

Are Complex Multimodal Interventions the Best Treatments for Mental Health Disorders in Children and Youth?

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Abstract

There is a pressing need for effective interventions to treat mental health disorders in children and youth. There is evidence for increasing incidence rates across a wide range of conditions, and these can lead to very significant long-term impacts. They include depression, anxiety, abuse of drugs and alcohol, and the impacts of a variety of traumas. Recently we have carried out a number of studies in which complex and multimodal interventions were either introduced and then studied, or were on-going but hadn't previously been rigorously tested for efficacy. Here we present a review based upon some of these multimodal programs which examined outcomes in: (1) a school-based program to reduce depression and suicidal thinking in youth aged 11-17 years old in which all students were screened on an electronic tablet using standard scales for depression and suicidal thinking followed by the option of an internet-based cognitive behavioural program; (2) a screening, brief intervention and referral to treatment (SBIRT) program to help youth aged 11-17 years old who had significant drug and/or alcohol abuse in which initial screening for drug and alcohol use was followed by the options of an internet-based cognitive behavioural program and referral to child and adolescent specialists; and (3) outcomes following trauma experienced by children aged 5-12 years old in two separate programs in which a complex intervention was used involving 2-3 hours of weekly interventions for both the child and a primary care-giver. The depression, suicidal thinking, and drug and alcohol results were from a large school-based program involving over 6,200 youth termed the Empowering a Multimodal Pathway Towards Healthy Youth (EMPATHY) program, for which 15-month outcomes are recently available. The other two programs treated child victims of trauma. These were firstly in an intensive 8-12 month outpatient intervention program with 50 children aged 5-11 years old who developed an attachment disorder following trauma, given in a dyad model involving their primary caregiver. Secondly, in a 12-month program for 40 children aged 8-12 years old who were victims of childhood sexual abuse, which included intermittent residential treatment. The details of the programs varied greatly, but all involved multimodal methods of treatment. In terms of outcomes, all of these programs found significant longer-term improvements in multiple areas. In conclusion, our findings from this review suggest that future research and clinical programs should consider multimodal approaches for the treatment of mental health disorders in children and youth, and future research should directly compare such programs to individual therapeutic approaches.

Keywords: Mental health; Trauma; Post-Traumatic stress disorder (PTSD); Child sexual abuse (CSA); Abandonment; Depression; Anxiety; Suicidal thinking; Drug abuse; Alcohol abuse

Introduction

Many mental health disorders are first evident during childhood, and it appears that the frequency of several mental disorders may be increasing in children and youth [1,2]. Approximately 10% of youth have depression [3,4], while suicide rates are also high in this age group [5,6]. It is likely that each year between 4-7% of youth will make at least one attempt at suicide [7,8]. It is also recognized that many adults who subsequently have drug and alcohol abuse developed this during their youth, and may also have other prior mental health issues [9,10]. Additionally, abuse experienced or witnessed by youth (including physical, emotional, and sexual abuse) also frequently leads to negative longer-term psychiatric outcomes [11-13] or disruptive behaviours [14]. For all these reasons early treatment of mental health disorders in children and youth is important to decrease their long-term risks and improve outcomes [15-18].

To address this issue there have been a wide range of potential interventions proposed for the treatment of children and youth who have depression, anxiety, trauma-associated disorders, or drug and alcohol abuse. These interventions come from many different modalities, including psychotherapy [19], particularly cognitive behavioural therapy (CBT) [20], pharmacotherapy alone or in combinations with psychotherapy [21,22], psychosocial interventions [14,23], and family-based interventions [24-26]. In addition to these single modality of approaches, so-called "Multisystemic Therapy" has also been found to be effective over many years in children and youth to treat externalizing disorders such as violent offending and substance abuse, or where there is physical parental abuse or neglect [27].

Nonetheless, even in areas in which many research studies have taken place the best approach to treatment remains highly uncertain. Thus, a recent Cochrane review concluded that CBT "is an effective treatment for childhood and adolescent anxiety disorders; however, the evidence suggesting that CBT is more effective than active controls or treatment as usual or medication at follow-up, is limited and inconclusive" [28]. It is therefore clear that despite the multitude of

treatment approaches, no single therapeutic intervention is likely to be successful for all children or youth, and there remains a lack of clarity about whether outcomes are better with single interventions or combined approaches.

