SNAP (Stop Now And Plan): Helping children improve their self-control and externalizing behavior problems

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ABSTRACT

Purpose: The Stop Now And Plan (SNAP®) model is designed to improve self-control. Extant research however, has not considered how the program targets self-control and its relation to externalizing behaviors such as aggression and rule-breaking.
Methods: This paper explores the effects of SNAP on improving self-control using the Child Behavior Checklist and Social Skills Improvement System, respectively, from a sample of 318 children. Paired samples *t*-tests were used to compare SSIS self-control and CBCL externalizing scores during initial and follow-up stages of treatment. Controlling for gender and age at each assessment period, a multiple linear regression was used to predict the change in externalizing behaviors based on change in self-control.
Results: Analyses further supported the effectiveness of the SNAP model by demonstrating statistically significant improvements in self-control with moderate effect sizes; this in turn predicted less externalizing behaviors.
Conclusions: The findings highlight the importance of self-control modification programs for improving self-control and reducing problem behavior.

1. Introduction

Jacob is a seven-year-old boy who loves playing with his friends. While passing a ball back and forth, Jacob is surprised and angered when his peer abruptly takes the ball and walks away. "Give it back!" he shouts, but his demands go ignored. With his heart beginning to race and thoughts running wild, Jacob clenches his small fist and poises himself to strike the other boy. What happens next may be determined in large part by Jacob's capacity for self-control.

The construct of self-control, and its influence over behavior, holds a place among the most researched subjects in developmental psychology (Carlson, Zelazo, & Faja, 2013; Duckworth & Steinberg, 2015), and has been covered extensively within the realm of crime and deviance (Gottfredson & Hirschi, 1990; Pratt & Cullen, 2000; Rocque, Posick, & Piquero, 2016; Vazsonyi, Mikuška, & Kelley, 2017) as well as other psychological and behavioral issues including binge eating (Goldschmidt et al., 2016). Despite its popularity, a precise definition and means to measure it still differ widely across disciplines (Duckworth & Kern, 2011; Vohs & Baumeister, 2016). Though an important element of self-regulation, it is in fact a distinct concept

(Shanker, 2010) that "reflects adequate impulse control and attention" (Bridgett, Burt, Edwards, & Deater-Deckard, 2015, p. 604).

Evidence suggests that "parenting behavior is a likely, and key social mechanism in the intergenerational transmission of self-regulation", exerting an influence over behavioral outcomes and neural substrates related to self-control (Bridgett et al., 2015, p. 611). Unsurprisingly, negative parenting practices are chief among the risk factors that threaten its development, in addition to overall child rearing environments, dysfunctional inter-parental relationships, high home chaos, low socioeconomic status, and elevated cumulative family risk (Bridgett et al., 2015). Failure to develop sufficient self-control can have a long-lasting impact on a child's life, making him or her more likely to suffer a range of poor outcomes with regards to health, wealth, and overall happiness (de Ridder, Lensvelt-Mulders, Finkenauer, Stok, & Baumeister, 2012; Moffitt et al., 2011). Added to this barrage of potential adversity is a greater propensity to commit crime in adolescence and even into adulthood. In fact, the association between self-control and crime is considered to be one of the most robust in the literature (de Ridder et al., 2012; Moffitt et al., 2011; Pratt & Cullen, 2000).

According to Howell, Lipsey, and Wilson (2014), children who engage in serious, violent, or chronic delinquent behaviors from a young age are on a trajectory for future criminal careers. The risk to children under the age of twelve is three-fold compared to adolescents (Loeber & Farrington, 2001; Moffitt, 1993). Though many children may eventually "grow out" of these behaviors, a failure to intervene and address them can lead to increasingly serious problems and even criminal offenses. Children under the age of twelve represent both a key risk demographic as well as a prime target for successful intervention and prevention. The "middle years" (ages 6 to 12) are a critical period of time when individuals are most responsive to the introduction of self-control and problem solving strategies (Moffitt et al., 2011; Piquero et al., 2016). Interventions aimed at improving self-control produce the most robust change (Moffitt et al., 2011). When targeting children and adolescents specifically, such programs produce reductions in delinquency moderated by improvements in self-control (Piquero et al., 2016; Piquero, Farrington, Welsh, Tremblay, & Jennings, 2009).

