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Fetal Alcohol Spectrum Disorder: Exploratory Investigation of Services and Interventions for Adults

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Abstract

The purpose of this literature review was to examine published information regarding interventions for adults with Fetal Alcohol Spectrum Disorder (FASD). The review was limited to articles that included an experimental design (i.e., pre-post measures) to ensure a focus on evidence-based interventions. Due to the limited amount of research available for the adult population, articles included here are primarily interventions aimed at children and adolescents. These were grouped into the following categories: family-centered, cognitive, adaptive training, and community-based interventions. A review of the "Best Practices" document produced by Health Canada (2000) is also presented. Limitations, efficaciousness of practices, and future directions are also addressed with regard to adult services for FASD based on this literature.

Fetal Alcohol Spectrum Disorder (FASD) refers to a group of disorders that are caused by prenatal alcohol exposure including: Fetal Alcohol Syndrome (FAS), Partial Fetal Alcohol Syndrome (pFAS), and Alcohol-Related Neurodevelopmental Disorder (ARND) (Popova, Lange, Burd, & Rehm, 2012). FASD is the leading preventable cause of intellectual disability in North America (Abel & Sokol, 1987). In the United States, approximately one in 100 children are living with FASD (Leenaars, Denys, Henneveld, & Rasmussen, 2012). These statistics shed light on the scope of FASD as a disability. However, despite the prevalence of this disorder, FASD has received minimal attention, and the research for treatment and intervention is limited.

Evidence has shown that individuals with FASD have global decreases in brain volume as well as abnormalities in various regions of the brain including the corpus collosum and the cerebellum (Hammond, 2012). Additionally, FASD is a disorder that is associated with life long deficits in: intelligence quotient (IQ), attention and executive control, impulse control, speed of information processing, math and number processing, memory, processing speed, speech and language, motor skills, and visual and social information processing (Hammond, 2012; Kodituwakku & Kodituwakku, 2011; Paley & O'Connor, 2011). In addition to the primary deficits, a number of secondary disabilities are associated with FASD. According to Streissguth, Barr, Kogan, and Bookstein (1996), secondary disabilities refer to disabilities that the individual is not born with but develop throughout the lifespan if appropriate interventions are not sought. It is hypothesized that secondary disabilities develop due to interactions between cognitive, behavioural and mental health issues and unsupportive or maladaptive environments (Streissguth et al., 1996). Secondary disabilities associated with

FASD include difficulty with the law, incarceration, drug dependency, alcohol dependency, and inappropriate sexual behaviours (Streissguth et al., 2004; Chudley, Kilgour, Cranston, & Edwards, 2007). Based on the aforementioned deficits, interventions for individuals with FASD are critical for adaptive and successful life outcomes.

In a recent paper, Popova et al. (2012) investigated the health care costs associated with FAS based upon information collected by the Canadian Institute for Health Information in 2008 to 2009. The total direct health care cost associated with FAS in one year was estimated at 6.7 million dollars (Popova et al., 2012). It is important to note that in this study the researchers only collected data on FAS and given that FAS only accounts for 10 to 20% of FASD diagnoses it is likely that the cost for individuals across the entire FASD spectrum would be much higher (Popova et al., 2012). In another review, Popova, Stade, Bekmuradov, Lange, and Rehm (2011) looked at total life-time costs for all aspects of FASD, including treatment, prevention, law enforcement, research, loss of production, morbidity and mortality. They estimated a figure of approximately 1.1 million dollars for each individual diagnosed with FASD. Overall, these findings suggest that there is a substantial cost associated with FASD across many aspects of our social system.

Individuals with FAS are frequently diagnosed as children, and require supports throughout their lifetime (Chudley et al., 2007). However, individuals without the more obvious physical features or cognitive delays associated with Fetal Alcohol Syndrome (FAS) may not be diagnosed or receive supports until adulthood (Chudley et al., 2007; Streissguth et al., 1996).

To compound these challenges, it is often difficult to diagnose FASD in adulthood due to a limited number of health care professionals with the appropriate training (Chudley et al., 2007). Additionally, there may be a difficulty in obtaining information regarding prenatal alcohol exposure that is required for a pFAS or ARND diagnosis (Chudley et al., 2007).

