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# Predictors of functional improvement in children and adolescents at a publicly funded specialist outpatient treatment clinic in a Canadian Prairie City



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## ABSTRACT

Children's mental health problems substantially impact their functioning. For clinically treated children and adolescents, we explored the impact of mental health treatment on functioning and identified predictors of functional improvement. Outpatient clinical data from a regional publicly funded specialist outpatient treatment clinic were analyzed. The Child and Adolescent Functional Assessment Scale (CAFAS) was used to assess outcomes. Non-parametric tests were used to compare baseline and exit scores. Logistic regression analysis was used separately for children and adolescents to examine predictors of improvement. Total CAFAS scores at exit showed a significant decrease from initial scores for both age groups, indicating improvements in clients' functioning. Children and adolescents had shared predictors for initial level of dysfunction, length of treatment and the presence of pervasive behavioral impairment (PBI). Primary presenting problem, caregiver support and area of residence were only associated with outcome among children. Clients with higher initial levels of dysfunction and PBI require longer treatment cycles to reach an acceptable outcome. Shortening the length of treatment cycles may improve the efficiency of resource use but can be detrimental to some clients. Personalized treatment should be tailored to the clients with specific characteristics and needs.

## 1. Introduction

Children and adolescent's mental health problems substantially impact their functioning in various aspects of life, especially social and cognitive development. Social functioning refers to an individual's interaction with their environment and the ability of fulfill their role within the environment. The environment includes work, social and leisure, marital, parental, and extended family (Bosc, 2000; Weissman, 1975). Social functioning is a key aspect of quality of life and an important predictor of well-being, happiness, and life satisfaction (Gu et al., 2016). Cognitive functioning is defined as an individual's ability of performing a variety of mental activities most closely associated with learning and problem solving (Neuronup, 2019; Dick and Riddell, 2010). It could include, but is not limited to, verbal, spatial, perception, information processing, learning, attention, memory, decision making, planning, inference and abstraction (Neuronup, 2019; Dick and Riddell, 2010). Children and adolescents with mental health

issues tend to have a lower self-worth, negative feelings, poor performance in school, and be later involved in unhealthy lifestyle. Good mental health is as important as good physical health and is essential for the individuals themselves and people surrounding them (Kids Mental Health, 2015).

Generally, there are two types of care available for people struggling with mental health problems: inpatient and outpatient treatments. Inpatient treatment is the most intensive level of treatment, and it offers 24-h care in a safe and secure facility and often offers to patients with severe mental health problems. Outpatient treatment offers many of the same services as inpatient care but has the flexibility to allow patients to attend treatment during the day and return home to be with their caregivers in the evenings. Because of the flexibility and freedom involved in outpatient treatment, this modality is often recommended to individual's with mild or moderate mental health problems, as well as those transitioning from inpatient treatment (MacDonald et al., 2018). Outpatient treatment is the most common treatment modality for

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children and adolescents, it has been consistently found to have a positive effect on psychiatric symptoms (Angold et al., 2000; Burns et al., 1999; Waddell et al., 2005). Such treatment typically contains a large number of therapeutic approaches, including individual and group psychotherapy, school-based services, therapeutic foster care, focused family-support programs, and Internet-based cognitive behavioral therapy (Kazdin and Weisz, 1998; Pettersson et al., 2014; PsychGuides.com, 2018). A systematic review identified outpatient treatment as either “well-established” or “probably efficacious” treatment for such mental disorders as disruptive behavior disorders, anxiety disorders, and autism (Burns et al., 1999). A significant dose-response relationship was also found between the number of treatment sessions received and improvement in symptoms at follow-up. Eight or more sessions was suggested as being required to produce such positive effects (Angold et al., 2000).

The Child and Adolescent Functional Assessment Scale (CAFAS) which is a multidimensional level of functioning (LOF) measurement, which has been used to assess functioning of children and adolescents entering and exiting from the mental health care. It consists eight subscales: School, Home, Community, Behaviour Toward Others, Mood/Emotions, Self-Harm, Substance Use, and Thinking. Changes in CAFAS subscale scores are informative as it is important to know whether clients improve generally as well as in specific domains when exiting from treatment (Rohr et al., 2014). Complementary scales allow the assessment of caregiver resources, *Family/Social Support* and *Material Needs* subscales are used to examine the extent to which the clients' functioning was disrupted due to limitations in the family's psychosocial resources and caregiving ability. Having an impaired caregiving environment can decrease the probability of successful treatment outcomes (Xue et al., 2004).

Reliability and validity for the CAFAS have been tested by previous studies. Reliability studies have demonstrated satisfactory internal consistency (Hodges and Wong, 1996; Barwick et al., 2004), test-retest reliability (Hodges, 1995; Pernice et al., 1997), and interrater reliability (Hodges and Wong, 1996; Ogles et al., 1999). Numerous studies also provided supportive evidence of construct, criterion, concurrent and predictive validity (Hodges and Wong, 1996, 1997; Hoge, 2002; Quist and Matshazi, 2000; Hodges and Kim, 2000; Hodges and Wotring, 2000; Bastiaansen et al., 2004; Hodges et al., 2000; Hodges et al., 1999; Lambert et al., 2001; Resendez et al., 2000).

Measures such as the CAFAS allow clinicians and health managers to know their clients, the effectiveness of their services in improving client functioning, and the factors that may affect the effectiveness of their services. It is also important to understand special needs for children and youth as they are at different development stages. Parents or caregivers play a large role in children's life during their development of behaviors, social skills, cognition, and emotions that can affect their life-long health. Similarly, the transition from childhood to adulthood can subject adolescents to a variety of psychological and social pressures. They experience puberty both physical and emotional changes, including hair, breasts, establishing identity, and so on. Rumsey and Harcourt (2007) believed that parental influence typically decreases from childhood to adolescent when kids increasingly engage in social network with their peers. Therefore, children and adolescents with mental health problems may require different focuses. For example, caregivers, often parents, have a great impact on children lives and development, whereas peers are the important social figures for adolescents.

Studies have reported on the use of the CAFAS scale for administrative purposes and in clinical settings. It helps linking the level of care and the level of need (Detroit Wayne Mental Health Authority, 2015; Newman et al., 1989; Newman and Hodges, 1995), program evaluation and planning (CAFAS In Ontario, 2017; Detroit Wayne Mental Health Authority, 2015; Herman and Mowbray, 1991; Pokorny, 1991), and predicting subsequent service utilization and associated costs (Detroit Wayne Mental Health Authority, 2015; Hodges and Wong, 1996).

Previous studies on the scale also indicated its usefulness in clinical settings, such as case formulation, tracking changes in functioning over time (Boydell et al., 2005; Detroit Wayne Mental Health Authority, 2015), and clinical decision-making about individual consumers (Hodges and Wong, 1996).

However, little research can be found that to what extent, the CAFAS subscales contribute to the overall functioning impairment, or on the different social-demographic and clinical characteristics associated with changes in clients' functioning (Walrath et al., 2001). Knowledge of the predictors of functional change are important for clinicians, decision-makers, and administrators as they need to know what determinants are associated with functioning improvements and apply personalized care towards clients' needs.