1.1. The Stop Now And Plan (SNAP) model

Despite our knowledge concerning its role in childhood externalizing behavior problems, self-control has been "a crucial and often missing ingredient for success in most treatment programs" (Strayhorn, 2002, p.7). Developed over thirty years ago with this need in mind (Augimeri, Pepler, Walsh, & Kivlenieks, 2017), SNAP® (Stop Now And Plan) multi-modal, gender-specific programs are continuously evolving therapeutic interventions grounded in the scientist-practitioner model (Augimeri, Walsh, Levene, Sewell, & Rajca, 2014). SNAP is offered to families with children aged 6–11 who struggle with externalizing behaviors. The program teaches cognitive and physiological awareness of emotional responses that may trigger aggressive behavior, and how to improve self-control and incorporate problem-solving skills to make better choices in the moment. The SNAP approach/model challenges the misconception that children in their middle years with externalizing behavior problems are the personification of these behaviors, while promoting the importance of working with these children, their families, peers, and schools during this critical developmental stage. Core and additional program components include a child cognitive–behavioral group, a concurrent parent group, individual child counselling/mentoring, family counselling, school advocacy and teacher consultation. These are provided based on an individual assessment of the child and families risk and needs. For each of these SNAP components the focus is to reinforce the SNAP strategy skills across a variety of settings, increasing generalization.

The SNAP model was initially designed in 1985 to fill a gap in services for young children in conflict with the law when Canada raised the age of criminal responsibility from seven to twelve in 1984 with the introduction of the Young Offenders Act. At this time, the primary treatment focus in the field was social skills training programs for children with conduct problems (e.g., McGinnis, Goldstein, Sprafkin, & Gershaw, 1984). SNAP differed in that the treatment focused on a multi-faceted approach to intervention that included an emotion regulation, self-control, and problem solving skills group for children where the group leaders modeled cognition based strategies for self-control (see Hrynkiw-Augimeri, 1986; Hrynkiw-Augimeri, Pepler, & Goldberg, 1993). The model is embedded within an eco-systemic framework, informed by five core theories (Cognitive Behavioral Theory, Feminist Theory, Social-Interactional Learning Theory, Attachment Theory, and Systems Theory), and delivered through a developmental lens (Augimeri, Sewell, Rajca, & Levene, 2017). Due to the complexity of the presenting problems SNAP is used to treat, it is unlikely that any one construct or mechanism will account for its outcomes (Burke & Loeber, 2016). For this reason, the model has always maintained a holistic treatment approach, underscored by the importance of how self-control and other elements of self-regulation fit into a broader context of individual risk and promotive factors.

Treatment planning incorporates assessed risk and need and is anchored by the Early Assessment Risk Lists (EARL-20B for boys; Augimeri, Koegl, Webster, & Levene, 2001 and EARL-21G for girls; Levene et al., 2001) structured professional judgement tools. Treatment and assessment targets are multifaceted and encompass dysfunctional antecedents in the home, school, and community (Goldberg & Augimeri, 2007).

The cornerstone of the SNAP model is the SNAP technique first developed in the late 1970s in a day treatment classroom for children with behavioral problems. In the classroom, the clinician would "snap her fingers" to cue a child to begin the SNAP process. This technique and subsequent model was formalized with the creation and publication of program manuals (Earlscourt Child and Family Centre, 1986a, 1986b, 1996a, 1996b; Levene, 1998) and was trademarked in 1998. The SNAP program manuals have undergone a number of revisions over the years; however, the core treatment elements and SNAP strategy have remained the same (Child Development Institute, 2017a,b,c,d; Levene, 2010). Children learn to identify physiological responses (body cues) and recognize any thinking errors and/or unrealistic cognitions (hard thoughts) that could impact their ability to make good choices in the moment. In stepwise order, SNAP helps children use calming strategies to deal with their 'body cues' such as take a deep breath, count to ten, and control their hands (**Stop**). Next, 'hard thoughts' are replaced with realistic, helpful coping statements or 'cool thoughts' (**Now And**). Finally, children devise a socially acceptable course of action that will keep their problems small, feel okay about how they handled the situation, and avoid harm to themselves or others (**Plan**). Consider the following example that helps to demonstrate the SNAP technique:

