

Longitudinal Hierarchical Linear Modeling Analysis of changes in Severity scores for Assertive Community Treatment Consumers P. Antonio Olmos-Gallo (antonio.olmos@mhcd.org), Mental Health Center of Denver

Rationale

Assertive Community Treatment (ACT) has proven to be very effective in improving outcomes for persons with Severe and Persistent Mental Illness. Yet ACT services are expensive and once consumers reach a specific level of improvement, services may not be appropriate and may even lead to negative outcomes Therefore, efforts to determine the right amount of services could be paramount to provide effective and

Additional rationale based on the fundamental belief that people with mental illness can and do recover.

MHCD has established a long-term commitment in the development of practices and nurturing of environments that will lead to recovery

General Definition of Recovery: Recovery is an ongoing journey of self-directed healing and transformation. - Pricilla Rideway (2000)

Operational Definition Recovery: Recovery is a non-linear process of transformation by which people move from lower to higher levels of fulfillment in the areas of hope, active/growth orientation, satisfaction with social networks, level of symptom interference, and personal sense of safety. - MHCD, Recovery Committee (2004)

Issues in the measurement of recovery:

- · Recovery is a journey. We should be able to measure changes in recovery over time
- <u>Different people have different starting points</u>. We should recognize that not everyone starts from the same point
- Recovery is unique for every consumer. We should be able to measure individual change (individual growth)
- · Different background variables can affect recovery. Variables like age, social support,

With the use of techniques like Hierarchical Linear Models (HLM; Bryk & Raudenbush (1987), a.k.a. Multilevel Modeling (Rubin, 1989), Growth Curve (Karney & Bradbury, 1995; Singer, 1998), we can address all of these issues using one set of analyses.

Hypothesis

- Consumers do recover as measured with the Severity index score. The rate of change will be negative (i.e., decrease in severity)
- · The journey to recovery can be influenced by environmental, instrumental, and background variables like age, length of stay in the system, primary diagnosis, comorbid substance abuse, work status, residential

Method

Instrument

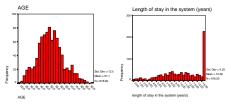
The instrument was presented last year ($\underline{Development\ of\ a\ Severity\ Index\ to\ measure\ Outcomes\ in\ ACT}$ teams. Olmos-Gallo, Bremer, Zahniser, Thomas, AEA, 2003). It is based on the weighted combination of the indicators included in the ACT team outcomes tracking form.

Information is collected monthly from all the consumers in the sample (see below). The only exception to this schedule is when the consumer has not been contacted during the month. Information is entered by the clinician/case manager in charge of the case directly into the electronic record



Sample of 918 consumers who have been followed since 2000 using the instrument described

Subjects





Residential Status				living situation				
Valid	HOMELESS OR IN JAIL/HOSPITAL	Frequency 62	Percent 6.8	_		Frequency	Percent	
	INDEPENDENT LIVING-RESIDENTIAL			Valid	lives with someone	537	58.5	
	HOME-OTHER Total	856	93.2		lives alone	381	41.5	
		918	100.0		Total	918	100.0	

PRIMARY DIAGNOSIS MAJOR CATEGORIES			HAS SUBSTANCE DIAG	NOSIS	
Valid THOUGHT DISORDERS MOOD DISORDERS OTHER Total	Frequency 664 219 35 918	Percent 72.3 23.9 3.8 100.0	Valid NO SUBSTANCE ABUSE DIAGNOS COMORBID SUBSTANCE DIAGNOS Total		Percent 58.7 41.3 100.0

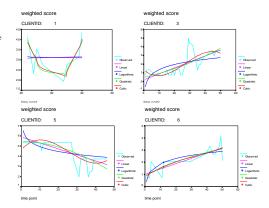
Results

Is the rate of change linear, polynomial or both?

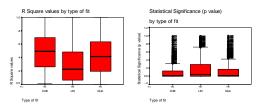
It is hypothesized that the recovery rate should increase over time. However, it is also assumed that the rate of improvement is not linear. After an initial surge in improvement (recovery), the rate may slow down. Informal observations suggest initial improvement after treatment engagement sometimes followed by deceleration.

To explore potential hypotheses for the rate of change, individual curve fits were run for all the consumers in the sample assuming linear, quadratic, or cubic fits

Examples of some of the fits generated for some of the individual consumer's data



Figures show the distribution of R2 and p-values for the different types of fit (CUB = cubic LIN = linear, QUA = quadratic)



Based on this analysis as well as results from HLM runs including linear and quadratic components, it was decided to favor the use of quadratic score only

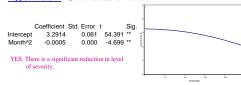
What is the best covariance structure?

