal confidence and hope: $b = 0.09$; $p = 0.273$; 95% CI from -0.07 to 0.26 ; goal and success orientation: $b = 0.05$; $p = 0.652$; 95% CI from -0.17 to 0.27 ; reliance on others: $b = 0.04$; $p = 0.631$; 95% CI from -0.15 to 0.25 ; no domination by symptoms: $b = 0.08$; $p = 0.511$; 95% CI from -0.17 to 0.34) (see supplementary data: Fig. 2).

Regarding quality of life, the significant increase in the WHOQOL-BREF global score ($b = 0.25$; $p = 0.007$; 95% CI from 0.06 to 0.43) was mainly explained by increased social relationships ($b = 0.27$; $p = 0.005$; 95% CI from 0.08 to 0.47), but not in environmental quality of life ($b = 0.20$; $p = 0.091$; 95% CI from -0.03 to 0.44), physical health ($b = 0.08$; $p = 0.519$; 95% CI from -0.16 to 0.32), nor psychological quality of life ($b = 0.10$; $p = 0.489$; 95% CI from -0.18 to 0.39) (see supplementary data: Fig. 3).

Concerning adherence to treatment, there was a non significant increase in MARS global score ($b = 0.19$; $p = 0.178$; 95% CI from -0.09 to 0.47) but a significant increase in the attitude toward medication ($b = 0.29$; $p = 0.012$; 95% CI from 0.06 to 0.51). Other subscales were not significant

Fig. 1 Standardized overall scores of BPRS, RAS, WHOQOOL-BREF, MARS and MCAS across time. *BPRS* Brief Psychiatric Rating Scale, *RAS* Recovery Assessment Scale Brief Version; *WHOQOL* World Health Organization Quality Of Life, *MARS* Medication Adherence Rating Scale, *MCAS* Multnomah Community Ability Scale



(medication adherence behavior: $b = 0.23$; $p = 0.108$; 95% CI from -0.05 to 0.52 ; and negative side-effects and attitudes to psychotropic medication: $b = 0.06$; $p = 0.649$; 95% CI from -0.30 to 0.19) (see supplementary data: Fig. 3).

There was a significant increase in social functioning in the community as shown by MCAS total score ($b = 0.55$; $p < 0.0001$; 95% CI from 0.36 to 0.75) which was explained by an increase of the following dimensions: interference with functioning ($b = 0.26$; $p = 0.024$; 95% CI from 0.03 to 0.48), adjustment to living in the community ($b = 0.34$; $p = 0.006$; 95% CI from 0.09 to 0.58), social competences ($b = 0.29$; $p = 0.005$; 95% CI from 0.09 to 0.50) and behavioral problems ($b = 0.29$; $p = 0.003$; 95% from 0.10 to 0.48).

Adding substance use disorders to the statistical models did not modify the magnitude or the direction of the effects.

Discussion

This study aimed a better understanding of the long term effects of an “as long as needed” ACT program on difficult-to-engage patients suffering from severe mental disorders. To our knowledge, this is the first study to explore the evolution of patients after ACT discharge, aiming to address a fundamental question: do patients intensively followed by programs such as ACT sustain their improvement over a long time evolution?

The most salient findings were that after a mean of 8.7 years of evolution and 6.3 years after discharge from ACT, patients who were treated by ACT team sustained an improvement of their symptoms, a reduced rate of

hospitalizations and an improvement in quality of life and in social functioning.

Thus, this research suggests that (1) such an ACT intervention targeting difficult-to-engage patients with severe mental disorders is effective in ameliorating most outcomes relevant to patients during treatment, and (2) the benefits can be maintained over time. Even considering that follow up outcomes may have being influenced by the “regression to the mean” phenomenon (i.e. the fact that patients are likely to be functioning better at follow up), the sustained improvements, years after discharge, suggests that intensive intervention of ACT programs may possibly serve as enhancer to engage patients in a positive process of reconstruction. In this perspective, among this population of patients facing the eruption of a psychotic process, ACT may help to resolve “personal crises” characterized by a long lasting course, treatment refusal, social isolation and sometimes nihilism and/or drugs abuse.

Interestingly, this sample of refractory to care patients suffering from severe mental disorders didn’t show significant increase in *global* adherence to pharmaceutical treatment. Their mean scores in the MARS were 4.5/10 at inclusion and 6.3/10 at follow up. To compare, in a recent study on homelessness patients with schizophrenia, whose medication non-adherence is particularly important, mean scores were 5.5/10 (Zemmour et al. 2016). When the data were examined more closely, it appeared that patients showed a significant and sustained-over-time improvement in the subscale specifically reflecting attitudes toward medication. This subscale, unlike total score, was showed to be highly correlated with the patient’s insight into both illness and need for

a treatment (Fialko et al. 2008). This suggests that patients, during and after ACT program, did not change statistically their total score in adherence to treatment but gained awareness of their mental disorder and awareness of the achieved effects of medication, and these gains were maintained over time. Moreover, a considerable improvement in adherence to care and in collaboration with professionals in the long term is to note: more than half of the 29 subjects, who used to be considered as very difficult-to-engage patients in the past, were currently treated by private psychiatrists, i.e. the least assertive treatment existing in the system of care, as 27.6% of them were treated in usual outpatients facilities.