This study aimed to fill this information gap by answering the following questions: (1) did, and to what extent, each subscale of CAFAS contribute to clients' overall functioning impairment? (2) did changes in total and subscale scores occur by the time clients exited treatment? (3) what factors were associated with improvement in client functioning? and, (4) were there any differences between children and youth regarding to the above questions? We used clinical data to answer these questions. The clinical data were from a publicly funded specialized provider of a range of outpatient mental health treatment services for children and youth in a mid-sized Canadian prairie city.

## 2. Methods

### 2.1. Context

Though federally mandated, provincial governments in Canada take the responsibility of most health services delivered within their provinces with the services provided varying somewhat from province to province. These services include almost all hospital and physician services, prescription drug subsidies, a significant proportion of nursing home, community care services and preventive public health services. Saskatchewan is a prairie province in Canada. These publicly funded health services available at no direct cost to the clients. Saskatoon is a city in central Saskatchewan. It is the largest city in the province with a 2016 census population of 246,376. The Saskatoon Health Region (SHR) was the largest health region in the province, and about 30% of the province's population resides within the region's geography. SHR was an integrated health delivery agency providing a comprehensive range of services and programs including hospital, long-term care, public health, home care, mental health and addition services, and prenatal and palliative care. SHR provides services to residents in Saskatoon and rural areas of the central Saskatchewan. In 2015 it served approximately 342,362 residents in urban and rural areas in central Saskatchewan (Saskatoon Health Region, 2015).

Child and Youth Mental Health and Addictions Services (CYMHAS) is the major agency in the Saskatoon region involved in the provision of a continuum of outpatient treatment services to children and youth (and their families) who require mental health treatment. Children and adolescents are generally referred for assessment and treatment from a variety of sources: parents, schools, health professionals, mental health centers, departments of juvenile justice, and social services. The common and over-arching treatments provided include cognitive behavioral therapy, exposure therapies, play therapy, parent education, behavioral therapy, pet therapy, art therapy, and neuro-sequential model of therapeutics. Treatment modalities vary between clinicians and depend on the clients' presenting concerns. These clinicians do not prescribe medications. In Saskatchewan, only licensed physicians and registered Nurse Practitioners (to a limited extent) are permitted to write prescriptions for medications.

The Child and Adolescent Functional Assessment Scale (CAFAS) was widely used as a functioning assessment tool within the CYMHAS during the study period. In general, the prototypical treatment cycle (episode) at the time was conceived as using the CAFAS at: an initial

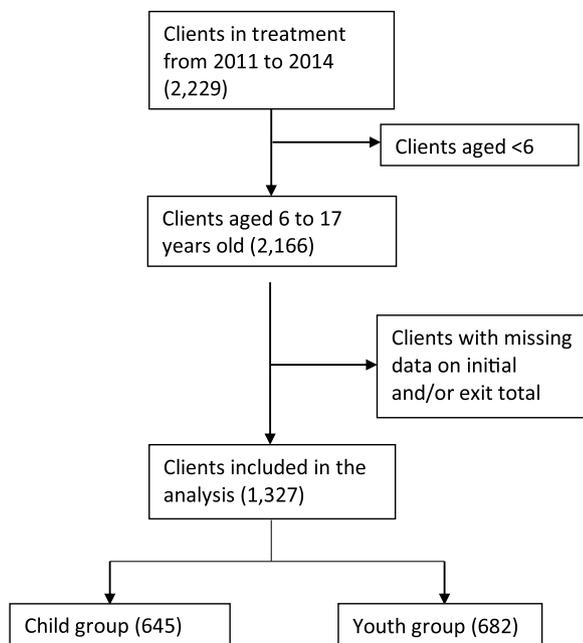


Fig. 1. Flowchart of subject selection.

assessment, a 3-month assessment, a 9-month assessment, followed by an exit assessment. Some clients can and do terminate treatment earlier than anticipated, whereas others continue treatment over a longer time period. The CAFAS assessments were conducted by social workers, counsellors, and psychologists who were trained by using a well-developed training manual with numerous training vignettes. The assessors may use various sources of information to complete the CAFAS, including interviews with the child and family, interviews with other professionals familiar with the child's behaviors, and record reviews (Bates, 2001).

## 2.2. Data resource

We analyzed data for all those CYMHAS clients aged 6 to 17 years old enrolled in treatment between 2011 and 2014 for their first treatment episode (cycle). Those with incomplete records of intake and exit assessments were excluded. The anonymized data analyzed were from the clinic's individual client clinical (CAFAS) and administrative (Administrative and Management Information System, AMIS) data files. A total number of 1327 children (645) and youth (682) met inclusion criteria and their data were included in the analysis (Fig. 1).

### 2.2.1. Child and Adolescent Functional Assessment Scale (CAFAS)

CAFAS consists of eight subscales (School, Home, Community, Behaviour Toward Others, Mood/Emotions, Self-Harm, Substance Use, and Thinking) and two caregiver resources subscales (Family/Social Support and Material Needs). Each of subscales is scored from 0 to 30, indicating minimal/none to severe impairment. Higher scores indicated greater impairment. Appendix shows the assessment rubric for each subscale and level of impairment. A total score is summed up by the scores from the eight subscales. The total score is further divided into five levels of dysfunction: 1 (scored 0–10) – no impairment; 2 (scored 20–40) – outpatient treatment; 3 (scored 50–90) – additional services beyond outpatient care; 4 (scored 100–130) – more intensive treatment than outpatient care and/or multiple sources of supportive care; and, 5 (scored 140 and above) – intensive treatment (inpatient).

### 2.2.2. Administrative and Management Information System (AMIS)

CYMHAS's AMIS – Administrative and Management Information System contains detail socio-demographic (e.g. living arrangement,

area of residence and number of residential addresses) and some clinical data (e.g. referral source and parental involvement in capacity development). It was matched with CAFAS data via clients' unique identification number. However, due to a large proportion of missing values in youth age group (approximately 85%), AMIS predictors were only used in the analysis of predictors of functioning and changes in functioning for the child age group.

## 2.3. Measures

### 2.3.1. Outcome

We defined our outcome as the improvement in level of dysfunction between intake and exit, which was calculated by the formula below, and coded as a dichotomous variable (1 = with improvement, 0 = without improvement):

$$\text{Improvement in the level of dysfunction} = \text{level of dysfunction at intake} - \text{level of dysfunction at exit}$$

### 2.3.2. Predictors

**Socio-demographic variables.** Majority of the socio-demographic variables were retrieved from AMIS including information on living arrangement (family of origin, foster homes/other, not provided), area of residence (Northeast, East Centre, South, Southwest, North, West, rural/Prince Albert), number of residential addresses (1, 2, 3+), referral source (professionals, client family/guardian, justice, school, other), and parental involvement in capacity development (yes, no). Information on sex (male, female) was retrieved from the CAFAS dataset.

**Clinical variables.** Information on primary presenting problem (aggressive behavior, anxiety, relationship difficulties, cognitive difficulties, behavioral concern, traumatic events, depression, other) and number of presenting problems (1, 2, 3+) was obtained from the AMIS dataset. The CAFAS dataset provided client information on initial and exit CAFAS total scores (0–240) and eight subscales scores (0–30), which contributed to the total scores, for specific functioning domains. Additional sub-scales which did not contribute to the total scores included: Pervasive Behavioral Impairment (PBI, yes/no), which was defined as moderately or severely impaired on all three of the School, Home, and Behaviour Towards Others sub-scales (scored 30 or 20); Caregiver Resources (family/social support, 0–30) which assesses the extent to which the client's functioning was disrupted due to limitations in the family's psychosocial resources, and Caregiver Resources (material needs, 0–30) which examined whether the client's material needs exceed the caregiver's ability to provide. The CAFAS dataset also provided data on length of stay in treatment (0–24+ months) and number of episodes (treatment cycles, 1, 2, 3+).