> …*With his heart beginning to race and thoughts running wild ("He better give me my ball back or he's gonna get it"- hard thought), Jacob clenches his small fist (body cue) and poises himself to strike the other boy. Despite Jacob getting caught up in his frustration he remembers to use SNAP by taking deep breaths and beginning to count slowly to 10 (STOPS), he says to himself, "I'm going to keep my problem small. I can handle this" (cool thought). He walks over to his friend and asks, "Excuse me, can I have my ball back?" His friend says, "No." Jacob's automatic hard thought is, "He's being a jerk" and his hand begins to ball up into a fist. As a result of SNAP, instead he remembers to snap his fingers; this helps to cue him to walk away and use his STOP NOW AND… He says to himself, "I don't want to get into trouble." As he walks away he continues to take deep breaths and says, "I can handle this." While staying calm he is able to think about a PLAN that might work. He says to his friend, "Now may I please have my ball back?" Other boy: "No." Jacob: "Well it's not yours, it's mine." Other boy: "I know." Jacob: "My mom bought that for me." The other boy pauses and then passes the ball back to Jacob. Jacob smiles and says "thank you."*

1.2. Prior research on SNAP

SNAP has been implemented in a variety of settings, both urban and rural (e.g., Indigenous) across Canada and the United States (Florida and Pennsylvania). Support for positive outcomes has been derived from studies spanning multiple disciplines. SNAP model programs are effective in terms of decreasing both offending (Burke & Loeber, 2015) and the financial burden of chronic delinquency to society (Farrington & Koegl, 2015; reviewed in Augimeri et al., 2017). Rigorous program evaluation has revealed diminished police contact and overall involvement with the criminal justice system (Augimeri, Jiang, Koegl, & Carey, 2006; Augimeri, Pepler, Walsh, Jiang, & Dassinger, 2009). A recent cost benefit analysis by Farrington and Koegl found an estimated savings between $2.05 and $3.75 for every $1 spent on the SNAP program; scaling up costs that controlled for co-offending to undetected offenses ranged between $17.33 and $31.77. These were conservative estimates based on convictions only and did not take into account other factors such as health, mental health, unemployment,

and education.

In children with behavior problems, there is strong evidence of prefrontal cortex (PFC) dysregulation (Woltering, Granic, Lamm, & Lewis, 2011; Woltering & Lewis, 2013), in terms of both functional and structural abnormalities (Sterzer & Stadler, 2009). For children who present with clinical levels on the externalizing spectrum (aggression and rule-breaking) like Jacob, electroencephalogram (EEG) investigation with an inhibitory control task has revealed an association between successful program completion and decreased activity in ventromedial PFC and limbic regions (linked to reactive styles of emotion regulation). Interestingly, sharp decreases in dorsomedial PFC (associated with deliberate control) were also documented, which the researchers hypothesize to be due to a reduced need for this systems support (Woltering et al., 2011; Woltering & Lewis, 2013). Neural changes associated with SNAP were found to persist one-year post-treatment (Woltering, Liao, Liu, & Granic, 2015).

Most recently, a program evaluation study was conducted in Pittsburgh with a sample of 252 boys using a stringent randomized controlled design (SNAP versus standard services treatment; STND; Burke & Loeber, 2015). Boys eligible for inclusion in this sample had scored within the 98th percentile on four teacher (Teacher Report Form (TRF); Achenbach & Rescorla, 2001) or parent (Child Behavior Checklist (CBCL); Achenbach & Rescorla, 2001) reported scales that included aggressive behavior, rule breaking, conduct problems, or externalizing behavior. At follow up, CBCL scores on three of the scales, including aggression, conduct problems, and externalizing behavior were significantly reduced for children in the SNAP condition relative to STND, with the majority falling out of the 'clinical' severity range. Furthermore, findings contradicted initial concerns that SNAP would be insufficient for boys who presented with the most severe and diverse behavioral problems. Instead, these boys showed the most pronounced improvement; compared with STND, CBCL scores at follow-up were significantly lower on all four scales, suggesting that SNAP may have been the most effective for those with the highest levels of risk and need.

A follow-up study using the same sample by Burke and Loeber (2016) aimed to investigate the individual mechanisms of change of SNAP treatment on aggressive behavior. Three partial mediators for the effect of SNAP treatment on CBCL measured aggression were established: prosocial behavior and emotion regulation skills (Social Competence Scale, Parent Version; Conduct Problems Prevention Research Group, 1995), and parental stress: difficult child (Parenting Stress Index, Short Form; Abidin, 1995). Though self-control represents a key theoretical mechanism for change in the SNAP treatment model, it was not examined here.