This is important to recognize, since much of the current research literature focuses on the utility of single interventions. It is quite conceivable that better clinical outcomes could be achieved from combinations of therapy. To help illustrate such clinical possibilities, in the present review we examine three areas of recent research we have been involved in which have examined longer-term clinical outcomes (12-months) following complex multimodal interventions in children and youth. We focus on three clinical areas linked to these: (1) outcomes in youth aged 11-18 for depression and suicidal thinking; (2) outcomes in youth aged 11-18 for drug and alcohol use; and (3) outcomes following trauma experienced by children aged 5-12 in two separate programs. Details on the specific programs and their results are either published, or have been submitted for publication, and therefore only brief summaries are given here.

Depression and suicidal thinking

As noted previously, depression and suicide rates are significant in childhood and youth [1-8]. It is also clear that those who have previously harmed themselves, and/or who have depression, have a higher risk for subsequently completing suicide [29-31]. It is therefore critical to effectively address this issue, but it remains unclear if approaches specifically targeting a so-called "high-risk" group are more effective than interventions given to the whole population (so-called "universal" interventions). Recent reviews have, generally, been supportive of a variety of both high-risk and universal interventions reducing youth suicide rates [22-43], although care is required since some approaches can be problematic or ineffective [44,45]. It is likely that schools may be the most appropriate setting in which to screen and intervene with youth [46,47], which can include increasing resiliency [47-49]. Universal prevention on its own is only partially effective [50-52]. Another approach is to identify a sub-group of "high-risk" individuals and intervening in this sub-group with CBT-based interventions [53-60], although this doesn't help the significant number of children and youth whose depressive symptoms are below the threshold for intervention [61,62].

More recently, it has been suggested that a more effective method to address youth depression and suicide is to combine both universal programs with screening for high-risk youth, followed by targeted interventions [5,42,43,63], although studies utilizing such multimodal methods have not all been successful [64,65].

Summary of complex intervention

We worked with a school district in Alberta, Canada to design a new program to be received by all youth in their district during designated "health" classroom time. The aim of the program was to reduce depression and suicidal thinking in their students. This program was called Empowering a Multimodal Pathway Towards Healthy Youth (EMPATHY) [66]. It consisted of several components including:

- The use of individuals experienced in youth care who interacted with students in multiple different areas (including during designated free-time), who were termed "Resiliency Coaches". One individual was present at every school.

- The use of an established resiliency CBT program (OVK) [67-70], targeted initially at only 2 Grades (for budgetary and other logistical reasons). OVK is an updated version of the Penn Resiliency Program [71-74]. These were given to those in Grades 6, 7, and 8 (ages 11-13).
- A 5-day integrated CBT training program was provided for the 5 Resiliency Coaches hired for this program, which included the study rationale, OVK, and the CBT internet-based programs.
- The use of electronic tablets with a specifically developed software "app" that was given within the classroom setting on a single occasion for rapid and consistent data collection during screening. This was done by the Resiliency Coaches and/or the classroom teacher.
- Rapid feedback being given to schools regarding students considered at higher risk of suicide, sometimes within 1-2 hours, as an output from this "app".
- All students who had significant suicidal thoughts had a 1- hour interview either the same day or the following working day (for this reason little screening was carried out on Fridays), and their family was contacted immediately afterwards.
- The use of an established internet-based CBT program for the 10% of those identified by this process as being considered at greatest risk from suicide, depression, or other factors. These programs were administered in a "guided" manner by the Resiliency Coaches.
- Dedicated training on diagnosis and treatment approaches for community physicians and mental health staff working in primary care, including specific information on CBT and other treatment approaches for youth.
- Awareness of the program in the community through communication with students, parents/guardians, and the use of various types of media including print and television.
- A city-wide approach involving all public schools that catered to students in Grades 6-12 (i.e. students aged 11-17 years old).