Similar to Streissguth's outcomes in America, a report from a Toronto-based community agency providing assessment, diagnosis, and treatment recommendations for adults, found many secondary disabilities in a group of 30 adults diagnosed with FASD (Temple, 2012). Legal issues were found in 70% of individuals, 80% had a mental health diagnosis, 70% suffered from problem addiction, and there were a large number without a permanent residence (Temple, 2012). Thus, it is clear that individuals with FASD living in Canada also require greater support and interventions to ameliorate secondary disabilities and to live successful lives.

Less than 40 years ago, FAS was recognized as a birth defect resulting from prenatal alcohol exposure (Paley & O'Connor, 2011). Thus, FASD is a relatively new disorder, and intervention research on adults with FASD is not readily available. Services for the adult FASD population in Canada are also limited (Kalberg & Buckley, 2007; Paley & O'Connor, 2011). Currently, those providing treatments frequently use an eclectic model that is often not evidence-based (Paley & O'Connor, 2009). A review of research in this area is needed to aid in guiding the design and implement effective intervention for this population.

A document entitled *Best Practices: Fetal Alcohol Syndrome/Fetal Alcohol Effects (FAE) and the Effects of Other Substance Use during Pregnancy* was published by Health Canada in 2000 to highlight current practices for this population. The document intended to identify best practices for prevention, identification, and intervention for FAS/FAE based on a comprehensive literature search. Health Canada (2000) found that there were very few studies that addressed or studied the effectiveness of interventions for adults with FAS/FAE (Health Canada, 2000). The authors made the following conclusion regarding best practices for interventions for adults with FAS/FAE:

> While there is no evidence to date, there is a consensus among experts supporting continuing advocacy or case management to help the adult affected by prenatal alcohol exposure to adequately deal with the many challenges of adult life *(*Health Canada, 2000, p. 81).

Based on this information, the purpose of the current literature review is to examine interventions for the adult FASD population. The review aims to examine articles that include an experimental design (i.e., pre-post measures) to ensure a focus on evidence-based intervention. Due to limited findings for the adult population, the articles reviewed primarily include child and adolescent interventions which were grouped into the following categories: family-centered, cognitive, adaptive training, and community-based interventions. A review of the "Best Practices" document produced by Health Canada (2000) is also examined to address the current evidence and support for various types of interventions. Limitations, effective and efficacious practices, and future directions are also addressed for adult services based on current practices in the literature.

Method

In order to conduct a comprehensive review of the literature as it pertains to the services and interventions for the adults living with FASD, the authors searched ERIC, PsycINFO, PUBMED, and Google Scholar.

In utilizing the aforementioned databases, the authors conducted a search using the following key terms in combination with *FASD, fetal alcohol spectrum disorder, and fetal alcohol syndrome: adult support, community support, exercise, group therapy, intervention, justice intervention, rehabilitation, supports, or treatment*.

Authors also reviewed and obtained articles in reference lists of the articles identified through the database search. To select the articles that would be included in the review, the authors reviewed abstracts for each article to determine if the studies included an intervention (i.e., manipulated some variable, and at minimum included a form of pre-post). In total, 38 abstracts were reviewed.

Inclusion and Exclusion Criteria

Additional inclusion and exclusion criterion were also used to guide the literature review. Initially, more stringent inclusion and exclusion criteria were attempted but due to the sparse research available for the adult FASD population, criteria were broadened to include more dated literature and research on children. The final review included all articles that contained participants with a diagnosis of FASD regardless of age, and did not include any articles published before the year 1997. Articles that were primarily targeting academically-based skills such as improved literacy and numeracy skills were excluded due to the more limited relevance to the adult population. As well, those studies that were primarily medically based interventions, such as prescription drug use was excluded. Based on the aforementioned criteria, 11 articles were selected. The process of article retrieval as well as inclusion/exclusion criteria is presented in Figure 1. A summary of the 11 articles included in our review is presented in Table 1.

Results

Community-Based Interventions

The literature search revealed two articles that used a community-based approach to treating specific outcomes for individuals with FASD (Grant, Huggins, Connor, Pedersen, Whitney & Streissguth, 2004; Denys, Rasmussen & Henneveld, 2011). The Parent-Child Assistance Program (PCAP) targets women with FASD who are at risk of giving birth to children with FASD. This is a three year program during which case managers work with women with FASD to increase access to community supports, ensure health care needs are met, access safe housing, and meet community service provider recommendations. In addition, the case managers educate and consult with relevant community service providers about FASD. Grant et al. (2004) assessed the outcomes of the PCAP model in 19 women with confirmed or suspected FASD between the ages of 14 and 36. Grant et al. (2004) compared individual's connection to key services, addiction and problem severity at baseline and after one year with PCAP. The authors concluded that there were improved outcomes for individuals who engaged in the PCAP intervention. Specifically, there was increased secure and stable housing, decreased alcohol and drug dependency, increased use of contraceptives, increased use of community resources, and increased treatment of medical and mental health issues (Grant et al., 2004). Authors suggested that the small sample size and the self-report measures present as limitations which lead to reduced power in the analyses and potential for underreporting in the measures due to the sensitivity of the subject matter (i.e., incidence of abuse and addiction). Nonetheless, Grant et al. (2004) suggested that PCAP was successful in using a case management model to develop improved outcomes for young women with FASD.

