ORIGINAL ARTICLE

A measurable treatment plan: Using the Children's Global Assessment and the Problem Severity scales as outcomes of clinical treatment

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ABSTRACT

Objective: To investigate the psychometric properties of the Children's Global Assessment Scale (CGAS) and the strength/concern (Problem Severity [PS]/Symptom) scale, collectively known as the measurable treatment plan (MTP).

Methods: We draw on a sample of consecutive patients (n = 25,563) enrolled for care between 2002 and 2016 in the Child & Adolescent Addictions and Mental Health Psychiatry Program of the Alberta Health Services, Calgary Health Zone. CGAS reliability was estimated using the Pearson Product-Moment correlation for repeated measures between referral and admission. For the internal consistency of paired referral and admission CGAS scores, $\alpha = 0.82$. We estimated the predictive validity of the CGAS and the strength/concern scale using analyses of variance with the demographic variables age and sex, and additionally the system variables service level, treatment completion and provisional diagnosis as covariates of analysis in a final reduced model or as independent variables where warranted.

Results: We discovered that there is a high level of agreement between paired referral and admission CGAS scores. We also discerned functional improvement and symptom reduction on discharge which was attributable to the effect of treatment alone. Importantly, patients who were categorized at the urgent/emergent service level of care at admission, exhibited more severe provisional diagnoses, and/or discontinued treatment attained lower function and PS ratings at discharge.

Conclusions: Overall, the current study supports the empirical applicability of using the MTP to clinically profile on admission those at risk of poor treatment outcomes and to undertake necessary modifications to the treatment process.

Key Words: Children's mental health services, Clinical treatment, Children's Global Assessment Scale, Problem Severity, Measurable treatment plan

1. INTRODUCTION

Assessing child and youth mental health (CYMH) services is essential for mental health providers to gauge the clinical effectiveness of clinical interventions.[1,2] Program evaluation is imperative for the improvement of social service programs and the dissemination of evidence about program effectiveness to stakeholders.[3] Understanding the nature of the population serviced (i.e., patient characteristics) through

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program evaluation is also an essential element in the effective implementation of evidence-based medicine.[4] Investigating symptom reduction across treatment time points is a cornerstone of clinical evaluation,[5–7] for example, the impact of cognitive behavioural group therapy upon reducing symptoms of posttraumatic stress, depression, and anxiety among schoolchildren and their caregivers.[8]

Literature review

Research has emphasized the importance of early intervention,[9] high-quality therapeutic relationships,[10] and undertaking an adaptive treatment disposition[11] in order to enhance therapeutic response among patients. Through assessing the overall symptom reduction of patients, CYMH programming ideally enhances academic performance,[12] alleviates the demands placed on family caregivers,[6] minimizes the possibility of relapse,[13] and improves the delivery of mental health services as a whole.[14]

Mental health screening instruments provide clinically useful information to help inform patient assessments as well as provide a basis for evaluation across time or to a normative sample.[15] One such screening instrument is the Children's Global Assessment Scale (CGAS),[16] a measure of psychosocial functioning during the preceding month. Studies have demonstrated the excellent validity and reliability of this scale within hospital and community settings,[17–19] along with its feasible integration into clinical practice.[20] Overall, the clinical application of the CGAS has been advantageous for measuring function change in patients[21] and evaluating the efficacy of CYMH treatment.[22]

In this paper, we report the in situ psychometric properties of the CGAS using a repeated measures design between referral and admission. We also report on the validity of the CGAS analyzed in relation to demographic and system variables (service level, provisional diagnosis and discharge disposition) as well as in relation to a strength/concern (Problem Severity [PS]/Symptom) scale. Our main objective is to examine the efficacy of these two scales (collectively known as the measurable treatment plan [MTP]) as predictive outcome measures for patients enrolled within CYMH services. We hypothesize a high level of agreement between paired referral and admission CGAS scores, along with functional improvement and symptom reduction at discharge as a result of treatment. We also hypothesize that patients who were categorized at the urgent/emergent service level of care at admission, exhibited more severe provisional diagnoses, and/or discontinued treatment attained lower function and PS ratings at discharge.