## 2.4. Statistical analysis

Because children and youth are experiencing different developmental stages both mentally and physically, thus they are facing different mental health treatment needs. All the analyses were conducted separately based on their age groups – children (aged 6–11 years) and youth (aged 12–17). The cut-point for the age groups studied are based on the definitions of children and youth from the U.S. Centres for Disease Control and Prevention (CDC) (CDC, 2015).

Descriptive analyses were used to understand clients' characteristics. Confirmatory factor analyses (CFAs) were applied to test whether and to what extent the eight CAFAS subscales were consistently predicting the overall level of dysfunction. Because the subscale variables were ordinal, CFAs were conducted using robust maximum likelihood estimation with the Satorra and Bentler (S-B) scaled chi-squared tests (Satorra and Bentler, 1994). This adjustment for non-normality also allowed us to obtain robust results for standard errors, *p*-values, confidence intervals, and goodness-of-fit statistics. Model fitting was evaluated by using the following fit statistics: S-B chi-square,

comparative fit index (CFI), Tucker Lewis Index (TLI), root mean square error of approximation (RMSEA), Akaike information criterion (AIC), and Bayesian Information Criterion (BIC). By convention, higher CFI and TLI values ( $\geq 0.90$ ), and lower chi-square values, RMSEA ( $\leq 0.08$ ), AIC, and BIC values indicate better fit (Hu and Bentler, 1998, 1999).

Because the subscale and total scores showed non-normality (skewnesses ranged from 0.029 to 4.160), non-parametric tests were used to gauge the changes in total and each subscale score and their significances. Higher CAFAS scores indicate more severe impairment both at intake and exit points. Differences in CAFAS scores were expected when comparing intake and exit scores. Asymptotic significances were used unless there were less than a total of 25 positive and negative differences, in which cases exact significances were employed.

Multivariable logistic regressions were used to examine determinants associated with functioning improvement. Again, the goodness of fit was tested. Due to the large proportion of missing values in adolescents (approximately 85%), AMIS variables were not included in the model for the youth group which were analyzed separately using chi-square tests. For the purpose of comparison of factors between children and youth, the model for child age group was assessed in two ways: AMIS variables included and not included. We used Stata 14 software (StataCorp, 2015) for all the analyses.

2.5. Ethical consideration

This research project analyzed an anonymized data without personal identification and was approved by the Behavioral Research Ethics of the University of Saskatchewan and the Saskatoon Health Region, certificate 14-421.

3. Results

3.1. The study sample

Table 1 presents the socio-demographic and clinical characteristics of the clients. Of note there were many more males in the child group ( $M = 60.8\%$ ,  $F = 39.2\%$ ) whereas in the adolescent group had somewhat more females ( $M = 43.4\%$ ,  $F = 56.6\%$ ) Overall, the majority of the subjects lived in the generally less affluent areas of West (23.5%) and Southwest (17.6%) of Saskatoon, lived with family of origin (86.3%) with one stable address (78.6%), were referred by health professionals (32.2%), families or guardians (45.9%), or schools (17.4%), had only one treatment episode/cycle (82.1%), had mostly behavioral concerns (30.5%) or anxiety (25.0%), received services for 15 months or less (87.0%), did not have issues with regard to both caregiver resources - family support (56.9%) and material needs (92.9%), PBI (90.1%), and had a Total Score of 90 or less at intake (86.2%), indicating minimal to moderate level of dysfunction, and their caregivers were not involved in any parental capacity developmental programs (83.6%).

3.2. Contribution of CAFAS subscale scores to overall level of dysfunction at intake

Fig. 2 shows the relationship of subscales and level of dysfunction for children and adolescents. While all eight subscales were positively and significantly predicting children's overall level of dysfunction, it does not show statistically significant relationship for 'Mood' and 'Thinking Problem' domains among adolescents. 'School', 'Home', and 'Behaviour Towards Others' subscales were the top three domains that had the strongest impact to the overall level of dysfunction in both groups. 'Mood', 'Self-Harm', and 'Substance Use' subscales had the least impact on overall dysfunction score among children. 'Substance Use' subscale also had a relatively low association with youth's level of dysfunction compared with other significant subscales. It is noteworthy

**Table 1**  
Population characteristics by age group (total number of cases may vary due to missing values).

Categorical variables	Child (6–11 years)		Adolescent (12–17 years)		Total	
	n	Percent	n	Percent	n	Percent
<b>Sex</b>						
Male	392	60.8%	296	43.4%	688	51.8%
Female	253	39.2%	386	56.6%	639	48.2%
<b>Total</b>	<b>645</b>	<b>100.0%</b>	<b>682</b>	<b>100.0%</b>	<b>1327</b>	<b>100.0%</b>
<b>Area of residence</b>						
Northeast	67	11.6%	11	10.9%	78	11.5%
East Centre	57	9.9%	15	14.9%	72	10.6%
South	71	12.3%	13	12.9%	84	12.4%
Southwest	108	18.7%	11	10.9%	119	17.6%
North	80	13.9%	12	11.9%	92	13.6%
West	129	22.4%	30	29.7%	159	23.5%
Rural & Prince Albert	65	11.3%	9	8.9%	74	10.9%
<b>Total</b>	<b>577</b>	<b>100.0%</b>	<b>101</b>	<b>100.0%</b>	<b>678</b>	<b>100.0%</b>
<b>Number of addresses</b>						
1	456	79.0%	77	76.2%	533	78.6%
2	95	16.5%	12	11.9%	107	15.8%
3+	26	4.5%	12	11.9%	38	5.6%
<b>Total</b>	<b>577</b>	<b>100.0%</b>	<b>101</b>	<b>100.0%</b>	<b>678</b>	<b>100.0%</b>
<b>Living arrangement</b>						
Family of origin	549	86.5%	99	85.3%	648	86.3%
Foster homes & other	39	6.2%	9	7.8%	48	6.4%
Not provided	47	7.4%	8	6.9%	55	7.3%
<b>Total</b>	<b>635</b>	<b>100.0%</b>	<b>116</b>	<b>100.0%</b>	<b>751</b>	<b>100.0%</b>
<b>Primary presenting problem</b>						
Aggressive behavior	59	10.4%	12	11.5%	71	10.6%
Anxiety	137	24.2%	30	28.8%	167	25.0%
Relationship difficulties	33	5.8%	4	3.8%	37	5.5%
Cognitive difficulties	37	6.5%	4	3.8%	41	6.1%
Behavioral concern	176	31.2%	28	26.9%	204	30.5%
Traumatic events	64	11.3%	13	12.5%	77	11.5%
Depression	44	7.8%	13	12.5%	57	8.5%
Other	15	2.7%	0	0.0%	15	2.2%
<b>Total</b>	<b>565</b>	<b>100.0%</b>	<b>104</b>	<b>100.0%</b>	<b>669</b>	<b>100.0%</b>
<b>Number of problems</b>						
1	195	34.5%	22	21.2%	217	32.4%
2	164	29.0%	38	36.5%	202	30.2%
3+	206	36.5%	44	42.3%	250	37.4%
<b>Total</b>	<b>565</b>	<b>100.0%</b>	<b>104</b>	<b>100.0%</b>	<b>669</b>	<b>100.0%</b>
<b>Referral source</b>						
Professionals	204	32.1%	38	32.8%	242	32.2%
Client family/guardian	290	45.7%	55	47.4%	345	45.9%
Justice	12	1.9%	3	2.6%	15	2.0%
School	115	18.1%	16	13.8%	131	17.4%
Other	14	2.2%	4	3.4%	18	2.4%
<b>Total</b>	<b>635</b>	<b>100.0%</b>	<b>116</b>	<b>100.0%</b>	<b>751</b>	<b>100.0%</b>
<b>Intake CAFAS Total Score</b>						
Low (0 – 40)	354	54.9%	237	34.8%	591	44.5%
Medium (50 – 90)	235	36.4%	318	46.6%	553	41.7%
High (100+)	56	8.7%	127	18.6%	183	13.8%
<b>Total</b>	<b>645</b>	<b>100.0%</b>	<b>682</b>	<b>100.0%</b>	<b>1327</b>	<b>100.0%</b>
<b>Pervasive Behavioral Impairment (PBI)</b>						
No	569	88.2%	626	91.8%	1195	90.1%
Yes	76	11.8%	56	8.2%	132	9.9%
<b>Total</b>	<b>645</b>	<b>100.0%</b>	<b>682</b>	<b>100.0%</b>	<b>1327</b>	<b>100.0%</b>
<b>Parental capacity development participation</b>						
No	526	82.8%	102	87.9%	628	83.6%
Yes	109	17.2%	14	12.1%	123	16.4%
<b>Total</b>	<b>635</b>	<b>100.0%</b>	<b>116</b>	<b>100.0%</b>	<b>751</b>	<b>100.0%</b>
<b>Caregiver resources – family support - deficits</b>						
Minimal (0)	386	62.6%	300	51.0%	686	56.9%
Mild (10)	129	20.9%	173	29.4%	302	25.1%
Moderate (20) to Severe (30)	102	16.5%	115	19.6%	217	18.0%
<b>Total</b>	<b>617</b>	<b>100.0%</b>	<b>588</b>	<b>100.0%</b>	<b>1205</b>	<b>100.0%</b>