1.3. Current study

Despite what has been learned so far, there remains a strong need for better understanding of the precise mechanisms driving behavioral change in successful SNAP interventions (Burke & Loeber, 2016; Woltering et al., 2011; Woltering & Lewis, 2013). A large body of literature references self-control in childhood aggression and behavioral problems, and SNAP's focus has always been on enhancing self-control for children and their families; however, prior SNAP research has not analyzed this particular construct. This paper provides an opportunity to explore the effects of SNAP treatment on self-control. Specifically, we will examine the effects of improving self-control on reducing externalizing behaviors. We hypothesize that: (1) evaluation data for the SNAP program will show that it reduces externalizing behaviors such as aggression and rule-breaking while improving self-control; and (2) improvements in self-control will predict improvements in externalizing behaviors.

1.4. Data

The data analyzed here was drawn retrospectively from participants of the SNAP program at a community-based children's mental health center (Child Development Institute, CDI) in Toronto, Canada between 2013 and 2017, all of whom met admission criteria for SNAP. Admission criteria requires either parent or teacher report of the child's behaviors to fall into the borderline or clinical levels (95th and 98th percentiles, respectively) on the following scales: either externalizing or conduct problems for boys and girls, or oppositional for girls only. Additionally, police contact would also be considered meeting criteria regardless of parent or teacher report of the child's behavior.

For the purpose of this analysis, only one informant was utilized per child. Priority was first given to the primary caregiver. When two or more informants were considered primary caregivers, priority was next granted to the caregiver who completed a baseline with the most follow-up assessments. Finally, all things being equal, the mother's information was used for consistency as mothers constitute nearly 90% of respondents. After accounting for this inclusionary criteria the final sample consisted of 169 boys and 149 girls (N = 318).

1.5. Procedures

At CDI, intake begins with the primary caregiver calling in to complete a Service Inquiry Record during initial contact. At this point, a follow-up telephone meeting is scheduled with the primary caregiver to complete the Brief Child and Family Phone Interview (BCFPI; Cunningham, Boyle, Hong, Pettingill, & Bohaychuk, 2009) to assess the child and ensure they meet admission criteria. Once admitted into the program and assigned to a Family & Child Worker (FCW), an initial face-to-face meeting is arranged. At this meeting, the FCW has families sign consents for treatment and evaluation, and begins to collect all necessary information to complete an initial needs assessment. This assessment includes a SNAP evaluation measures package. The first evaluation package is completed prior to treatment (baseline) and is identified as Time 1 (T1). The second package (Time 2; T2) is scheduled to be completed six months later; this is after the completion of SNAP groups and/or initial stages of SNAP treatment (e.g., individual counselling). Ideally, measures are administered every six months for the first two years of service and yearly thereafter while the family is engaged in treatment, however, this can sometimes be variable. This information was collected for treatment planning and tracking progression, and was not under study protocol. Moreover, the measures used in this study are only a portion of a larger battery of measures that take about 60 to 90 min to complete. Therefore, due to various issues that may arise (e.g., time constraints, caregiver stress/anxiety) caregivers may not complete an entire assessment package, or may complete it in pieces over a period of a few (or more) days. Finally, each client receives various levels of treatment dosage based upon risk, need, and engagement. As such, treatment dosage will also vary from client to client between assessments.

2. Measures

The primary measurements used in this study are the CBCL (Achenbach & Rescorla, 2001) and the Social Skills Improvement System (SSIS; Gresham & Elliott, 2008).

Child Behavior Checklist (CBCL/6–18) is a standardized measure completed by parents and/or caregivers to identify problem behaviors (externalizing and internalizing) and social competency. The CBCL/6–18 is composed of 112 problem items (item 113 is left blank for parents to add in other problem behaviors not included in the questionnaire) which fall under 8 syndrome scales: *Anxious/Depressed, Withdrawn/Depressed, Somatic Complaints, Social Problems, Thought Problems, Attention Problems, Rule-Breaking Behavior, and Aggressive Behavior*. The respondents are asked to rate these items as 0 (*not true of*

the child), 1 (*sometimes or somewhat true*), or 2 (*very true or often true*), based on the preceding 2 months. In addition, the syndrome scales are grouped into 3 composite scales (*externalizing problems, internalizing problems, and total problems*). The CBCL is also scored on (optional) competence scales for activities, social relations, school and total competence. The CBCL/6–18 has a reliability of 0.88 (r = 0.88, $p < 0.001$). The construct validity of the problem scales is supported by concurrent and predictive associations with a variety of other measures, as well as evidence for substantial genetic components of the patterns of problems assessed by the scales. We use the externalizing composite scale, as it is a long-standing indicator of treatment progress in the SNAP program, and has been found to predict reductions in future criminal offending (Farrington & Koegl, 2015). The externalizing composite scale is made up of the aggressive behavior and rule-breaking behavior subscales and totals 35 items (split 18 and 17 items, respectively).