Denys et al. (2011) investigated the effectiveness of the Step-by-Step program in addressing the needs and goals of mothers with confirmed or suspected FASD. Twenty-four women between the ages of 19 and 47 participated in their study. A retrospective closed case file analysis was completed. The Step-by-step program is an adaptation of PCAP that supports parents with FASD. The program involves one-to-one mentorship for three years following the birth of a child. Mentors work with individuals to meet basic needs (housing, food, etc.), access diagnostic services, and establish community linkages. Collaboratively, the parents and mentor determine needs and set two to four goals for every six month period. This retrospective analysis evaluated whether there was a change in needs and goals scores after completing the program. It was found that post-program, there was a reduction in needs scores and increase in goals met (Denys et al., 2011). The researchers also found that the three most common needs categories were: family parenting, relationships and peers, and behavioural problems. However, it was found that the largest decreases in needs scores post-program were in the following categories: experience of abuse, social problems, housing and transportation, and community resources. Interestingly, family parenting was the most common need but showed little change in scores. It was suggested by case mentors involved in the program that it may be due to the need to work on goals that were of higher priority such as stable housing, food, and supporting addiction treatment. This suggests that the Step-by-Step program may be an effective community-based model to decrease needs of parents of young children and meet pre-determined goals. However, there are limitations that are inherent to the retrospective file analysis design including missing data for some participants and important variables including long-term follow-up that were not assessed.

Of the two articles that included pre and post measures of specific variables, both studies suggested that case management was an effective means of improving various aspects of the lives of women with FASD.

Adaptive Skills Training

Adaptive skills include skills that are necessary to achieve independence in the community. The research revealed five articles that targeted teaching adaptive skills to children with FASD (Coles, Strickland, Padgett, & Bellmoff, 2007; Frankel, Paley, Marquardt, & O'Connor, 2006; O'Connor et al., 2006; Padgett, Strickland, & Coles, 2006; Timler, Olswang, & Coggins, 2005).

Padgett et al. (2006) investigated the use of a computer program to teach fire safety skills to children aged four to seven diagnosed with FAS or pFAS. Participants observed and followed a character model the fire safety