In HLM analysis it is important to know if the data is correlated over time (i.e., the severity for month 30 is more similar to the severity score for month 29 than it is to the severity score for month 60). Based on criteria recommended by Norusis (2003) Information criteria was compared for 3 different covariance structures: 1) Compound symmetry, 2) Autoregressive, 3)

	symmetry	Autoregressive	Toeplitz
 -2 Restricted Log Likelihood 	63616.577	55272.884	53320.022
Akaike's Information Criterion (AIC)	63620.577	55276.884	53420.022
Hurvich and Tsai's Criterion (AICC)	63620.577	55276.885	53420.276
Bozdogan's Criterion (CAIC)	63638.393	55294.701	53865.438
Schwarz's Bayesian Criterion (BIC)	63636.393	55292.701	53815.438
The information criteria are displaye	ed in smaller-is	-better forms	

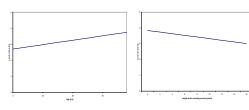
Autoregressive covariance structure was chosen (though, it Toeplitz was a little better)

Hypothesis 1: Do consumers recover?



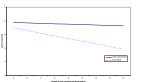
Hypothesis 2: Is the journey to recovery influenced by environmental, instrumental and/or background variables?

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	Intercept	2.702	0.251	10.774 *	*
AGE: Significant increase in	age	0.012	0.005	2.418 *	
level of severity	Intercept	3.845	0.162	23.805 *	*
Length of Time receiving services: Significant reduction in	Length	-0.052	0.014	-3.676 *	**
level of severity	Intercept	2.947	0.239	12.335 *	*
	Age	0.016	0.004	3.665 *	**
	Length	-0.053	0.013	-4.073 *	**



		Coefficient	Std. Error	t	Sig.
	Intercept	3.775	0.215	17.546	**
GENDER: Not	Length	-0.051	0.019	-2.617	**
significant	Gender	-0.096	0.292	-0.329	n.s.
	Length * Gender	0.015	0.026	0.575	n.s.

IVING STATUS: The		Coefficient	Std. Error	t	Sig
nteraction of living status	Intercept	3.486	0.216	16.138	**
y Length of Time	Length	-0.089	0.019	-4.698	**
	Living Status	0.395	0.277	1.427	n.s
teceiving Services is	Length * Living Status	0.082	0.024	3.364	**
ignificant					



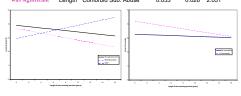
		Coefficient	Std. Error	t	Sig.
	Intercept	3.662	0.200	18.322	**
RACE: Not	Length	-0.035	0.017	-2.014	*
significant	Race	0.109	0.291	0.373	n.s.
	Length * Race	-0.015	0.026	-0.596	n.s.

Coefficient Std. Error t

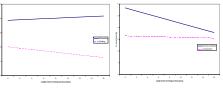
Coefficient Std Error

JIAGNOSIS: The					
nteraction of	Length	0.095	0.056	1.699 n	ı.s.
rimary Diagnosis	Thought Disorders	0.949	0.611	1.553 n	ı.s.
ith length of time	Mood Disorders	0.723	0.645	1.120 n	ı.s.
as significant	Length * Thought disorder	-0.143	0.058	-2.481 *	
as significant	Length * Mood disorder	-0.179	0.062	-2.891 *	٠
					_
OMORBIDITY:		Coefficient	Std. Error	t	Si
oth Comorbidity	Intercept	4.197	0.212	19.764	**
nd its interaction	Length	-0.068	0.019	-3.513	**
ith length of time	Comorbid Sub. Abuse	-0.930	0.289	-3.213	**
as significant	Length * Comorbid Sub. Abuse	0.053	0.026	2.051	*

PRIMARY



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WORK STATUS:	Intercept	2.013	0.518	3.884 **
Work status was	Length	0.019	0.046	0.422 n.s.
significant	Work status	1.858	0.539	3.446 **
significant	Length * Work	-0.066	0.048 -	1.366 n.s.
RESIDENCE STATUS:		Coefficient	Std. Error	t Sig.
Both Residence status and	Intercept	3.284	0.158	20.846 **
its interaction with Length	Length	-0.011	0.014	-0.827 n.s.
of time receiving services	homeless	2.389	0.391	6.115 **
was significant	Length * homeless	-0.120	0.050	-2.400 *



Conclusions

- Evidence that consumer's level of severity decreases over time. The decrease seems to be better explained as a decrease followed by a stabilization.
- · Several background variables seem to be involved in the rate of change: Age, length of
- time receiving services, primary diagnosis, comorbidity, work and residence status
- Also living status, but hard to understand what it means at this point (very

Future directions

- · Development of more complex models that combine several factors
- · Modification of the severity score to make it more "recovery oriented" and retesting of the models ("Recovery Markers")
- Combine with our UM system to help clinicians and case managers determine when consumers can be transferred to a different level of care (either higher or lower).
- . Some of this work is currently in progress