Social Skills Improvement System (*SSIS*) is a standardized assessment for intervention completed by parents and/or caregivers to evaluate social skills, problem behaviors, and academic competence. The measure contains 46 items which are measured on a 4-point scale ranging from "never" (0) to "almost always" (4). These items fall under twelve subscales: *Communication, Cooperation, Assertion, Responsibility, Empathy, Engagement, Self-Control, Externalizing, Bullying, Hyperactivity/ Inattention, Internalizing, Autism Spectrum*. The SSIS has strong internal consistency, ranging from 0.94 to 0.95 on the total social skills scale and total problem behavior scale, respectively. Moderate convergent validity is also found for this instrument (as measured with Pearson's r). The 7-item self-control scale will be used (see Appendix A). This scale has strong reliability ($\alpha = 0.84$; Gresham & Elliott, 2008) and is commonly used to screen and/or measure self-control (i.e., Kettler, Elliott, Davies, & Griffin, 2011; Menzies & Lane, 2011; Walker, 2010).

2.1. Analysis plan

First, we will use paired samples *t*-tests to compare SSIS self-control and CBCL externalizing scores. These comparisons will investigate the change in scores between intake/baseline and what is typically the first six months of treatment (T1 and T2) and the most current post assessment following T1 we have on the client (T1 and LAST). The LAST measurement time point will vary with treatment trajectories between children, as some may be engaged in service for longer periods than others based on clinically assessed level of risk and need. This time point, therefore, refers to the most recent measure collected after T1 and captures SNAP service duration and the various SNAP treatment components.

Finally, we can evaluate the influence of self-control on externalizing behaviors. This will be done using multiple regression predicting the change in scores on the externalizing composite scale between different assessments. First, the difference will be calculated between the scale score at T1 and the score on that same scale at T2 and at LAST, such that a positive value indicates improvement on that scale between the two assessments. Then, controlling for gender, age at each assessment, and time between the two assessment periods (proxy due to inclusion of age at both assessments), we will regress changes in the CBCL externalizing scale (dependent variable) on changes in the SSIS self-control scale (independent variable). This will give us an indication as to the impact improvement on self-control has in terms of reducing externalizing behaviors.

3. Results

With respect to program efficacy, Table 1 displays the results of the paired samples *t*-tests evaluating the impact of SNAP treatment on parent report of self-control and externalizing behavior. On average there was 5.628 months between T1 and T2 ($SD = 5.266$) and 11.081 months between T1 and LAST ($SD = 11.649$). As noted in the

procedures section, this data was collected for treatment planning and tracking progress and therefore, as evidenced by the standard deviations there is some variability. Across both scales, in all instances, parent report of child behavior shows statistically significant improvement from baseline ($p < 0.000$). Effect sizes were consistently moderate ($d = 0.395$ to 0.527; Cohen, 1988).

Mean scores changed in the expected direction on both scales. Scores on the SSIS self-control scale (Fig. 1) increased indicating a parent-reported improvement in self-control from T1 to T2 and T1 to LAST. Similarly, scores on the CBCL externalizing scale (Fig. 2) decreased, signifying reductions in externalizing behaviors from T1 to T2 and T1 to LAST.[1]

Table 2 displays the relationship between the change in parent report of externalizing behavior (outcome variable) and the change in self-control from baseline (T1) to T2 (Model 1) and LAST (Model 2). With respect to Model 1, controlling for gender, age at T1 and T2, a one-point improvement on the SSIS self-control scale is associated with a 0.808-point improvement on the CBCL externalizing scale (recall that higher values on the CBCL externalizing scale represent a positive change between the two assessments, i.e., less externalizing behavior over time). Controlling for age at T1 and T2 as well as change on the SSIS self-control scale, the gender coefficient did not reach statistical significance ($p = 0.712$). Additionally, controlling for gender, age at T2, and change on the SSIS self-control scale, the relationship between age at T1 and change on the CBCL externalizing scale was not significant ($p = 0.433$). Finally, controlling for gender, age at T1, and change on the SSIS self-control scale, the relationship between age at T2 and change on the CBCL externalizing scale was also not significant ($p = 0.535$). As none of the control variables were significant we can attribute the models' significance to the impact of the relationship associated with change on the SSIS self-control scale. Therefore, we reject the null hypothesis that there is no relationship between the improvement on the SSIS self-control scale and improvement on the CBCL externalizing scale between T1 and T2.