2. METHODOLOGY

2.1 Instruments

The CGAS[16] is a measure of functioning within the last month for children under the age of 18 that is independent of specific mental health diagnosis. This measure was adapted from the adult Global Assessment Scale,[23] popularized through inclusion in the multiaxial assessment procedure of the Diagnostic and Statistical Manual of Mental Disorders.[24] The CGAS is a clinician completed numeric scale from 1, lowest functioning to 100, highest functioning. Behavioural descriptors of functioning levels are provided in increments of 10 with a child rated 1-10 requiring constant supervision, 41-50 denoting moderate functioning and 91-100 indicating superior functioning in all areas. In addition to employing the CGAS, we also used a strength-concern rating scale (PS) based on the Goal Attainment Scaling model of community child and family mental health service evaluation.[25] Together these two measures constitute the cornerstones of our regional evaluation model comprised of the expectation of functional improvement and symptom reduction. Measurement of function (CGAS) and PS (Strength and Concern) ratings on admission and discharge permitted the measurement of treatment effect on adaptive function and problems (e.g., symptom reduction), as well as measurement of the modifying effects of strengths (resilience). However, as our system of care is a disease-focused enterprise, only 59 strengths were measured since 2002, likely due to staff time constraints and mandate. Together with a goal attainment scale (GA: not reported), this approach to measurement has been regionally termed MTP, and is akin to the function and problem domains of goal attainment scaling that were developed for measuring the effect of children's mental health services.[25]

2.2 Data collection procedures

CGAS scores were collected at the time of referral by the regional access and intake staff, as item 5 from the Western Canada Waiting List Children's Mental Health Priority Criteria Score (WCWL-CMH-PCS) form,[26] and again on admission and discharge. PS scores were collected on admission and discharge.

2.3 Subjects

The sample was drawn from consecutive patients enrolled for care between 2002 and 2016 in the Child & Adolescent Addictions and Mental Health Psychiatry Program (CAAMHP) of the Alberta Health Services, Calgary Health Zone. Of 98,571 consecutive referrals, 85,757 (51.4% female; Chi Square $p < .0001$) were accepted for some level of service provision (assessment, consultation, treatment) with CAAMHP. However, the final sample was further reduced

to 56,422 (53% females) when patients without discharge CGAS scores were excluded where a functional assessment was not practical or feasible (e.g., assessment, consultation, early discharge, etc.). Males (mean age 11.89 years; standard deviation 3.90 years) were younger than females (mean age 13.57; standard deviation 3.26 years). Further reduction in the sample size to a smaller number (n = 25,563) (48.61% females) resulted from using provisional diagnosis and the CGAS on referral, which was derived from item 5 of the WCWL-CMH-PCS form,[26] a form only completed on new referrals and enrollments from the community and not usually collected on transfers or direct readmissions. At the 0.05 level, Ordinary Least Squares regression estimates reveal that sex (female = 1) (B = 1.48) and service level (urgent/emergent = 1) (B = 2.63) have statistically significant effects on age. Among this sample, 18,758 (73.38%) were categorized at the scheduled urgency level and 6,805 (26.6%) at the urgent/emergent urgency levels for access to psychiatric care. Provisional diagnoses associated with the WCWL-CMH-PCS form were also collected on 25,563 enrolled patients (adjustment disorder 27.43%, attention deficit hyperactivity disorder (ADHD) 13.92%, conduct disorder/oppositional defiant disorder (CD/ODD) 43.30%, pervasive developmental disorder (PDD)/autism 1.67%, anxiety/depression 8.55%, substance use disorder 2.91%, psychosis 2.22%).

Additionally, the PS component of the MTP was not implemented until 2008 and as a result, the ANOVA models were based on a smaller, yet, representative sample (n = 4,915 for CGAS and n = 4,883 for PS, respectively).

3. ANALYSIS

Our analysis examined the reliability of the CGAS collected on referral and admission. CGAS clinical effect was examined by comparing scores on admission and discharge. For the internal consistency of paired referral and admission CGAS scores, $\alpha = 0.82$. CGAS reliability was estimated using the Pearson Product-Moment correlation (Pearson's r) for paired referral and admission CGAS scores. We estimated the predictive validity of the CGAS and the strength/concern rating using analysis of variance with the demographic variables age and sex, and additionally the system variables service level (e.g., scheduled vs. emergent), treatment completion and provisional diagnosis as covariates of analysis in a final reduced model or as independent variables where warranted. For inclusion in ANOVA, provisional diagnoses were ranked from least to most severe by admission CGAS in order to form a simple ordinal variable. For the purpose of examining convergent, predictive and criterion-related validity, admission and discharge PS were the independent variables in the model with discharge CGAS as the dependent variable, whereas admission and discharge CGAS were the independent variables in the model with discharge PS as the dependent variable, along with service level, treatment completion, diagnosis, sex, and age.

4. RESULTS

4.1 Reliability of function scores on referral and admission

For the Pearson's r between the CGAS scores at the time of referral, $r = 0.61$ and is statistically significant ($p < .05$). Additionally, there are statistically significant modifying effects of age and sex ($r = 0.53$ for males and $r = 0.55$ for females under 12 years of age, and $r = 0.63$ for males and $r = 0.64$ for females over the age of 11 years).