(continued on next page)

Table 1 (continued)

Categorical variables	Child (6–11 years)		Adolescent (12–17 years)		Total	
	n	Percent	n	Percent	n	Percent
<b>Caregiver resources – material needs</b>						
Minimal (0)	570	92.8%	547	93.0%	1117	92.9%
Mild (10)	34	5.5%	34	5.8%	68	5.7%
Moderate (20) to Severe (30)	10	1.6%	7	1.2%	17	1.4%
<b>Total</b>	<b>614</b>	<b>100.0%</b>	<b>588</b>	<b>100.0%</b>	<b>1202</b>	<b>100.0%</b>
<b>Number of episodes</b>						
1	524	81.2%	565	82.8%	1089	82.1%
2	100	15.5%	108	15.8%	208	15.7%
3+	21	3.3%	9	1.3%	30	2.3%
<b>Total</b>	<b>645</b>	<b>100.0%</b>	<b>682</b>	<b>100.0%</b>	<b>1327</b>	<b>100.0%</b>
<b>Length of stay (month)</b>						
0–3	104	16.1%	242	35.5%	346	26.1%
3–6	128	19.8%	109	16.0%	237	17.9%
6–9	136	21.1%	185	27.1%	321	24.2%
9–12	77	11.9%	45	6.6%	122	9.2%
12–15	75	11.6%	52	7.6%	127	9.6%
15–18	41	6.4%	10	1.5%	51	3.8%
18–21	34	5.3%	21	3.1%	55	4.1%
21–24	22	3.4%	4	0.6%	26	2.0%
24+	28	4.3%	14	2.1%	42	3.2%
<b>Total</b>	<b>645</b>	<b>100.0%</b>	<b>682</b>	<b>100.0%</b>	<b>1327</b>	<b>100.0%</b>

that ‘Self-Harm’ subscale negatively predicted the overall level of dysfunction in youth.

3.3. Difference in CAFAS total score between initial and exit assessment

Fig. 3 graphs the differences in the distribution of Total Score at

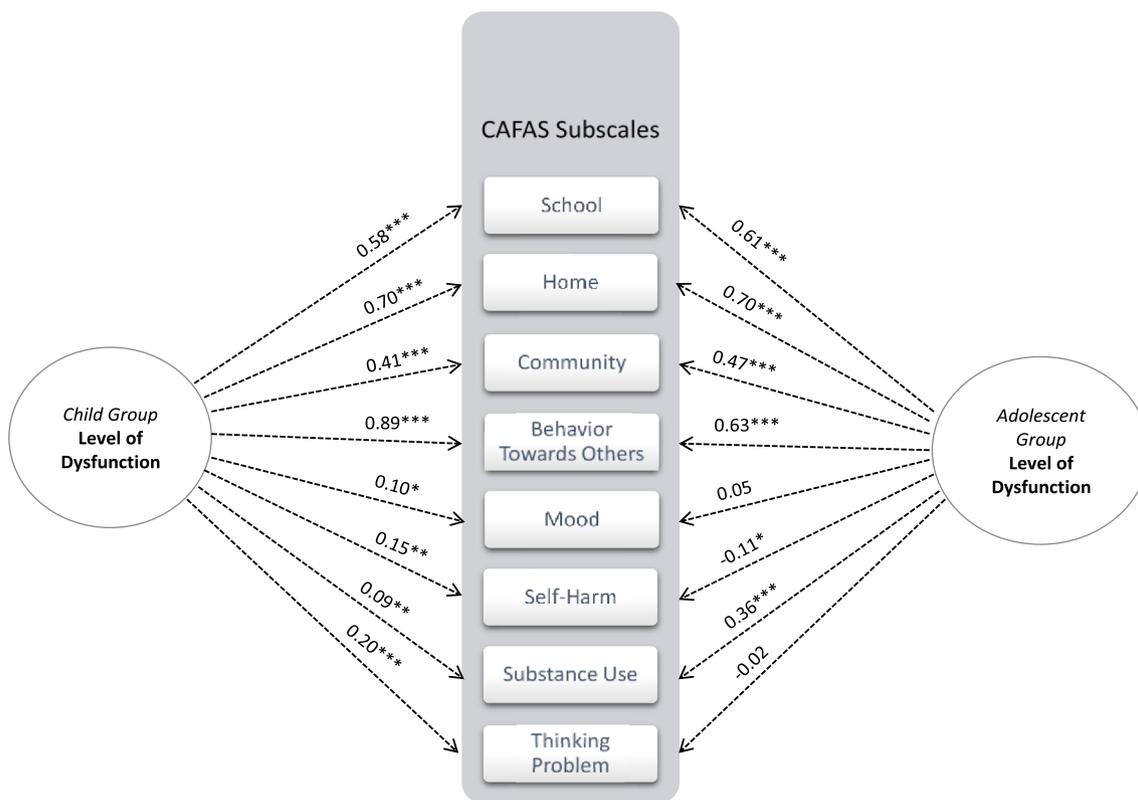
initial assessment and at exit for child and adolescent client populations separately. Clearly evident is that substantial improvement has occurred for the majority of clients in both age groups. However, it is also evident that there is still a number of clients that remain substantially dysfunctional after a single treatment episode.