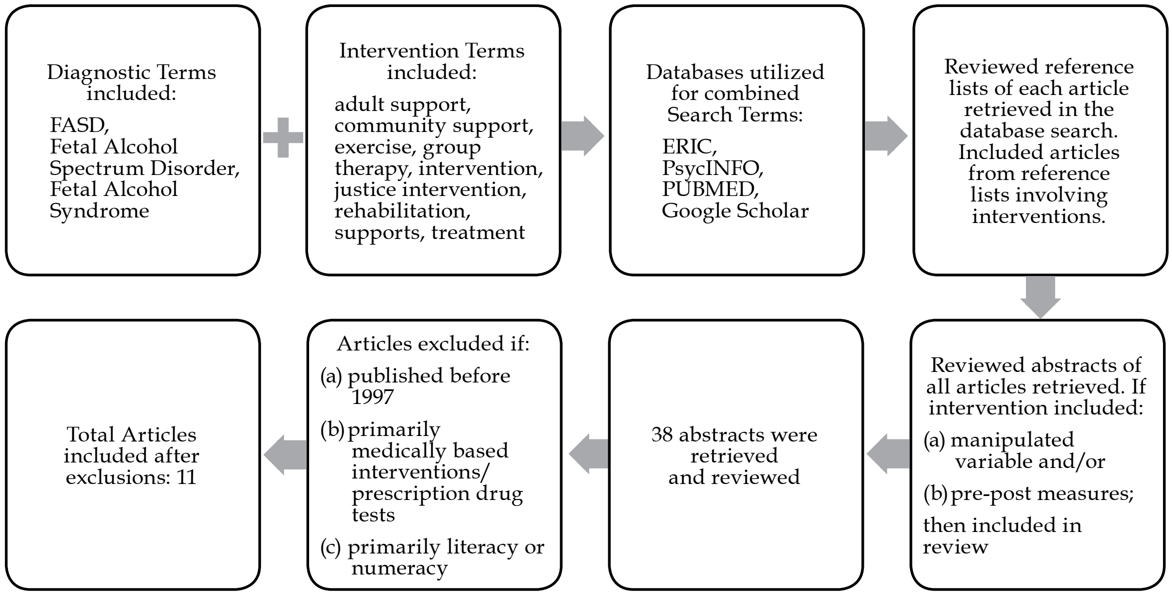

Figure 1: Article search and inclusion/exclusion process.

Table 1. Details of Reviewed Studies Exploring Interventions for FASD

Community-Based Interventions

Grant et al. (2004)

n	19
Age Range (years)	14–36
Experimental Design	Retrospective Case File Analysis
Validity/Reliability	Not reported
Approach for Interpretation	Repeated measures
Conclusions	After 1 year of PCAP,[1] there were improved outcomes for individuals in the study. This included decreased alcohol and drug dependency, increased stable housing, increased use of contraceptives, and better treatment and access to mental health services.

Denys et al. (2011)

n	24
Age Range (years)	19–47
Experimental Design	Retrospective Case File Analysis
Validity/Reliability	Not reported
Approach for Interpretation	Repeated measures
Conclusions	Found that after intervention, there was reduction in needs scores and increase in goals met.

Adaptive Skills Training

Padgett et al. (2006)

n	5
Age Range (years)	4–7
Experimental Design	Multiple baseline, multiple probe design
Validity/Reliability	Not reported
Approach for Interpretation	Percentage correct
Conclusions	All participants reached 100% accuracy on the virtual program and generalized to a real-world simulation at one-week follow-up.

Coles et al. (2007)

n	32
Age Range (years)	4–10
Experimental Design	Group Comparison Design
Validity/Reliability	Not reported
Approach for Interpretation	Rigorous statistics
Conclusions	Children showed significantly better knowledge of the game in their condition (i.e., fire-safety or street-safety) immediately and at follow-up. Children were able to generalize the knowledge to a real-life simulation.

Frankel et al. (2006)

n	77
Age Range (years)	5–12
Experimental Design	Randomized group design to treatment or delayed treatment
Validity/Reliability	Reported reliability and validity of Social Skills Rating Scale (SSRS)
Approach for Interpretation	Rigorous statistics
Conclusions	Children prescribed neuroleptics in combination with Childhood Friendship Training showed greater improvements than those prescribed stimulants, no medication, or both medications.

[1] *PCAP = Parent-Child Assistance Program*

Table 1. Details of Reviewed Studies Exploring Interventions for FASD (continued)

Adaptive Skills Training (continued)	
O'Connor et al. (2006)	
n	100
Age Range (years)	6–12
Experimental Design	Two group longitudinal design
Validity/Reliability	Reported reliability and validity of measures (Vineland Adaptive Behavior Scale; Kaufman Brief Intelligence Test)
Approach for Interpretation	Rigorous statistics
Conclusions	After receiving Childhood Friendship Training, children displayed increased knowledge of social skills and demonstrated improvements in social skills as reported by parents. However, there was no difference in social skills based on teachers' report.
Timler et al. (2005)	
n	1
Age Range (years)	9
Experimental Design	Case Study
Validity/Reliability	Not reported
Approach for Interpretation	Visual analysis
Conclusions	After social communication training, the participant displayed increased use of language to behave appropriately during social interactions.
Family-Centered Interventions	
Leenaars et al. (2012)	
n	186
Age Range (years)	1–10
Experimental Design	Retrospective Case File Analysis
Validity/Reliability	Not reported
Approach for Interpretation	Repeated measures and correlational analysis
Conclusions	After participating in the Coaching Families program, parents reported significantly lower needs scores and significant increase in goal attainment.
Wells et al. (2012)	
n	78
Age Range (years)	6–11
Experimental Design	Randomized Control Group Design
Validity/Reliability	Reported validity and reliability of the Behavior Rating Inventory of Executive Function and The Roberts Apperception Test for Children
Approach for Interpretation	Repeated measures
Conclusions	After neurocognitive habilitation intervention, there were significant improvements on measures of executive function and emotional problems in the treatment group.