It is also interesting to note that the 13.8% of the cohort who dropped out from psychiatric facilities and needed ACT readmission did so between 1 and 3 years after ACT discharge whatever following psychiatric care was proposed. It suggests that a minor percentage of patients who were refractory to care, with difficult profiles, required an intensive, mobile and assertive care in the longer term.

Literature shows a positive impact of ACT programs in number and length of inpatients stays (Huguelet et al. 2012). In a recent study assessing ACT's impact on hospitalizations by comparing use of admissions 2 years before and 2 years after ACT inclusion in a large number of patients being currently treated, authors find ACT to decrease admissions trends (Aagaard et al. 2016). To assess the evolution of patients after ACT discharge, we used the number of hospitalizations as outcome measure by comparing the rate of admissions the year preceding ACT inclusion with the mean rate of admissions in the 6.3 years after ACT discharge. Our results showed a significant improvement, but the interpretation of this outcome needs further consideration. On one hand, real clinical improvements may remain underestimated. Indeed, among the baseline sample of "revolving-door" patients with high rates of involuntary admissions and very few contact with outpatients facilities, it is important to mention that some patients began, after treatment, to purposely use voluntary hospitalization to prevent crisis and deterioration of their mental state. This should be considered as an improvement in adherence to care and an advance in the recovery process, despite an increase of the average hospitalization rate per year after ACT treatment. On the other hand, we must consider that inclusion in ACT program may have been done in particularly hard times for patients, and therefore, the number of hospitalizations in the year preceding ACT inclusion, used as baseline, may perhaps not be entirely representative of the clinical condition of patients over the years preceding ACT.

Concerning recovery, patients showed an enhancement at 6 months of treatment maintained over long term follow up, yet without reaching significance. Despite an evolving definition of recovery, literature over the last decades consistently points out that the process of recovery appears to be

associated with life satisfaction, social functioning and relationships (Lysaker and Buck 2008; Ralph 2000). Thereby, if we take into account the fact that patients feature a long term improvement in quality of life (especially in social relationships), as well as improvements in social functioning in the community and reduction in symptomatology, it may be possible that the lack of significance of our results on recovery may be related to our small sample size, that being likely to reduce statistical power. Indeed, patients showed long term enhancement in their daily life with adaptations to the limitations of their mental disorder, improvements in their ability to engage in appropriate and meaningful interpersonal relationships and reduction in behaviors that make it difficult to integrate in the community.

The sustainability of the benefits of the ACT program over time suggests that it can help patients who are refractory to care to gain clinical improvement, while being cost effective at the same time. Indeed, for a large majority of patients, it doesn't imply a lifetime treatment and seems to lay foundation for better long-term adherence to out patient care, as well as a better clinical and psychosocial evolution.

It should be noted that this study specifically addresses an ACT program intended for patients who are refractory to care, having high degree of anosognosia and characterized by multiple treatment interruption leading to frequent hospitalization. In addition, the program promotes intensive care "as long as needed", which represented, in this cohort, an average of 30 months of treatment. It involves a particular focus on patients' connection or reconnection with outpatient care and their social network, and on relieve of symptoms; psychosocial dysfunctions and families' burden. Therefore, it is necessary to determine which components of ACT programs are likely to have a positive impact on long term outcomes and/or work as a recovery starter or consolidator. Further studies are needed to investigate this question (Schmidt et al. 2018). Moreover, in order to better determine admissions and durations of ACT interventions; it would be useful to explore predictors of long term evolution. For instance, different typologies of evolution may be determined by some patient's clinical and social specific characteristics.

The present study has limitations that need to be pointed out. First, the study did not include a comparison group. Second, we didn't assess for Axis II diagnosis. Third, generalization of these results may be restricted due to the small sample size and the specificity of treatment delivered by this ACT program in this Geneva's area. Indeed, this setting is characterized by a large number of public and private conventional outpatient treatment opportunities. This easily available support may be at least in part related to the results described in our data.

Hence, such a protocol should be replicated in other settings, taking into account the fact that our results strongly

suggest a long time clinical and social improvement of these difficult-to-engage patients, even after ACT's discharge.

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Author Contributions PH designed the study. SV drafted the manuscript, and PH and NP gave critical revision. LC and SV carried out the data acquisition. NP and SV performed the analysis. All authors provided critical feedback and gave final approval of the version to be published.

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Compliance with Ethical Standards

Conflict of interest The authors report no conflict of interest.

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