CAFAS defines a clinically meaningful and reliable difference in Total Score (dysfunction) as a reduction in Total Score of 20 or more points. A client must have score 20 or more at intake to be included in the analysis, 583 (out of 645) children and 645 adolescents (out of 682) qualified. Of those, 52% of children and 56% of adolescents were deemed to have made a clinically significant and meaningful change in functioning. It is obvious that those with higher initial Total Score have a greater potential for achieving a clinically meaningful improvement.

3.4. Difference in total and subscale scores of CAFAS between intake and exit assessments

Non-parametric tests (sign tests) were used to compare the differences in total and subscale scores between initial and exit assessment for both children and adolescents (see Table 2). The total score and seven of the eight subscale (except ‘Substance Use’) scores at exit elicited a statistically significant median decline in functioning impairment compared to intake assessment scores among children. ‘School’, ‘Home’, ‘Behaviour Towards Others’, and ‘Mood’ subscales showed most improvement. The exact significance test was used for ‘Substance Use’ due to the small number of negative and positive differences, and the p-value was 0.25.

For adolescents, the total score and all subscale scores at exit demonstrated a significant median decrease in functioning impairment, compared to initial assessment scores. ‘Mood’ and ‘Self-Harm’ subscales declined more (improved) than other subscales.



\*p<0.05; \*\*p<0.01; \*\*\*p<0.001

Fig. 2. Confirmatory factor analysis by age group.

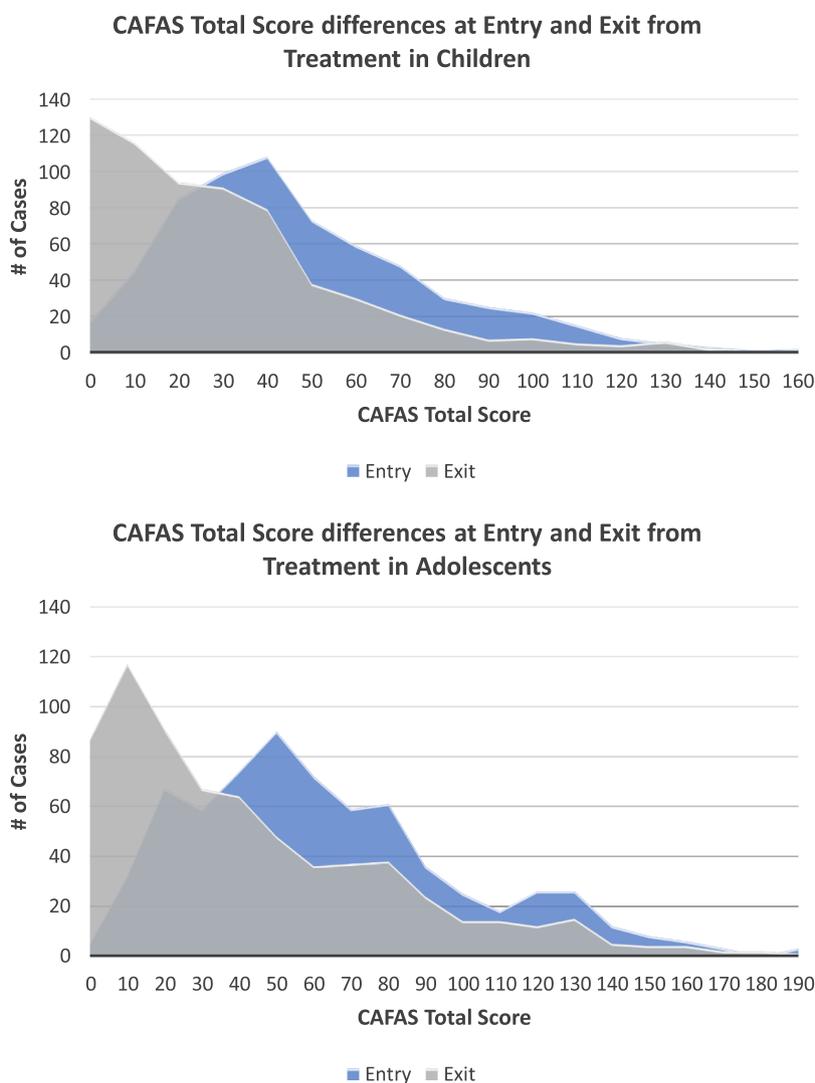


Fig. 3. Area graph of the distribution of initial and exit CAFAS Total Scores for both child and adolescent age groups.

Table 2

Median differences, total and subscale scores from entry to exit for children and adolescents (N = 1327).

	Children (6–11 years, n = 645)				Adolescent (12–17 years, n = 682)			
	Negative differences <sup>a</sup> (better)	Positive differences <sup>b</sup> (worse)	Ties <sup>c</sup>	Z score	Negative difference <sup>a</sup> (better)	Positive difference <sup>b</sup> (worse)	Ties <sup>c</sup>	Z score
<b>Total score</b>	389	57	199	-15.7***	457	96	129	-15.3***
School subscale	205	40	400	-10.5***	187	63	432	-7.8***
Home subscale	207	23	415	-12.1***	198	61	423	-8.5***
Community subscale	24	9	612	-2.4*	72	23	587	-4.9***
Behavior subscale	233	32	380	-12.3***	168	49	465	-8.0***
Mood subscale	247	31	367	-12.9***	301	47	334	-13.6***
Self-Harm subscale	60	10	575	-5.9***	211	16	455	-12.9***
Substance subscale	3	0	642	0.250 <sup>d</sup>	83	49	550	-2.9**
Thinking subscale	27	8	610	-3.0**	59	27	596	-3.3**

<sup>a</sup> Exit score < initial score;

<sup>b</sup> Exit score > initial score;

<sup>c</sup> Exit score = initial score;

<sup>d</sup> Exact sign test was used.

\* p-value < 0.05;

\*\* p-value < 0.01;

\*\*\* p-value < 0.001.