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Table 1. Details of Reviewed Studies Exploring Interventions for FASD (continued)

Cognitive Interventions	
Loomes et al. (2008)	
n	33
Age Range (years)	4–11
Experimental Design	Randomized Control Group Design
Validity/Reliability	Not reported
Approach for Interpretation	Two group repeated measures
Conclusions	After rehearsal training, children in the intervention group scored significantly higher on a digital span task. Children in the control group did not show any improvement.
Kerns et al. (2010)	
n	10
Age Range (years)	8–15
Experimental Design	AB Research Design
Validity/Reliability	Not reported
Approach for Interpretation	Rigorous statistics
Conclusions	After 16 hours of PCAT[2] and metacognitive strategy training, participants showed improvements in distractibility, sustained attention, divided attention, working memory and math and reading fluency tasks.

[2] *PCAT = Computerized Progressive Attention Training*

sequence correctly twice before completing the sequence correctly without a model twice to master the program. Feedback was given to the child throughout the program based on performance. Using a pre/post case study design, the study aimed to determine if after mastering the computer program, the child could identify fire safety rules and generalize the skills to the natural environment immediately after mastery and at one-week follow-up (Padgett et al., 2006). It was found that pre-intervention, none of the children could accurately describe the steps to take if a fire occurred. However, after the intervention most children were able to accurately sequence pictures depicting the steps to safely get away from a fire and all children generalized to the real world simulation both upon mastery and at one-week follow-up. However, it was noted that the follow-up period was only one week after training, which limits the strength in the findings (Padgett et al., 2006). Padgett et al. (2006) concluded that the positive results of this study warrant the further investigation of the use of computer simulation as an educational tool for children with FASD.

In a follow-up study, Coles et al. (2007) used a between groups comparison to evaluate the effectiveness of the virtual reality computer program to teach safety skills. Thirty-two children with FAS or pFAS and borderline range of intelligence participated in their study. Children were randomly assigned to one of two groups: fire safety or street safety. Each group served as control for the other group. Coles et al. (2007) assessed ability to verbalize safety skills for both fire and street safety at pre-test, post-test and one-week follow-up. Similar to Padgett et al. (2006), generalization to a real-world simulation was evaluated after mastery and at one week follow-up. It was determined that the computer program training resulted in increased knowledge in the particular safety skill it was targeting (either fire or street) and did not increase knowledge in the other skill. The skill generalized to a real world situation immediately after training and at one week follow-up. Based on this information, it was suggested that the computer program was an effective method for teaching safety skills for children with FAS or pFAS with borderline intelligence. Coles et al. (2007) notes that a limitation of their study is that an alternative teaching method was not used as a comparison to evaluate if there are other equally effective and potentially more practical interventions for teaching specific safety skills.

Social skills are another area of adaptive functioning that was found in the literature to be a deficit for individuals with FASD (Frankel et al., 2006; O'Connor et al., 2006; Timler et al., 2005). Frankel et al. (2006) examined children diagnosed with FASD who were given 12 sessions of Children's Friendship Training (CFT) to target social skills. The four groups tested included those prescribed stimulant medication, neuroleptic medication, no medication, or both types of medication. Parent and teachers provided pre- and post- measures using the Social Skills Rating System (SSRS). Results indicated that children showed greater social improvements when prescribed neuroleptic medications, in comparison to those who were not (Frankel et al., 2006). The results of those taking stimulant medications showed limited improvement, or less favorable outcomes when compared to children not prescribed stimulants (Frankel et al., 2006). However, it is important to note that researchers did not obtain information around compliance with children receiving medications as prescribed, as such results must be interpreted with caution. These results may suggest that particular classes of medication may contribute to improved social functioning for those with FASD when combined with social skills intervention.

A second study was found that examined the Children Friendship Training (CFT) program (O'Connor et al., 2006). The study compared two groups of children with FASD, ranging from age 6–12 years old. The authors' aim was to examine the efficacy of the program by comparing a group that received the training, to those who received delayed access to the program (O'Connor et al., 2006). The study measured social skills knowledge of the children using the Test of Social Skills Knowledge (TSSK), and both parents and teachers completed the Social Skills Rating System (SSRS) before and after the implementation of program which assessed the social skills and problem behaviours of the children (O'Connor et al., 2006). The results of the study demonstrated substantial improvement of knowledge of appropriate social skills in those who received the program in comparison to the delayed treatment group; however, once treatment was received; the delayed treatment group demonstrated similar positive results (O'Connor et al., 2006). At a three month follow-up, these skills were maintained (O'Connor et al., 2006). Parent and teacher outcomes from the SSRS displayed divergent results. The SSRS completed by the parents' demonstrated improvements in socials skills and problem behaviors; however, teacher outcomes were not as promising (O'Connor et al., 2006). However, the authors noted that these results may not generalize to the larger population of individuals with FASD as Verbal IQ was required to be above 70 and participation was voluntary which is likely to comprise a group of individuals who are highly motivated to improve their child's social skills. These results not only show improvements in adaptive skills in children with FASD, but also maintenance of these skills at follow-up.