For Model 2, controlling for gender, age at T1 and LAST, a one-point improvement on the SSIS self-control scale is associated with a 0.880-point improvement on the CBCL externalizing scale. Controlling for age at T1 and LAST as well as change on the SSIS self-control scale, the gender coefficient did not reach statistical significance ($p = 0.922$). Additionally, controlling for gender, age at LAST, and change on the

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[1] As this data was collected from a retrospective sample of clients, there are a number of considerations around data collection. Parents did not always complete an assessment on time or simply not complete an entire assessment package. In some cases, they might only partially fill out a measure (sometimes leaving too many missing items to score some scales) or sometimes not fill out a measure or two at all. Only children who had either a CBCL or SSIS completed at T1 were included in the sample. Whether or not the scales of interest were able to be calculated was, however not considered. Additionally, in some cases, children and families may have disengaged from services prematurely. These considerations are reflected in the sample sizes of the paired samples t-tests being smaller than the overall sample of children. In order to ensure that these results are representative of the entire sample a series of independent-samples t-test were conducted to compare the SSIS self-control scale scores and CBCL externalizing scale scores at intake (T1) for individuals with and without subsequent assessments at T2 and/or LAST.

For the SSIS self-control scale, there was no significant difference in scores at T1 for those with an assessment at T2 (n = 156, M = 6.718, $SD = 3.041$) and those without an assessment at T2 [n = 86, M = 6.814, $SD = 3.310$; $t(240) = 0.228$, $p = 0.820$]. The magnitude of the differences in the means was very small (eta squared < 0.001). There was also no significant difference in scores at T1 for those with an assessment at LAST (n = 156, M = 6.712, $SD = 3.052$) and those without an assessment at LAST [n = 86, M = 6.826, $SD = 3.291$; $t(240) = 0.271$, $p = 0.787$]. The magnitude of the differences in the means was very small (eta squared < 0.001).

For the CBCL externalizing scale, there was no significant difference in scores at T1 for those with an assessment at T2 (n = 215, M = 22.888, $SD = 9.243$) and those without an assessment at T2 [n = 100, M = 22.070, $SD = 10.155$; $t(313) = -0.709$, $p = 0.479$]. The magnitude of the differences in the means was very small (eta squared = 0.002). There was also no significant difference in the scores at T1 for those with an assessment at LAST (n = 216, M = 22.852, $SD = 9.223$) and those without an assessment at LAST [n = 99, M = 22.141, $SD = 10.209$; $t(313) = -0.613$, $p = 0.540$]. The magnitude of the differences in the means was very small (eta squared = 0.001).

Table 1
Paired samples *t*-tests.

Scale	Assessments	N	Mean Change	SD	t	df	Sig. (2-tailed)	Cohen's d
SSIS self-control	T1 to T2	156	1.667	2.859	−7.282	155	0.000	0.527
	T1 to LAST	156	1.596	2.931	−6.802	155	0.000	0.504
CBCL externalizing	T1 to T2	215	−3.656	8.175	6.557	214	0.000	0.395
	T1 to LAST	216	−4.236	8.744	7.120	215	0.000	0.508

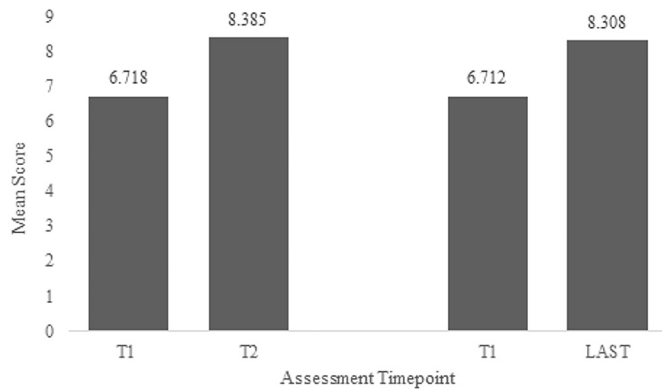*Note. Cohen's d was calculated such that a positive value indicates improvement.*

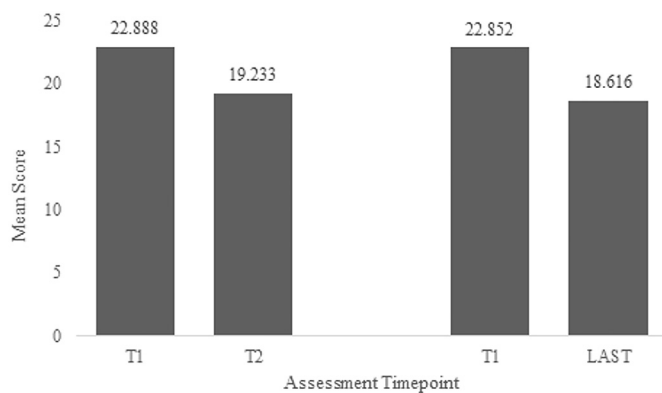**Fig. 1.** Mean scores on the SSIS Self-Control scale from T1 to T2 and T1 to LAST.