Statistical analysis

The primary statistical method was a paired design, in which each student who completed both baseline ratings and follow-up ratings was their own control. As the data showed evidence of non-normality, a non-parametric test was carried out to compare the differences between the mean scores at baseline and 12-week follow-up. This involved Wilcoxon signed-rank test (paired), unless otherwise specified, which is a non-parametric statistical test for testing hypotheses on medians. Statistical analysis was carried out on an "intention to treat" basis utilizing R, version 3.1.0 (R Foundation for Statistical Computing, Vienna, Austria) and Stata/IC 13.1 for Windows (StataCorp, College Station, Texas, USA). Correlations were calculated using IBM SPSS Statistics 20.0 (Chicago, Illinois, USA).

The study was designed to determine potential changes in depression scale scores and in suicidality. From previous studies, it was determined that there may be a 5% decrease in both these scores. To detect a statistically significant reduction of this size would require a sample size of 65 students in a 1-sided sample size calculation completed using the G Power calculator, version 3.1, with $\alpha=0.05$. Given our sample size of 3,500 students, of which we estimated a minimum of 4% (i.e. 140 students) would be depressed with a similar number being suicidal, this study was adequately powered.

Outcome summary from complex intervention

The longer-term outcomes have recently been analyzed for data collected during the time period February 2014-June 2015 (Silverstone PH, personal communication). During this there were 4 time-points at which students were assessed, at Baseline, 3-months, 7-months, and 15-months. A total of 6,227 students were assessed at least once, while 1,884 completed assessment at all 4 time points. It was therefore possible to examine both cross-sectional data (by comparing each group), and longitudinal analysis (by examining those who completed all assessments and therefore acted as their own controls). At each time point the number of students assessed varied, being n=3,244 at Baseline, n=3,229 at 3-months, n=4,860 at 7-months, and n=4,497 at the final 15-months assessment. There were highly significant decreases in suicidality rates in every group at each follow-up period, with the percentage of the total school population who were actively suicidal decreasing from 4.4% at baseline (n=143 of 3,244) to 2.8% at 15-months (n=125 of 4,497). There were also highly significant decreases in scores on a measure of depression, the 9-item patient health questionnaire (PHQ-9) [75], adapted for adolescents (PHQ-A) which has been well validated in youth [76-78]. For the cross-sectional analysis there were also highly significant reductions in depression scores and in suicidal thinking. Although not primary objectives, improvements were also seen in anxiety, self-esteem, and quality-of-life, and anecdotal reports also suggested a marked decrease in rates of bullying (Silverstone PH, personal communication).

Given the multitude of different aspects of the program, as well as items not captured formally (such as the number of informal interactions between the Resiliency Coaches and students over a prolonged period) it is not possible to determine what specific factors were involved in these highly positive outcomes.

Drug and alcohol abuse

The rate of substance misuse appears to be increasing with those aged between the ages of 15 - 24 showing the highest rates of substance misuse [79,80]. Abuse of drugs or alcohol in youth increases the risk of developmental delays and in areas of cognition, motivation, and impulse control [80,81]. While there have been several interventions proposed to reduce substance misuse in adolescents [82-84], one suggested approach for youth is to utilize a combination of universal Screening, Brief Intervention for those at high risk, and Referral to Treatment when needs are identified (SBIRT) [85-87]. While used in adults quite widely, SBIRT may also be an effective approach in both schools and primary care sites, possibly used with CBT [88]. SBIRT in youth has potential public health benefits since early identification and treatment of individuals engaging in high-risk substance use may prevent subsequent substance use problems [85-88]. Several key issues arise when considering appropriate methods to utilize SBIRT most effectively including the choice of screening tools, the nature of any brief interventions, and the best methods for subsequent referral to treatment. Current evidence suggests that there are no clear differences in outcomes between programs for alcohol abuse [89].

Summary of complex intervention

The intervention was based on the EMPATHY study [66], and screening was carried out in the same manner (and at the same time) for depression and suicidal thinking. Again, data was collected electronically. However, the initial data on drug and alcohol use, previously reported [66] was subsequently transformed to allow

extraction of items from the CRAFFT assessment scale (Hamza D, personal communication), named after the focus of each of the 6 questions (Car, Relax, Alone, Forget, Friends, and Trouble) [90,91]. The CRAFFT is a 6-item screening tool that can assess lifetime and current substance misuse, and is specifically designed for youth populations [90,91]. The questions are answered dichotomously (yes/no), and each positive answer is scored as one (1) point, with a maximum score of 6. Individuals who score ≥ 2 are likely to be at risk of developing a substance use disorder. It should be noted that the CRAFFT has been widely used in adolescent populations [92-95], but that the questions relate to activities over the previous 12 months, and so to determine any changes, longer-term follow-up is required. In addition to screening using CRAFFT, a brief intervention was offered, namely an on-line CBT program guided by the Resiliency Coaches. If this was not effective referral to either primary care, or specialist psychiatric care, was offered. This program therefore met all criteria for SBIRT.