A study by Timler et al. (2005) which looked at social skills tested whether an intervention that was derived from current research in social communication would be effective for a child diagnosed with FASD. Using a case study design, the intervention targeted mental state verb use and social cognitive skills in a third grade female student diagnosed with FASD (Timler et al., 2005). Intervention sessions occurred across six weeks and included both individual and group sessions. Sessions included modeling and rehearsal of social scripts to guide the participant to resolve social situations and engage in appropriate responses (Timler et al., 2005). Checklists were used to guide thinking and participation during the role play. Probes on mental state verbs strategies for successfully completing a social goal and consequences for the participant's actions were conducted. The results of the study demonstrated an increased use of mental state verbs during intervention and follow-up, and increased average number of possible strategies suggested during intervention (Timler et al., 2005). Despite increased strategies suggested, the strategies chosen were not always the most relevant to the social situation. The participant's ability to take on a peer's perspective did not change throughout the course of the study. It was concluded that the participant increased her use of language to be able to appropriately behave during social interactions more effectively (Timler et al., 2005). This study provides preliminary evidence that a social communication intervention may be effective to improve social skills in children diagnosed with FASD. However, these results must be interpreted with caution due to the design of the study. Further investigation is warranted to explore the effects of social communication intervention for the larger population of individuals with FASD.

In teaching adaptive skills to children with FAS or pFAS, researchers concluded that a virtual reality computer game was an effective tool. Additionally, social skills intervention – with, and without pharmaceuticals – have shown promise in improving social functioning with these children. Although these studies seek to improve adaptive skills in children, there are countless measures when assessing and teaching adaptive skills, many of which have not been measured in current literature (e.g., self-care, street safety, cooking etc.). These skills are important throughout the life span and are of great relevance to the adult population and may suggest an area of focus in future intervention.

Family-Centered Interventions

Findings in the literature produced two articles that tested intervention approaches related to family-centered involvement for supporting individuals with FASD (Leenaars et al., 2012; Wells, Chasnoff, Schmidt, Telford, & Schwartz, 2012). Both studies examined different strategies involving individuals with FASD and their families

Leenaars et al. (2012) examined the Coaching Families (CF) program that aids the parents of individuals with FASD. The study included 186 families and measured family's needs, goals, stress levels, and program satisfaction at the outset of the study and at the end of the program. The program seeks to build knowledge of FASD, assess family needs and supports, and mentor families to access community supports. Results indicated a decrease in family needs in relation to their child, and an increase in the accomplishing of goals (Leenaars et al., 2012). Additionally, families reported high levels of satisfaction with the program, and a decrease in stress level. A possible limitation of this study, however, is that the measures used to obtain information were not standardized and were created by the CF team (Leenaars et al., 2012). Despite this, the results of their study shed light on services that may be helpful in order to establish "buy-in" from families in other areas of intervention.

A study conducted by Wells et al. (2012) also examined the role of families in intervention for children with FASD by measuring executive functioning and emotional problem solving skills before and after the implementation of neurocognitive habilitation therapy. This study randomly assigned participants to a treatment, and a non-treatment group. Both children and caregivers in the study were exposed to the neurocognitive habilitation program. The program included components of the Alert Program to ensure issues of self-regulation of the children were addressed (Wells et al., 2012). Through the curriculum of the program, caregivers were taught ways to recognize characteristics in their child that may signal changes in arousal level, how to respond, and how to accommodate their child's needs (Wells et al., 2012). Both parents and children assigned to the treatment group were part of 12 sessions (Wells et al., 2012). The results of the study compared pre- and post-scores on the Behaviour Rating Inventory of Executive Function (BRIEF) and the Roberts Apperception Test for Children (RATC) (Wells at al., 2012). The results demonstrated significantly higher scores on measures of executive functional and emotional problem-solving in the treatment group. (Wells et al., 2012). All participants in this study resided in foster or adoptive homes. As such, the authors note that these results may not generalize to children with FASD living with their biological parents (Wells et al., 2012). Nonetheless, this study demonstrates promise for family involvement for improving those skills in children with FASD, and contributes to the relatively limited research for randomized control studies for this population.