**Table 3**  
Comparison of predictors for improvement in level of dysfunction by age group.

Logistic regression Variable	Categories	Child (AMIS variables included in the model)	Child (Amis variables excluded)			Adolescent (Amis variables excluded)		
		OR (95% CI)	OR (95% CI)			OR (95% CI)		
<b>Initial total score</b>	Low (0–40)	1	1			1		
	Medium (50–90)	4.3 (2.7–7.0)***	3.7 (2.5–5.4)***			2.4 (1.6–3.5)***		
	High (100+)	9.9 (3.1–31.9)***	5.8 (2.4–14.1)***			7.2 (3.5–14.9)***		
<b>Initial PBI</b>	Yes	1	1			1		
	No	3.8 (1.5–9.7)**	1.6 (0.8–3.4)			3.1 (1.3–7.4)**		
<b>Length of stay (month)</b>	0–3	1	1			1		
	3–6	2.0 (1.0–4.0)	1.5 (0.8–2.6)			1.4 (0.8–2.4)		
	6–9	1.8 (0.9–3.6)	2.0 (1.1–3.6)*			1.9 (1.2–2.9)**		
	9–12	2.1 (0.9–4.6)	2.6 (1.3–5.1)**			1.8 (0.9–3.6)		
	12–15	4.3 (1.9–9.5)***	4.3 (2.2–8.5)***			2.6 (1.3–5.1)**		
	15–18	4.4 (1.6–12.1)**	4.4 (1.9–9.9)***			6.9 (1.2–40.9)*		
	18–21	4.0 (1.4–12.0)*	5.1 (2.1–12.8)***			5.6 (1.5–20.5)*		
	21–24	1.9 (0.6–6.5)	1.6 (0.6–4.4)			1.2 (0.2–9.3)		
	24+	4.2 (1.4–13.1)*	3.8 (1.5–9.9)**			1.8 (0.5–6.1)		
	<b>Caregiver resources – Family support</b>	Minimal (0)	1	1			1	
Mild (10)		0.7 (0.4–1.1)	0.5 (0.4–0.9)**			0.9 (0.6–1.3)		
Moderate (20) to Severe (30)		1.0 (0.6–1.9)	0.6 (0.4–1.0)			0.6 (0.4–1.0)		
<b>Number of address</b>	1	1						
	2	1.6 (0.9–2.8)						
	3 or more	1.7 (0.6–5.1)						
<b>Primary presenting problem</b>	Behavioural concern	1						
	Aggressive behavior	2.0 (1.0–4.2)						
	Anxiety	2.5 (1.4–4.4)**						
	Relationship difficulties	4.0 (1.6–10.0)**						
	Cognitive difficulties	1.5 (0.6–3.6)						
	Traumatic events	1.4 (0.6–3.0)						
	Depression	3.1 (1.3–7.1)**						
	Other	1.7 (0.5–6.2)						
		Chi-square test						
		Not improved	Improved	Total	Not improved	Improved	Total	
<b>Area of residence</b>	West	1	76 (58.9%)	53 (41.1%)	129 (100%)			
	Northeast	2.4 (1.1–4.9)*	33 (49.3%)	34 (50.7%)	67 (100%)			
	East Centre	1.7 (0.8–3.8)	29 (50.9%)	28 (49.1%)	57 (100%)			
	South	1.9 (1.0–3.9)	34 (47.9%)	37 (52.1%)	71 (100%)			
	Southwest	1.1 (0.6–2.1)	74 (68.5%)	34 (31.5%)	108 (100%)			
	North	2.2 (1.1–4.5)*	39 (48.8%)	41 (51.2%)	80 (100%)			
	Rural & Prince Albert	3.0 (1.4–6.6)**	26 (40.0%)	39 (60.0%)	65 (100%)			
		Chi-square value: 18.3**						

PBI, Pervasive Behavioural Impairment; OR, odds ratio; CI, confidence interval;

\*  $p < 0.05$ ;  
 \*\*  $p < 0.01$ ;  
 \*\*\*  $p < 0.001$ .

**3.5. Predictors of improvement in level of dysfunction among children with all AMIS variables included in the model**

There were 76.7% (495/645) children with completed records for all variables (including AMIS variables) included in the model. Clients who had medium to high initial Total Score, no initial Pervasive Behavioral Impairment (PBI), stayed 12 month or longer for the treatment, had a diagnosis of anxiety, relationship difficulties, and depression as primary presenting problems, and who lived in the north and northeast of Saskatoon and rural areas and Prince Albert (a neighboring city) were more likely to have improvement (decreases) in level of dysfunction (Table 3). These area of residence differences no doubt reflect differences in the socio-economic characteristics of various areas of the City.

**3.6. Comparison of predictors between children and adolescents with AMIS variables analyzed separately**

Due to a large proportion of missing values of AMIS variables in the adolescent group, AMIS variables were excluded from model building

process and were analyzed separately by using chi-square tests. For the purpose of comparison, a model was also built for children without AMIS variables. In the regression models, 95.7% (617/645) of children and 85.8% (585/682) of adolescents with completed records of CAFAS variables were included in the analysis. Initial Total Score and length of stay were associated with the improvement in level of dysfunction for both groups, while initial PBI showed significant association only in the youth group and caregiver family support only in the children group. Children living in North, Northeast, South, in rural areas and Prince Albert were more likely to improve (decrease) their level of dysfunction at exit, whereas no significant area of residence differences were identified among adolescents.

**3.7. Comparison of predictors in children with and without AMIS variables included in the models**

The predictors of improvement in level of dysfunction were analyzed via two different methods for children – including and not including AMIS variables in the models. Both methods indicated that initial Total Score, length of stay, and area of residence were

significantly associated with the improvement in level of dysfunction. Initial PBI and primary presenting problem did not show significant impacts in the model without AMIS variables and separate chi-square tests, respectively. Children with mild impairment on their caregiver family support on initial assessment (10), were more likely to have a decreased level of dysfunction compared to those who had a minimal score (0) in the CAFAS variables only model.

#### 4. Discussion

This study evaluated the structure of the CAFAS as a tool assessing client functioning in various aspects of life, examined the effectiveness of treatment offered by the publicly funded and assessable Saskatoon Mental Health and Addiction Services, and identified the determinants of positive outcomes. All CAFAS subscales values generally contributed to the overall level of dysfunction for both children and adolescents. The Total Score and most of the subscales scores (except the 'Substance Use' in child group which was low to begin with) were at exit significantly decreased compared to initial scores, meaning that client functioning had improved by the time they exited treatment. Common and unique characteristics were associated with functional improvements for both children and adolescents. Among children, those residing in more affluent areas of the City were more likely to have better outcomes. Among adolescents, we lacked data on area of residence. For children and adolescents, there was a positive relationship between length/duration of treatment and improvement with a plateau effect after 21 months.

CAFAS scores have been reported as significant predictors of treatment and service utilization (Bates et al., 2006; Hodges and Wong, 1997). Bates (2001) in his review also pointed out the merit of using CAFAS as a tool for making treatment eligibility decisions and documenting the outcomes. Our study used CAFAS as an indicator of functioning to evaluate whether clients benefited for their outpatient services. Overall, children and adolescents had improved functioning at exit. Statistically significant declines in scores were observed for most of the subscales, while the 'Substance Use' subscale did not show significant results for either age group, this finding is consistent with a previous CAFAS report (Rohr et al., 2014). In terms of substance use subscale, we only observed significant findings for adolescents, not for children. Because children reported very few substance use problems at intake, as shown in Table 2 (only three cases improved at exit). The rest of children had no substance use problems, therefore no changes could be observed. Even though all the three cases improved at exit, this number is relatively small (3/645), improvements in these three cases cannot contribute statistical significances to the whole group. In contrast, among adolescents, a relatively larger group (83/682) had improvements in their Substance Use functioning at exit. The Pervasive Behavioral Impairment (PBI) is one of the shared predictors for improvements in functioning among children and adolescents. This finding is in line with the existing literature. Pervasive behavioral problems were the strongest predictor for poor outcome in 'School' and 'Home' domains, and social interactions (Xue et al., 2004). Emck et al. (2009) also pointed out in their review that children with developmental and emotional disorders tended to be restricted in participating in active lifestyles and further disruption of their psychosocial and physical development.