Statistical analysis

To test the equality of medians from two independent groups, we used a Wilcoxon rank-sum test to test hypotheses on the differences between median scores. Statistical significance was $=0.05$. The statistical method was a paired design, in which each student who completed both baseline ratings and follow-up ratings was their own control. A statistical power analysis was from the previous program, which determined that the study was adequately powered. Although we collected data at Baseline, 3-months, 7-months, and 15-months, because the CRAFFT questions ask about use "during the past 12-months", the statistical comparisons were between Baseline ratings and those at 15-months.

Outcome summary from complex intervention

The CRAFFT scores at Baseline (n=3,224), 3-months (n=3,229), 7-months (n=4,860), and 15-months (4,497) over two school years were available, as were CRAFFT scores in the 1,884 students who completed all 4 assessments (Hamza D, personal communication). The results found that rates for substance abuse increased with age. They also found that this complex SBIRT program led to a highly significant reduction in the total percentage of students who scored ≥ 2 , from 14% to 7%, at the 15-month follow-up. This occurred in all Grades from 6-12 (ages 11-17) (Hamza D, personal communication). For example reductions in Grade 12 (mean age 17.3) were from 31% of the student population who scored ≥ 2 at Baseline to 20% for the group assessed at 15-months, while reductions in Grade 11 were from 24% at Baseline to 15% at 15-months. Interestingly, there was also a significant reduction in comorbidity with both depression and anxiety over time.

Trauma Experienced by Children

Attachment issues

During healthy childhood development, caregivers foster fundamental attachment needs leading to positive developmental outcomes, including self-esteem, social competence, and the ability to maintain relationships. All of these factors may be linked to the quality of the attachment relationship with a primary caregiver, while poor interactions may be associated with deficits in executive function, attachment, and a decreased ability to self-regulate [96-98]. It is possible that poor attachment may be one of the mechanisms leading

to longer-term mental health problems [98-101]. These challenges are often compounded by problems with self-regulation, self-concept, and anxiety [102,103].

Despite growing awareness of the impact of early attachment related deficits on child neurodevelopment and mental wellbeing there are relatively few studies that have determined the most effective treatment approaches for children who develop attachment related disorders as a result of early trauma. Documented approaches with older children have included psychodynamic psychotherapy [103] and CBT [104]. Interventions with both a caregiver and a young child together, in a so-called “dyad” approach have also been suggested [105,106]. In order to address this issue, a program was developed by CASA (Child, Adolescent, and Family Mental Health) a provider of mental health services for children and families, and youth. This program, termed the Trauma and Attachment Group (TAG) Program, was designed to address developmental trauma [107-109], and is based, in part, on a trauma-informed three-stage treatment model which aims to integrate developmental, biological, psychodynamic and interpersonal theoretical perspectives [190,110]. TAG was designed to help children in middle childhood diagnosed with attachment disorders following complex developmental trauma and aims primarily to promote healing through the development and strengthening of caregiver-child attachment relationships. We recently reported in more detail on some of the outcomes from this program [111].