Both articles show promise for utilizing parents as a tool to providing intervention to children with FASD. More specifically, the results suggest increased goal attainment, decreased family need in relation to particular supports, and the significance of parent training.

Cognitive Interventions

Cognitive interventions seek to target processes in the brain that pose significant challenges to individuals with FASD. These deficits in the brain may contribute to difficulties with memory, social skills, and information processing which often endure into adulthood (Hammond, 2012). A study by Loomes, Rasmussen, Pei, Manji, Andrew (2008) examined the effect of rehearsal training for children with FASD. The participants were divided into two groups: rehearsal training, and control. The children were tested on a digit span task, whereby they were expected to remember a series of numbers at baseline and during post-test. During the post-test, the treatment group was given a strategy to remember the numbers, and the control group was not. Ten days later, the treatment group was given the same numbers and reminded of the strategy they were taught in the prior session. The results of the intervention showed a significant increase in performance for the treatment group across sessions (Loomes et al., 2008). Additionally, the treatment group demonstrated a greater increase in scores at 10 day follow-up, than at post-test. Long-term follow-up and generalization to novel scenarios was not reported which would have provided greater power in the results. However, the results demonstrate the value of rehearsal training for individuals with FASD.

Another area of cognitive intervention focused on attention training. A study by Kerns, Macsween, Vander Wekken, and Gruppuso (2010) examined The Computerized Progressive Attention Training (CPAT) program specifically for children with FASD (Kerns et al., 2010). The authors examined pre- and post- scores for working memory (i.e., the ability to hold and mentally manipulate information), attention, and academic tasks through a series of standardized psychometric tests (Kerns et al., 2010). The results of the study demonstrated substantial improvement in areas including sustained and selective attention, spatial working memory, and math and reading fluency, however there were no differences in accuracy based on the Attentional Netword Test (ANT-C), the child friendly version (Kerns et al., 2010). The results of this study highlight the possibility that computerized training materials may be a component of successful intervention for improving cognitive performance in children with FASD. Further research employing a more sophisticated research design involving a control group would add greater evidence for effectiveness of the program.

The literature for cognitive interventions suggests positive results for both attention training and rehearsal training for the child FASD population. These findings may present some key areas that may be useful for teaching, and coaching the adult population.

Discussion

Limitations

There were few articles that met the criteria deemed necessary to be considered evaluative of a specific intervention as laid out in the methods section of this paper. It is clear that the literature is lacking scientific research papers that investigate the effectiveness of interventions for adults diagnosed with an FASD. The current review was able to locate only two articles (Denys et al., 2011; Grant et al., 2004) that evaluated specific outcomes before and after an intervention in the adult FASD population. An AB research design was used in both which limits the conclusions that can be drawn due to a lack of experimental control. In addition, validity and reliability of measures was rarely reported. Despite the limited research design, the articles are the only available research that evaluates an intervention for adults. Due to this limited research, the current review included evaluations of interventions for children with an FASD. However, it is unclear how these interventions would generalize to the adult population.

In addition, the results of the current literature review are based on the researchers' conclusions. Specific limitations of each study were not identified. Thus, the results are being collated to make conclusions on the effectiveness of categories of interventions based on the results put forth by the researchers. Due to the limited number of studies and researchers investigating interventions for FASD, there is a lack of independent replications of interventions which would suggest greater legitimacy in the results.

Efficacious of Interventions

According to Chambless and Hollon (1998), efficacious treatment refers to one that through controlled research the benefits observed are reasonably proven to be from the treatment and not due to confounding variables or chance. To test the efficacy of a treatment, randomized controlled trials or carefully controlled single case designs should be undertaken. Criteria set forth by Chambless and Hollon (1998) suggest that only when a treatment has been shown to be efficacious by two independent investigatory research teams using high methodological rigour and appropriate outcome assessments, can it be deemed an efficacious treatment. Using the aforementioned criteria, there are as yet no interventions that can be deemed efficacious for adult or children's population of individuals with FASD.