Fig. 2. Mean scores on the CBCL Externalizing scale from T1 to T2 and T1 to LAST.

Table 2
Multiple regression estimates of change in CBCL Externalizing Scale scores from T1 to T2 and T1 to LAST.

Assessments	Model 1			Model 2		
	T1 to T2			T1 to LAST		
	b	SE	p	b	SE	p
Male	−0.527	1.427	0.712	−0.142	1.454	0.922
Age at T1	−2.517	3.201	0.433	−1.354	1.660	0.416
Age at T2	1.987	3.193	0.535			
Age at LAST				1.007	1.661	0.545
SSIS self-control scale score change	0.808	0.231	0.001	0.880	0.246	0.000
Intercept	6.869	4.279	0.111	5.387	4.489	0.232
Adjusted R²	0.065		0.008	0.058		0.013
N	150			151		

SSIS self-control scale, the relationship between age at T1 and change on the CBCL externalizing scale was not significant (*p* = 0.416). Finally, controlling for gender, age at T1, and change on the SSIS self-control scale, the relationship between age at LAST and change on the CBCL externalizing scale was also not significant (*p* = 0.545). As none

of the control variables were significant we can attribute the models' significance to the impact of the relationship associated with change on the SSIS self-control scale. Therefore, we reject the null hypothesis that there is no relationship between the improvement on the SSIS self-control scale and improvement on the CBCL externalizing scale between T1 and LAST.

Taken together, after controlling for gender, age, and time between assessments, change on the SSIS self-control scale predicts between 5.8 and 6.5% of the variability in change on the CBCL externalizing scale between T1 and T2, and T1 and LAST.

4. Discussion

Social scientists have long been interested in the concept of self-control. Not surprisingly, researchers have paid close attention to its relationship with various outcomes, in particular antisocial behavior. Somewhat less research has been focused on measurement aspects related to self-control as well as how self-control can be modified and/or improved. In this paper, we focused our attention on the effects of SNAP treatment on self-control and examine the effects of improving self-control on reducing externalizing behavior in a sample of Canadian youth. The stated hypotheses were supported: (1) the SNAP program is an effective intervention as measured by reductions in externalizing behaviors and improvements in self-control and (2) concomitant improvements in self-control are related to reductions in externalizing behaviors.

A moderate effect size was found for the initial stage of treatment occurring between intake and the second assessment. These findings are in line with previous SNAP studies that have consistently demonstrated that SNAP is an effective intervention for latency-aged children with externalizing behavior problems (e.g., Burke & Loeber, 2015; Lipman et al., 2008; Pepler et al., 2010), especially "aggressive children with serious violent and chronic potential" (Howell et al., 2014, p.46). Not only does SNAP effectively decrease externalizing behaviors, this study also showed that it appears to be related to increases in self-control. The changes in the self-control scale were moving in the expected direction and yielded a moderate effect.

Our second hypothesis was also supported as increases in self-control were found to significantly predict improvements in externalizing behaviors. These findings show that change on the self-control scale on the SSIS predicts about 6% of the variability on the CBCL externalizing scale.

To be sure, although our work provided an important extension over previous studies and further added important proof-of-concept research to the assessment of SNAP, some limitations should be acknowledged—all of which offer opportunities for subsequent work. First, the sample size was not very large and the sample sizes decrease over time such that comparisons could not be made later in the follow-up periods. Second, this is a preliminary analysis that does not compare findings to a control or comparison group of any form. Additionally, because SNAP's continued care model assigns treatment based on level of risk and need, the dosage and intensity of treatment between assessments varies between subjects. These two-fold limitations regarding lack of a control group and variability in dosage between participants speak more generally to the extent to which the study findings are strong

enough to support a causal interpretation. As a result, study findings should be regarded as consistent with expectations that the program had an effect but further work is needed especially with respect to a control/comparison group, and within an experimental design ideally, in order to ensure more firm conclusions regarding causal effects. Further, that there was variability in dosage between participants also limits the extent to which we can discern 'how much' of the intervention is needed in order for potential effects to emerge. Future research should consider one of two ways to assess the effect of treatment dosage. In one scenario, dosage would be randomly assigned between groups, which would help to address the 'amount' issue. In another study, dosage could be made precisely the same for all study participants. Ideally, both sets of dosage-related studies would be conducted, using different samples, and the results will be illuminating for further development to the SNAP intervention.