Summary of complex intervention for attachment issues

CASA offers a TAG program for the caregiver/child dyad for children aged 5-11, which is split into two separate sections (TAG I and II), each of which lasts 4 months and has the capacity to treat a maximum of 10 caregiver/youth dyads, during the 9-12 month course of treatment. The actual course of treatment (2 x 4 month sessions) is always the same, but if a cohort starts in January then the actual program is longer as there is a 3-month summer break. This is in contrast to those who start in September where there is only a 2-week break at the end of the calendar year. The treatment is intensive, and involves several members of the experienced multi-disciplinary team, which meets to review progress every two weeks, and includes a psychiatrist, a psychiatric nurse, a clinical support worker, psychologists, social workers, and a part-time occupational therapist. Because the program is carried out at a teaching facility, others may be involved in the program for educational purposes. In addition to group involvement, the team makes weekly support calls to families, schools, and family community-care teams where necessary. Treatment dyads (i.e. the child and their primary non-offending caregiver) meet once a week for 2-2.5 hours with separate group sessions for caregivers, children, and inclusive caregiver-child dyad sessions. Initially, the caregiver's group is designed to increase awareness of the neurological, emotional, and behavioural effects of trauma, encourage the development of therapeutic parenting skills that promote attachment, and facilitate the development of environmental conditions for attachment to take place in the home. Secondly, there is a concurrent group play therapy experience for the children which includes therapeutic free play with staff support and guidance; physical activity to promote self-regulation; visualization; experimentation with sensory strategies; verbal processing of weekly strengths and challenges; activities related to interpersonal boundaries, emotional identification and expression, life history, and current family relationships; therapeutic stories related to trauma and attachment needs, and community snack. Finally there is a guided caregiver-child dyadic interaction.

Emotional regulation is connected to receiving consistent and attuned responses (involved in reflective functioning) from the primary caregiver. Reflective functioning on behalf of the caregiver is believed to be an integral part in the development of a child's safety and comfort in the attachment relationship [112]. In an attempt to help develop this attunement in caregivers, TAG I begins with caregiver education on the neurological, emotional, and behavioural effects of developmental trauma, through the Neurosequential Model of Therapeutics [113,114]. This is a developmentally-driven neurobiological model, where, for example, caregivers discuss the potential impacts of trauma on brain functioning, including controls over regulation, arousal, and attention, before trying to move on to higher-level functions, such as decision-making and problem solving.

During caregiver/child dyad time, group activities for clinical stabilization include role-playing, body feeling map drawings, and safe place visualizations. Children are supported to increase their self-regulation skills both through reflection on their feelings and thoughts, and through connection with their caregiver. Caregiver-child attachment is further encouraged outside of group meeting times through dyadic activities such as “kit time”, where caregivers and children set aside time every day to do activities together that mimic early attachment behaviours (i.e. providing one-to-one attention and connections through games that encourage increased eye contact and/or increases in the amount of physical touching between the caregiver and child).

Once clinical stabilization has been achieved, the TAG facilitation team then supports the family to increase the child's environmental safety. This is achieved, in part, through the development of family connections to school or community supports, and includes the need to help the child begin to generalize feelings of safety gained within the relationship with their caregiver, to others in the child's social world.

Once completed, the treatment dyad progresses to the next stage, TAG II. This is a 15-week group for the children and their parents/caregivers which focuses on trauma resolution using an attachment model. There are 3 parts to the group: (1) grounding the body orientation using movement exercises and dyad activities, and anxiety reduction using visualization, (2) sand-tray therapy, and (3) storytelling and closure. The TAG II treatment component seeks to support Trauma Resolution (stage two of van der Kolk's treatment model) [110,111], through encouraging the child's recollection of their early traumatic experiences in a safe environment. The caregiver learns to become a witness to the youth's “trauma story” in a mindful, non-judgmental, and supportive manner [115,116]. Children are supported to integrate past trauma into a narrative that also includes present experiences and respond to their present environment without viewing it through the lens of their trauma. Children begin to tell their story through drawing, collages, and sand-tray work. They also participate in regulatory activities, (i.e. learning to “be present” in their own bodies), practice mindfulness-based stress reduction [116], and are guided through relaxation exercises. During this part of the process, children are also encouraged to reframe their early attachment experiences to help them understand that the current caregiver is not the one responsible for their early developmental trauma. Caregivers are supported with regard to increasing their capacity to make sense of their own and their child's mental states, which is believed to play a critical role in helping children to self-regulate and establish healthy and meaningful relationships [112]. This reframing for both children and caregivers aims to re-build models of healthy attachment and reinforce safety and stability. The final goal of TAG II treatment is to

address Reconnection and Generalization to the Community [109,110], which involves the successful transfer of treatment gains across environments.

Statistical analysis

The statistical method was a paired Student's t-test, in which each student who completed both baseline ratings and follow-up ratings was their own control, to examine the differences between baseline and follow-up scores. Statistical significance was $=0.05$. This was carried out with IBM SPSS Statistics Version 22 to analyze the results, utilizing two tailed t-tests to determine statistical significance.