Notably, we did not find differences between children and adolescents with regard to length of stay in treatment as a predictor of improvement. All three models generally showed a positive association between improvements (decrease) in level of dysfunction plateauing around 18–21 months (see Table 3). However, staying longer than that in the treatment did not appear to play a role in achieving a better outcome.

Caregiver resources (family support), primary presenting problem, and area of residence were unique factors related to the improvement in functioning in the children group. Children's mental and psychological

development may heavily rely on parents and caregivers in contrast to adolescents. As a result, family's psychosocial resources (family support) and social economic status (reflected by area of residence) play greater roles in children's mental health and their recovery from dysfunction in comparison to adolescents. This is consistent with the findings of prior studies showing that children's mental health status can be influenced by a number of parental factors, including family's socioeconomic situation (Sheehan, 2017), early parent-child interaction and attachment (Rumsey and Harcourt, 2007). Sheehan (2017) believes that therapeutic interventions for children mostly involved working with the family, factors such as socioeconomic status and psychosocial issues can impact the capacity to receive care and the linkages between 'social illnesses and problems' and mental health issues, and thus may further affect recovery and improvement of health outcomes for children.

##### 4.1. Strengths and limitations

Although this is a prospective case cohort study using standardized assessment of functioning, a few limitations should be noted. First, our analysis was limited to clients' first treatment cycle. We did not report on the predictors or effectiveness of treatment in subsequent treatment cycles. Second, data analyzed here were limited for adolescents due to the large proportion of missing values in the AMIS database. We were not able to examine the effects of socio-demographic characteristics to the improvement of functioning, neither were we able to look at the effects of clinical characteristics after adjustment for these socio-demographic factors. Third, data were also limited to the variables already collected for standard administrative and clinical purposes. As a result, we did not have enough information to include the analyses of variables such as ethnicity, number of services/visits, medications prescribed by physicians and other treatment received during study period in the analysis. Nor did we have access to the data on how long the treatment effect persisted, or whether these clients came back for subsequent treatment of similar or new emerging problems. Fourth, the CAFAS was not administered to all clients with behavioral consults or to children under 6 years old not attending school. It was estimated that the CAFAS is administered to approximately 75–80% of all clients seen by Saskatoon Child and Youth Mental Health and Addictions Services during the study time period. Finally, the analysis concerning predictors of functioning only dealt with clients who had completed their first treatment cycle (episode) using their initial and exit assessment records, which means in-process improvements were not considered (e.g. 3-month and/or 9-month assessment).

In addition, there are queries regarding the credibility of the ratings from clinicians who were working with the child and family due to the motivation of showing improvement, however, Hodges et al. (1998) believed that the treating clinician knows the most about their clients and are the best persons to make judgments about their client's growth. They also suggested some restrictions to reduce bias of the ratings. It is important to note that each rating on the CAFAS has to be supported by at least one specific behavioral description of the child. Second, rating errors can be reduced by assessing inter-rater reliability and ensuring that all raters are satisfactorily trained. For this reason, the CAFAS training materials were developed, which can be used for inter-rater reliability tests and ensured that all trainees were receiving standardized training. It might also be helpful to reduce intentional rater bias by auditing and the use of independent raters but such raters would not have the same means of obtaining pertinent information as do the treating clinician (Hodges et al., 1998).

Our findings provide robust evidence indicating that current outpatient specialist child and adolescent mental health services effectively improved clients' functioning. Treatment does make a difference. Clients with a high level of dysfunction at intake and pervasive behavioral problems needed a longer period for treatment to reach a favourable outcome. While shortening the length of each treatment cycle

may improve the efficiency of resource use but perhaps at the expense of clients that need more time to achieve a more optimal functional improvement level. Personalized treatment services are what is required. Further studies on predictors of functioning improvement are warranted. Future research should also compare CAFAS and other assessment tools to see how it performs with respect to other evaluation tools.

**Funding**

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**Appendix**

**Table A1**  
CAFAS assessment rubric<sup>a</sup>.

Measurement	Level of dysfunction Mild (0–10)	Moderate (20)	Severe (30)	
<b>Subscales</b>				
<b>School</b>	<ul style="list-style-type: none"> <li>• Attendance at school</li> <li>• Behavior in the classroom</li> <li>• Credits- Academic performance</li> </ul>	<ul style="list-style-type: none"> <li>• Minor problems: attention, lower productivity</li> <li>• Problems that can be handled by teacher</li> </ul>	<ul style="list-style-type: none"> <li>• Frequently truant/suspended</li> <li>• In or need special setting</li> <li>• Known by principal</li> <li>• Failing ½ courses</li> <li>• Persistent non-compliance with rules</li> <li>• Runaway overnight; where known</li> <li>• Moderate damage</li> <li>• Profanity (not okay)</li> </ul>	<ul style="list-style-type: none"> <li>• Out of school</li> <li>• Serious threat</li> <li>• Failing most courses</li> <li>• Special setting not working</li> <li>• Not in home</li> <li>• Serious threats</li> <li>• Intimidation</li> <li>• Major damage</li> <li>• Runaway over night; where not known</li> <li>• Must be monitored</li> <li>• Interferes with caregiver doing day to day</li> </ul>
<b>Home</b>	<ul style="list-style-type: none"> <li>• Carrying out expectations in the home – chores, rules, responsibilities, self-care</li> <li>• Behavior towards family members</li> <li>• Run away behavior</li> </ul>	<ul style="list-style-type: none"> <li>• Frustrating to caregiver</li> <li>• Balking chores</li> <li>• Repeatedly told to do chores</li> </ul>	<ul style="list-style-type: none"> <li>• In system, or at risk for moderately serious offence: not confronting victim, stealing, sexually inappropriate – adults concerned, repeatedly playing with fire &amp; damage could occur</li> <li>• Probation</li> </ul>	<ul style="list-style-type: none"> <li>• In system or should be in system for serious offence: confronting victim, robbery, selling drugs, prostitution, deliberate damage, sexual assault, deliberate fire starting with malicious intent</li> </ul>
<b>Community</b>	<p>How the child behaves in the community:</p> <ul style="list-style-type: none"> <li>• Violation of persons or property</li> <li>• Fire setting in home included</li> <li>• Do not endorse if: youth was the victim; act was accidental; youth was acting in self-defense</li> <li>• Do endorse if: youth gets into legal trouble; reliable information (“good faith”) from others about youth’s delinquent behavior</li> </ul>	<ul style="list-style-type: none"> <li>• Minor, single offences: vandalism, shoplifting, playing with fire</li> </ul>		
<b>Behavior Toward Others</b>	<p>How the child relates to others:</p> <ul style="list-style-type: none"> <li>• Patterns of behavior towards others</li> <li>• Displays of anger</li> <li>• Poor judgment</li> <li>• Inappropriate sexual behavior</li> <li>• Cruelty to animals</li> </ul>	<ul style="list-style-type: none"> <li>• Poor judgment</li> <li>• Easily annoyed</li> <li>• Annoying to others</li> <li>• Poor peer relations</li> </ul>	<ul style="list-style-type: none"> <li>• Fighting</li> <li>• Promiscuity</li> <li>• Inappropriate sexual behavior</li> <li>• Spiteful/vindictive</li> <li>• Risky behaviors could cause injury</li> <li>• Bullying</li> <li>• Gang activity</li> <li>• Frequent anger outburst</li> </ul>	<ul style="list-style-type: none"> <li>• Behavior consistently odd</li> <li>• Behavior could cause serious harm</li> <li>• Abuse/sexual abuse to others</li> <li>• Constant intimidation</li> <li>• Deliberately &amp; severely cruel to animals</li> </ul>
<b>Moods &amp; Emotions</b>	<ul style="list-style-type: none"> <li>• Anxiety</li> <li>• Fear</li> <li>• Worry</li> <li>• Depression</li> <li>• Separation anxiety</li> <li>• Does NOT include anger/hostility (scored on Behaviour Towards Others)</li> </ul>	<ul style="list-style-type: none"> <li>• Self-critical</li> <li>• Easily distressed when make mistakes</li> <li>• Sad or anxious if criticized</li> <li>• Notable emotional restriction</li> </ul>	<ul style="list-style-type: none"> <li>• Depression or anxiety at least ½ the time, with one disturbance (e.g., sleep, eating, energy)</li> <li>• Emotional blunting from trauma</li> <li>• Separation anxiety</li> </ul>	<ul style="list-style-type: none"> <li>• Viewed as odd/strange</li> <li>• Depression of anxiety with school incapacitation, social isolation or suicidal intent</li> </ul>
<b>Self-harm</b>	<p>Score all self-destructive behavior:</p> <ul style="list-style-type: none"> <li>• Suicidal behavior</li> <li>• Behavior not life-threatening but not trivial</li> <li>• Behavior trivial and unlikely to cause serious injury</li> </ul>	<ul style="list-style-type: none"> <li>• Non-accidental self-harm that is unlikely to cause harm (e.g., scratching skin, picking skin)</li> </ul>	<ul style="list-style-type: none"> <li>• Talking about killing self</li> <li>• Cutting or other non-accidental self-harm or mutilation</li> </ul>	<ul style="list-style-type: none"> <li>• Intent to die/clear plan</li> <li>• Self-destructive behavior which could result in death (e.g., eating disorder, running in front of car)</li> </ul>
<b>Substance Use</b>	<ul style="list-style-type: none"> <li>• Alcohol</li> <li>• Street drugs</li> <li>• Inhalants</li> </ul>	<ul style="list-style-type: none"> <li>• Regular usage</li> <li>• High or intoxicated at least once/week</li> </ul>	<ul style="list-style-type: none"> <li>• Use interferes with functioning</li> <li>• Use gets person into trouble (e.g.,</li> </ul>	<ul style="list-style-type: none"> <li>• Lifestyle centers around</li> <li>• Withdrawal symptoms</li> <li>• Expelled or fired</li> </ul>