Chambless and Hollon (1998) further suggest that a treatment can be considered possibly efficacious using a single study involving more than three participants if there is not conflicting evidence. Based on this criteria, the computer program used to teach safety skills to children with FASD can be deemed possibly efficacious (Padgett et al., 2006; Coles et al., 2007) until it is replicated by an independent research team. In terms of family-centered approaches, both neuroleptics and CFT demonstrated an increase in social skills, and neurocognitive habilitation therapy showed promising results at increasing executive function and emotional problem solving skills in children with FASD (Frankel et al., 2006; Wells et al., 2012). These interventions are considered possibly efficacious until further research confirms the results found by the research teams. Finally, research conducted by Loomes et al. (2008) proved that rehearsal training is a possibly efficacious strategy at increasing recall of numbers in children with FASD.

Future Directions

The current literature review has revealed a gap in the empirically tested interventions and practices for adults living with FASD. Although there is a gap in evidence-based intervention, there may be numerous FASD interventions and supports that are frequently used and potentially beneficial, however, are not reported in the literature. Much of the current research, although also somewhat limited, focuses on the child and adolescent population. This lack of research evidence has also been noted by others doing literature reviews in the area (Premji, Benzies, Serrett, & Hayden, 2006; Kodituwakku, 2010). Despite this, various components of interventions found in the literature may be instructive in guiding further research.

Adaptations of specific programs have been undertaken to accommodate the needs of individuals with FASD (Laugeson, Paley, Schonfeld, Carpenter, Frankel, & O'Connor, 2007; Wells et al., 2012). This approach may be helpful in the development of supports for the adult population; ensuring programs are designed to meet the challenges associated with these classes of disorders. For instance, Laugeson et al. (2007) modified the Children's Friendship Training (CFT) program to include increased opportunities to practice skills, role-play, and summarize children's responses, in addition to various other modifications. Using current evidenced based interventions and modifying these to meet the needs of this population may serve as a starting point for empirically testing interventions.

Another adaptation tried by researchers is using elements of Behavioural Skills Training (BST) (Laugeson et al., 2007; Loomes et al.2008; Frankel et al., 2006; Padgett et al., 2006). BST looks at teaching individuals a specific skill(s) through a four step process: (1) instructions, (2) modeling, (3) rehearsal, and (4) feedback (Sarokoff & Sturmey, 2004). BST has been used to teach a variety of skills to individuals with various abilities (Johnson, Miltenberger, Egemo-Helm, Jostad, Flessner, & Gatheridge, 2005; Miltenberger, Flessner, Gatheridge, Johnson, Satterlund, & Egemo, 2004; Rosales, Stone, Rehfeldt, 2009). For instance, BST has demonstrated positive results for teaching street safety (Johnson et al., 2005), gun safety (Miltenberger et al., 2004), and teaching communication (Rosales et al., 2009) for several populations including those with and without disabilities. Identified vulnerabilities for the adult population with FASD may include difficulties with self-advocacy, sexual abuse, and violence. It has been suggested that these issues are not currently being addressed within the system (Chudley et al., 2007). This framework may be useful to teach skills that target the adult population who are at risk. Much of the research presented here focuses on using various elements of this model for interventions to support individuals with FASD; however, further research may consider testing the BST model as a package to teach specific life skills to these adults.

Best Practices for FASD: Health Canada (2000)

The evidence-base for adult services and interventions for individuals with FASD is currently minimal (Health Canada, 2000). *Best Practices* outlined that although there is limited evidence, there is an overall consensus within adult services that case management is helpful in managing challenges associated with adults with FASD. For instance, interventions which focus on addictions and mental health supports, employment training and those focused on correctional services may be of benefit (Health Canada, 2000). However, without controlled research, conclusions regarding effectiveness of these practices are difficult.

Unfortunately, the information provided in the best-practices statement published by Health Canada (2000) cannot be updated based on the results of this literature review. Additionally, based on the criteria set forth by Chambless and Hollon (1998), there are no interventions that can be deemed efficacious in the treatment of FASD in the adult population at present, leaving this population with minimal interventions that have demonstrated positive results.

Key Messages From This Article

People with disabilities: You are entitled to supports and services that will help you. Right now, there are not many supports that have been well tested. We need to do more research to find out which ones work best.

Professionals: Currently there are few evidence-based empirically tested interventions for adults with FASD. Making positive change in an individual's life by providing up-to-date intervention procedures that have demonstrated success is needed.

Policymakers: This paper outlines the limited research evidence available to support interventions for the adult FASD population. It will be important to provide increased opportunities to experimentally evaluate the outcome of interventions.

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Author Note

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