Outcome summary from complex intervention for attachment issues

The primary measure used to determine if changes occurred following participation in TAG was the Attachment sub-scale of the Parenting Relationship Questionnaire (PRQ) [117]. Preliminary findings demonstrated statistically significant improvements in attachment, communication, discipline practices, involvement, and relational frustration [111]. Additionally, there were statistically significant improvements in the ability of caregivers to recognize and understand both their own and their child's feelings about the parent-child relationship, and a trend indicating a reduction in symptoms typical of post-traumatic stress disorder (PTSD). Longer-term and more detailed findings have recently been analyzed (Ashton C, personal communication) and these further support preliminary findings. There is also an extensive qualitative analysis (Ashton C, personal communication) which demonstrates that some of the clinical benefits may be due to the multiple non-specific interactions that occurred both in groups and during individual time. These included the recognition that other parents were experiencing similar challenges, or the benefits of improved relational interactions between the dyad from the caregiver being "forced" to spend time playing with their child. The provision of psycho-education on the effects of trauma has also been suggested to improve outcomes.

Victims of childhood sexual abuse

Child sexual abuse (CSA) is frequent [118,119], with as many as 1-in-6 girls and 1-in-12 boys experiencing sexual abuse that has involved bodily contact [120], and it is currently uncertain if these rates are changing [121,122], particularly given the increase in use of internet pornography [123,124]. The impact of CSA is very significant, with a substantially greater risk for a range of future medical, psychological, behavioural, and sexual disorders [11-13,125]. It is possible that these long-term issues may reflect physiological changes [126-129]. For these reasons, preventing CSA is of great importance [130,131].

In adults who have experienced CSA long-term problems can include an increased risk of suicide attempts, and multiple other psychological, behavioural, sleep, and sexual issues [132-135]. Some of these outcomes are linked to inappropriate feelings of shame that these victims frequently feel [136-138]. Perhaps the most important of these psychological issues is the development of post-traumatic stress disorder (PTSD), since these symptoms are closely linked to poorer longer-term outcomes [139,140]. This occurs in approximately 40% of CSA survivors [140,141]. It is possible that these changes are mediated via neurobiological or cognitive developmental changes that occur following CSA [142-145].

Treating CSA victims has, more recently, utilized trauma-focused cognitive behavioural therapy (TF-CBT), which can be effective for many children in reducing the number who have PTSD symptoms after treatment [146,147]. TF-CBT consists of skills-building components, a trauma narrative during which children describe and cognitively process their personal trauma experiences, treatment closure including conjoint caregiver-child sessions and safety planning, and its benefits have been shown to be continued over extended periods in children who have been victims of CSA [147]. In more limited research studies there have been findings suggesting that other treatment modalities may also have some efficacy, including eye movement desensitization and reprocessing (EMDR), animal-assisted therapy, art-therapy, and play therapy [148-151]. However, questions remain about possible benefits of combinations of therapeutic approaches, as well as the most effective therapy for different ages or types of CSA [144], as well as the length of treatment and possible standardization of treatment components [152,153]. Access issues for children and youth who have experienced CSA also occur [154]. Finally, recent evidence suggests that brief intensive interventions are effective for PTSD [155,156].

For these reason a novel program was introduced by a charitable organization to help victims of CSA. This involved the use of multiple therapies, all of which had some evidence of efficacy, but was given in shorter more intensive interventions over a 12-month period [157,158]. The program was implemented in 2014 at a purpose-designed "camp-like" residential facility called the "Be Brave Ranch" (BBR).

Summary of complex intervention

The program involves a 4-week initial stay at BBR, where intensive therapeutic interventions are employed for 8 - 10 hours from Monday to Friday. Weekends are dedicated to a variety of community-based recreational activities [158-161]. Children return to the BBR for further interventions, followed by additional reassessment at 13-weeks, 26-weeks, and 52-weeks. Assessments of progress take place before starting at the BBR ("Baseline") at the end of the initial 4-week stay ("Assessment #2"), at the end of the 13-week stay ("Assessment #3"), at the end of the 26-week stay ("Assessment #4"), and at the end of the final 52-week visit ("Assessment #5").