Given the age range being investigated in the current study, it is unclear the extent to which SNAP's efforts at improving self-control relates to other types of antisocial and analogous behaviors that may be more age-appropriate in the late teens and into the 20s. Currently, a SNAP Youth Justice model using innovative digital modules is being developed, implemented and tested in a number of youth custody facilities, probation offices and community agencies across Ontario, Canada. The program serves high-risk youth (ages 12 to 20) with youth justice contact and possible gang affiliation with promising results (Augimeri, Walsh, Woods, & Belisle, 2016). In a preliminary qualitative study, youth in custody consistently identified that SNAP provided them with skills to help regulate their emotions, challenge thinking errors, and use the "tools to not react" (Sewell, Walsh, Belisle, Woods, & Augimeri, 2017). It would be very interesting to consider SNAP's effects (in improving self-control) on non-crime life domains as well. Given the importance attributed within the SNAP curriculum vis-a-vis decision-making skills and the like, it would be of interest to consider how these youths navigate education, employment, and interpersonal relationships going forward. As part of SNAP's continued care model, SNAP Youth Leadership services focuses on these identified areas (Mohamud, Fredericks, & Gregg, 2017). Further investigation of its impact is in development.

Lastly, there have been few efforts to consider how SNAP and related self-control modification programs operate across race/ethnicity and across children and families who experience compromised socioeconomic environments. This is especially the case within inner-cities –perhaps the areas that need these sorts of programs the most. Early evidence in this regard has been promising; for example, the Pittsburgh sample (Burke & Loeber, 2015, 2016) which saw significant reductions in problem behaviors relative to a control group, was comprised primarily of boys who identified as either African-American or mixed race. It is important to note that this study did not however compare ethnic groups for differences in overall rate or magnitude of change.

Addressing these limitations, although difficult, will further both the literature on the SNAP program and also improve our understanding of the mechanisms of change for children with externalizing behavior problems. It also provides rationale for further exploration. It would be advantageous to investigate pre-existing data retrospectively. In particular, there is a 9-item self-control scale for the CBCL, most recently used by Meldrum and colleagues (2016). The CBCL has been consistently collected over the years to evaluate the SNAP program across Lab and Affiliate Sites. If concurrent validity can be established between the SSIS self-control scale and the CBCL 9-item scale, future research could measure how SNAP programming is related to this specific construct. Most notably, it provides an opportunity to further investigate the Pittsburgh sample comparing SNAP to treatment as usual (Burke & Loeber, 2015, 2016).

5. Conclusion

In short, this study and its results provide preliminary evidence that

indicates the SNAP model improves self-control, providing children with the necessary skills to decrease externalizing behavior. It is important to underscore the importance of self-control to reach all facets of daily life and behaviors. As such, prevention and intervention efforts aimed at developing and/or improving self-control are critical for individuals to have successful lives. SNAP is one such program that can be added to the list of effective interventions that have significant promise in this area. Additional work along the lines noted above as well as scaling-up the program more generally will continue to add to the research and policy bases in the future.

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Author declarations

We would like to note that the following authors are employed by the Child Development Institute (Toronto, ON) where SNAP programming was developed and is currently housed:

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We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us.

We confirm that we have given due consideration to the protection of intellectual property associated with this work and that there are no impediments to publication, including the timing of publication, with respect to intellectual property. In so doing we confirm that we have followed the regulations of our institutions concerning intellectual property.

We understand that the Corresponding Author is the sole contact for the Editorial process (including Editorial Manager and direct communications with the office). She is responsible for communicating with the other authors about progress, submissions of revisions and final approval of proofs. We confirm that we have provided a current, correct email address which is accessible by the Corresponding Author and which has been configured to accept email from laugimeri@childdevelop.ca.

Appendix A

SSIS Self-Control Items
Resolves disagreements with you calmly.
Stays calm when teased.
Takes criticism without getting upset.
Makes a compromise during a conflict.
Tolerates peers when they are annoying.
Responds appropriately when pushed or hit.
Stays calm when disagreeing with others.

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