4.2 Validity of function and PS scores on admission and discharge

Table 1 presents the mean descriptive statistics for admission and discharge CGAS and PS scores by provisional diagnosis and treatment completion status. On average discharge scores for both variables were lower on admission compared to discharge. Table 1 shows that the highest rated treatment outcomes were realized by patients provisionally diagnosed with adjustment disorder. The least satisfactory treatment outcomes were realized by patients with psychosis and substance use disorder. However, the greatest functional improvement was observed in patients with psychosis, whereas those having ADHD and PDD diagnoses experienced the greatest change in PS.

Table 1 presents the differences between admission and discharge CGAS and PS scores by treatment completion status. Among participants who did not complete treatment, we see that the average CGAS score at discharge was lower compared to completers. Table 1 also presents the differences between admission and discharge CGAS and PS scores by service level. Among those admitted to the urgent/emergent, the average CGAS and PS scores at discharge were lower compared to those admitted to scheduled services.

Table 2 presents two analyses of variance with the respective discharge CGAS and PS scores as dependent variables modeled with the independent variables age and sex, the service level, treatment completion status, provisional diagnosis and the respective admission and discharge PS or CGAS ratings. All variables in the first analysis were significant predictors of the discharge CGAS score, with the exception of age. Similarly, all variables in the second analysis were significant predictors of the discharge PS score, with the exception of sex. Overall, these models explain 51% of the variance in discharge CGAS scores and 42% of the variance in discharge PS scores, as predicted by admission and discharge PS and CGAS respectively.

Table 1. Descriptive statistics by independent variables

		Admission CGAS	Discharge CGAS	PS Admission	PS Discharge
Adjustment Disorder	Obs	5,140	4,996	1,339	1,260
	Mean	52.59	56.71	33.97	57.91
	Std. Err.	0.16	0.17	0.47	0.69
	L95%CI	52.27	56.38	33.04	56.56
	U95%CI	52.9	57.05	34.89	59.26
ADHD	Obs	2,425	2,327	712	701
	Mean	49.95	55.15	26.84	64.06
	Std. Err.	0.22	0.23	0.53	0.87
	L95%CI	49.51	54.69	25.8	62.35
	U95%CI	50.38	55.61	27.88	65.77
CD/ODD	Obs	7,744	7,392	2,454	2,407
	Mean	48.81	54.51	30.48	58.18
	Std. Err.	0.13	0.14	0.31	0.52
	L95%CI	48.56	54.23	29.87	57.15
	U95%CI	49.05	54.79	31.08	59.21
PDD/Autism	Obs	293	292	72	70
	Mean	41.62	44.79	21.93	54.2
	Std. Err.	0.87	0.85	1.53	2.72
	L95%CI	39.9	43.12	18.88	48.77
	U95%CI	43.34	46.47	24.98	59.63
Anxiety/Depression	Obs	1,518	1,495	301	295
	Mean	46.88	50.24	23.47	46.97
	Std. Err.	0.26	0.28	0.71	1.16
	L95%CI	46.37	49.69	22.07	44.69
	U95%CI	47.39	50.8	24.87	49.26
Substance Use Disorder	Obs	583	570	113	112
	Mean	45.21	48.28	24.59	43.55
	Std. Err.	0.44	0.44	1.28	1.77
	L95%CI	44.34	47.42	22.07	40.04
	U95%CI	46.08	49.14	27.12	47.06
Psychosis	Obs	448	447	159	158
	Mean	37.25	44.26	21.04	45.92
	Std. Err.	0.59	0.61	0.97	1.83
	L95%CI	36.1	43.05	19.13	42.3
	U95%CI	38.41	45.47	22.96	49.54
Incomplete Treatment	Obs	26,947	25,369	8,916	8,520
	Mean	47.28	51.16	29.18	48.07
	Std. Err.	0.07	0.07	0.15	0.21
	L95%CI	47.14	51.02	28.88	47.66
	U95%CI	47.41	51.3	29.49	48.48
Treatment Completed	Obs	21,488	21,488	10,067	10,067
	Mean	49.31	56.59	33.61	67.47
	Std. Err.	0.08	0.09	0.15	0.29
	L95%CI	49.15	56.41	33.3	66.91
	U95%CI	49.47	56.77	33.91	68.03
Scheduled Service Level	Obs	33,390	31,988	14,098	13,612
	Mean	50.95	56.99	34.03	63.69
	Std.Err.	0.06	0.07	0.13	0.24
	L95%CI	50.83	56.85	33.77	63.22
	U95%CI	51.07	57.13	34.28	64.16
Urgent/Emergent Service Level	Obs	17,793	18,157	5,030	5,018
	Mean	43.84	48.09	24.64	44.68
	Std.Err.	0.09	0.08	0.19	0.23
	L95%CI	43.67	47.93	24.27	44.23
	U95%CI	44.01	48.24	25	45.13

Note. CGAS: Children's Global Assessment Scale; PS: Problem Severity; ADHD: Attention deficit hyperactivity disorder; CD/ODD: Conduct disorder/ oppositional defiant disorder; PDD: Pervasive development disorder