(continued on next page)

Table A1 (continued)

Measurement	Level of dysfunction Mild (0–10)	Moderate (20)	Severe (30)	
	<ul style="list-style-type: none"> <li>Misuse of prescription drugs</li> <li>Misuse of over-the counter drugs</li> <li>Tobacco use is not scored</li> <li>Do not rate religious or cultural use</li> <li>12 or younger use lower band of items</li> <li>Score all “hard” drugs at severe level</li> </ul>	<ul style="list-style-type: none"> <li>arguments, breaks rules)</li> <li>Use endangers (e.g., rape)</li> </ul>	<ul style="list-style-type: none"> <li>Intoxicated or high more than 2x/week</li> <li>Pregnant while using</li> <li>Blackouts</li> <li>Drinks alone</li> </ul>	
Thinking	<ul style="list-style-type: none"> <li>Items refers to behaviors that may warrant a referral to a psychiatrist</li> <li>Dysfunctional thought processes or communications</li> <li>Pathological thought processes</li> <li>Obsessions, fantasies, hallucinations</li> <li>Disorders including autism, PDD, schizophrenia can be scored here</li> </ul>	<ul style="list-style-type: none"> <li>Occasional difficulty in communications, in behavior, or in interactions with others</li> <li>Eccentric/odd speech; odd beliefs</li> <li>If older than 8 years – magical thinking</li> <li>Unusual perceptual experiences</li> </ul>	<ul style="list-style-type: none"> <li>Frequent difficulty in communication/ behavior OR specialized setting needed due to any of the following:                             <ul style="list-style-type: none"> <li>Disorganized communications</li> <li>Frequent obsessions/suspicion</li> <li>Intermittent hallucinations</li> </ul> </li> <li>Frequent marked confusion, or evidence of short-term memory loss</li> <li>Pre-occupying fantasies or cognitions</li> </ul>	<ul style="list-style-type: none"> <li>Cannot attend a normal school classroom, does not have normal friendships, and cannot interact adequately in the community due to:                             <ul style="list-style-type: none"> <li>Incoherent communication; loosening of associations</li> <li>Flight of ideas</li> <li>Echolalia</li> <li>Idiosyncratic language</li> </ul> </li> <li>Frequent hallucinations/delusions</li> <li>Pattern of short-term memory loss</li> <li>Disorientation to time/place</li> </ul>
<b>Caregiver Scales</b>				
Material Needs	<ul style="list-style-type: none"> <li>Basic material needs:                             <ul style="list-style-type: none"> <li>Food</li> <li>Housing (safety, privacy)</li> <li>Medical attention</li> <li>Reasonably safe neighborhood</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Occasional negative impact on youth due to disruption in youth needs for food, shelter, medical, or neighborhood safety</li> </ul>	<ul style="list-style-type: none"> <li>Frequent negative impact or major disruption in youth needs for food, shelter, medical, or neighborhood safety</li> </ul>	<ul style="list-style-type: none"> <li>Needs for food, shelter, medical or neighborhood safety are not met &amp; severe risk to health</li> </ul>
Family/Social Support	<ul style="list-style-type: none"> <li>Caregiver behavior is rated</li> <li>Relative to child's needs</li> <li>Parental judgment</li> <li>Supervision problems</li> <li>Conflict problems</li> <li>All forms of abuse</li> </ul>	<ul style="list-style-type: none"> <li>Unable to provide warmth</li> <li>Frequent arguments</li> <li>Poor family relations &amp; problem solving</li> <li>Inconsistent parenting</li> <li>Inadequate supervision/firmness</li> </ul>	<ul style="list-style-type: none"> <li>Youth developmental needs exceed resources</li> <li>Marked impairment of judgment</li> <li>Family conflict</li> <li>Not supportive of traumatized youth</li> <li>Domestic violence</li> <li>Threat of violence</li> </ul>	<ul style="list-style-type: none"> <li>Severe lack of resources, youth needs not met</li> <li>Gross impairment of judgment (e.g., substance, mental)</li> <li>Rejecting, does not want youth home</li> <li>Risk of abuse</li> <li>Youth kicked out with no provisions</li> <li>Not protecting youth who was severely traumatized</li> <li>Severe domestic abuse</li> <li>Openly unlawful or approves of youth being unlawful</li> </ul>

<sup>a</sup> Source: adapted from [https://www.aero-aoce.org/uploads/6/6/0/0/6600183/cafes\\_ppt\\_melaniebarwick.pdf](https://www.aero-aoce.org/uploads/6/6/0/0/6600183/cafes_ppt_melaniebarwick.pdf).

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