Central to the program is the daily TF-CBT group, which comprises 100 hours of group therapy across 12 months, focusing on: (1) developing self-regulation skills; (2) supportive discussions about the child's CSA experience; (3) processing the child's trauma narrative; and (4) conjoint caregiver-child sessions, as well as safety planning to facilitate appropriate closure [160]. During each of their visits to BBR, children repeat the sharing of their trauma narrative, an approach consistent previous findings that repeated exposure to the trauma was more efficacious than supportive therapy alone [161]. Treatment fidelity is ensured through the use of a detailed program guide as well as daily clinical consultations and weekly team meetings.

In conjunction with TF-CBT, the multimodal program at BBR includes multiple other interventions including daily cardiovascular exercise, yoga, music, art, EMDR, individual counselling, and interactions with animals, most of which have some level of evidence supporting efficacy in the treatment of CSA [146].

Statistical analysis

The statistical method was a paired Student's t-test, in which each student who completed both baseline ratings and subsequent follow-up ratings was their own control. This was used to examine the differences between baseline and all subsequent follow-up scores. Statistical significance was ≤ 0.05 . This was carried out with IBM SPSS Statistics Version 22 to analyze the results, utilizing two tailed t-tests to determine statistical significance.

Outcome summary from complex intervention

Over the short-term this program has been found to decrease symptoms of PTSD as well as depression and anxiety [159]. The initial longer-term findings for the first group of 40 CSA victims has recently been published [158], and demonstrated highly statistically significant reductions in Child Posttraumatic Stress Disorder Symptom Scale (CPSS) scores, which decreased from a mean score at baseline of 20.8 ± 1.4 to a mean of 12.5 ± 2.3 at 52-weeks. There was also a marked reduction in the percentage of children whose scores were above threshold for the diagnosis of PTSD, decreasing from 73% at baseline to 29% at 52-weeks. It should be noted that while much of the reduction in mean CPSS scores occurred in the first 4-weeks, the percentage reduction in those who met criteria for PTSD continued over time.

Discussion

This review has examined the potential effectiveness of 3 different multimodal interventions in three different clinical areas. These were selected as models we have been involved with, and are very familiar regarding the outcomes. This is not intended to be a conclusive review of the literature, but rather to utilize these approaches to clarify that complex multimodal treatment approaches can lead to positive outcomes. This is important since much of the current research literature focuses on the utility of single interventions, though it remains uncertain if this is the most effective treatment approach for children and youth who have mental health problems.

In the three areas we have reviewed it is also clear that each of three study programs are quite different from each other, in terms of techniques, therapeutic approaches used, population served, and numbers involved. Despite these obvious and considerable differences, each of them shows that clinical treatment approaches that utilize a variety of components can be highly effective clinically at creating change, and merit considering them together despite these differences. This review potentially illustrates that multimodal approaches may have benefits compared to standard single approaches. One possible reason for this, which is poorly explored in the literature, is the potential cumulative benefits of different interventions. This is widely recognized in other areas of human behaviour, where repetition or reinforcement in utilizing a variety of methods can alter both thinking and behaviours across a vast range of activities. One clear example is cigarette smoking cessation, where combinations of approaches seem to be more effective [161] and can include pharmacotherapy [160], nicotine replacement [161], health promotion [162], and using technological methods for reinforcement [163].

Given this, while it is clearly speculative, it is possible that the effectiveness of complex multimodal therapies may indicate that utilizing different approaches allows such reinforcements to occur more frequently. Another potential benefit is that all of these programs offer an intensive period of interaction, and certainly there is evidence

linking this to positive clinical outcomes in adults. Linked to this is the possible role of repeated interactions with different groups and therapists, since in all these complex interactions there were interactions with many different individuals. It is therefore conceivable that such a large group of interactions may allow children to identify different therapists or support systems which suit them individually, whereas being limited to a single individual or methodology may not allow this. Despite such speculation, at this time it does appear that complex multimodal treatment programs appear to offer significant clinical benefits across a wide range of indications. Future research could therefore usefully compare best practice single interventions (such as CBT) against more complex interactions. This should be done in the same group of children and youth with the same conditions, ideally where they would be randomized to either group. Without such studies it is not possible to identify the potential best clinical approaches.

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