Table 2. Outcome CGAS and PS ANOVA results

Discharge CGAS					
Number of obs = 4,915	Root MSE = 9.11		Adj Rsquared = 0.50	Rsquared = 0.51	
Source	**Partial SS**	*df*	*MS*	*F*	**Prob > F**
Model	417,678	166	2,516.13	30.35	0.00001
Sex	690.47	1	690.47	8.33	0.0039
Age	2,061.3	16	128.83	1.55	0.0728
Service Level	31,652.7	1	3,1652.7	381.81	0.00001
Completed Treatment	2,020.9	1	2,020.9	24.38	0.00001
Diagnosis	16,522.3	6	2,753.72	33.22	0.00001
Admission Problem Severity	13,866	52	266.65	3.22	0.00001
Discharge Problem Severity	105,331	89	1,183.5	14.28	0.00001
Residual	393,616	4,748	82.9		
Total	811,295	4,914	165.1		
Discharge PS					
Number of obs = 4,883	Root MSE = 18.95		Adj Rsquared = 0.41	Rsquared = 0.42	
Source	**Partial SS**	*df*	*MS*	*F*	**Prob > F**
Model	1,233,380	42	29,366.2	81.77	0.00001
Sex	249.85	1	249.85	0.7	0.4043
Age	13,924.1	16	870.26	2.42	0.0012
Service Level	2,534.57	1	2,534.57	7.06	0.0079
Completed Treatment	69,089.7	1	69,089.7	192.37	0.00001
Diagnosis	28,286.5	6	4,714.41	13.13	0.00001
Admission CGAS	40,310.9	8	5,038.87	14.03	0.00001
Discharge CGAS	516,645	9	57,405.1	159.84	0.00001
Residual	1,738,294	4,840	359.15		
Total	2,971,673	4,882	608.7		

Note. CGAS: Children's Global Assessment Scale; PS: Problem Severity

5. DISCUSSION

Notwithstanding age and sex effects, the referral and admission CGAS scores had acceptable levels of Pearson product-moment correlation indicating reliability.[27] The correlation coefficient was a combination of test-retest and interrater reliability, as different staff members completed the CGAS scores on referral and admission. In addition to reliability, measuring CGAS twice before admission established a patient's trajectory and provided a basis for estimating the validity of the CGAS as a measure of treatment effect when examined at discharge.

Improvement of client function and PS at discharge was attributable to the effect of treatment based on the change in slope between admission and discharge as compared to its stability between referral and admission. Measuring trajectory controlled for the effect of time in that each patient's CGAS score served as their own waitlist control compared to discharge. While past studies have examined the use of the CGAS with varying results,[28–30] the current study controlled for the effect of time in measuring trajectory, as a result indicated that the CGAS reliably measured function at service standard encounter points and validly measured treatment effect at discharge.

The change in function (CGAS) between admission and discharge paralleled the change in the independent measure of PS. Additional support for the validity of the CGAS and PS as indices of function and problem change comes from the theoretically meaningful relationship with treatment completion status and provisional diagnosis. One would expect, as observed, patients who discontinued treatment received lower function and PS rating at discharge compared to those who completed treatment. Similarly, patients diagnosed with what are considered more severe diagnoses (psychosis, autism, or substance use disorder) had the lowest admission function and PS scores. While all patients were reported to demonstrate improved functioning and reduced symptomatology regardless of their provisional diagnosis, our results are consistent with previous research highlighting the poor prognoses of patients experiencing these particular mental illnesses,[31–33] in addition to those who do not complete treatment.

6. CONCLUSIONS

Overall, the current study demonstrates the sound psychometric properties of the MTP as a measure of client improvement. While providing an index of validity in terms of diagnosis and treatment completion, those who do not

improve as much are of paramount concern when already enrolled in care. Together with the WCWL-CMH-PCS form, there is the opportunity to use the MTP to clinically profile on admission those at risk of poor treatment outcomes once they are enrolled. The present study forms a cornerstone of this planned work. Additionally, and consistent with evidence based medicine,[34] the present results encourage development of a modular treatment process that recognizes a differential treatment response to account for patient characteristics and clinical state on admission.

The MTP model of outcome evaluation stemmed from goal attainment scaling. It is a boon to the crisis currently faced in evidence based medicine.[35] It has also been generalized

beyond children's mental health intervention evaluation and has been published as an application known as the Treatment Response and Client Tracking (TRACT) in service of documenting the assessment and treatment for any disease, disorder, or problem and published in the WHO compendium of emerging technologies.[36] The ability to measure complex clinical outcomes for any treatment effectively and efficiently using the MTP concept, as generalized in TRACT, widens the range of application to all health service interventions and improves the ability to provide evidence of practice effect in the field.

CONFLICTS OF INTEREST DISCLOSURE
The authors have no potential conflicts of interest to report.

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