CHAPTER - II

REVIEW OF RELATED LITERATURE

2.0.0 INTRODUCTION

In the first chapter, information about ADHD, Rationale along with Objectives and Hypotheses has been given. The present chapter is devoted to reviewing researches related to different aspects of ADHD and different treatment modalities in practice.

For better understanding the review has been classified under the captions of Medicinal interventions: stimulant based medication; Alternative interventions- such as yoga, complementary (ayurvedic) supplements, and nutritional changes; Psycho-educational uni-modal interventions, which further entail- family based approach, school based approach; Psycho-Educational combination, bi-modal interventions, and finally the Multimodal interventions.

2.1.0 TREATMENT PRACTICES

Although ADHD is one of the most frequently diagnosed and studied clinical disorders in child psychology (Barkley, 1990; Barkley, 2006), very little is known about the efficacy of treatment for children and adolescents with this disorder (Olfson, Gameroff, Marcus & Jenson, 2000, Smith, Waschbusch, Willoughby & Evans, 2000; Trout, Lienemann, Reid & Epstein, 2007). There are multiple approaches and research indicates strengths and weaknesses of all modalities and approaches.

2.1.1 Medicinal Interventions- Stimulant based Medication

2.1.1 i. Prevalence of Medicinal Interventions

Investigation on the documented research reveals that the most widely studied, implemented and reported treatment for children and adolescents with ADHD continues to be stimulant treatment (ST), primarily methylphenidate
The vast majority of children diagnosed ADHD receive a course of medication that usually continues at least for several months and often throughout the school-age years (Chaddha, 2002). In a survey of primary care physicians, Wolraich et al. (1990) found that 88% of children considered hyperactive had received methylphenidate. Safer and Krager (1988) reported average durations of medication use of 2, 4, and 7 years for elementary, middle, and high school students, respectively. The portion of middle school students receiving stimulant medication increased from 0.6% in 1975 to 3% in 1993 (Safer & Krager, 1994) and stimulant prescriptions for children and adolescents have increased to 2.5 fold from 1990 to 1995 (Safer, Zinto & Fine, 1996). Murray and Patel (2001) found that stimulant medications remain the mainstay of treatment in India and are highly effective in more than 75% of patients. According to Du Paul and Stoner (2003) approximately 1.5 million US children with ADHD are treated with psychostimulant medication. A survey study indicated that 4.3% of children (ages 4 to 17) took medications for ADHD in 2003; which was about 56% of the children who had a history of ADHD diagnosis (CDCP, 2005). According to Castle, Aubert, Verbrugge, Khalid and Epstein (2007) in the year 2005, 4.4% of children received one or more prescriptions and it was more common among older children (ages 10 to 19) than younger children (ages 0 to 9) and boys were 2.3 times more likely to use these medications than girls. Study further described that older boys (ages 10 to 19) showed the highest prevalence of use; 8.1% of boys in this range used ADHD medications during 2005.

2.1.1 ii. Effect of Medicinal Interventions

Improvement in the core symptoms of inattention, impulsivity, and hyperactivity are most noticeable as a result of stimulant treatment. Methylphenidate was found to increase levels of arithmetic performance and task in compatible behavior (Gorman, Klorman, Thatcher & Borgstedt, 2006). Methylphenidate also lowered parent and teacher ratings of inattention and hyperactivity for all the children diagnosed with ADHD and various subtypes.
(Gorman, Klorman, Thatcher & Borgstedt, 2006). Stimulant medication has also been found to increase attentiveness and reduce non compliance among children with ADHD in classroom (Carlson, Pelham, Milich & Dixon, 1992).

Numerous studies and their findings support the widespread practice of prescribing psychostimulant medication to treat ADHD as a first line of treatment, (Corkum, McGonnell & Schachar, 2010). Psychostimulant prescriptions have increased during the last decade (Safer, Zito & Fine, 1996; Zito et. al. 2000) despite the lack of long term safety information, negative side effects (Barkley, 2006) and parental concerns about chronically medicating young children through out their formative years (Bramble & Cosgrove, 2002).

A postal survey was undertaken by Bramble and Cosgrove (2002) of the parents of 326 patients with severe and complex forms of ADHD to obtain their views of the efficacy and safety of risperidone augmentation therapy. Replies were received from parents of 170 patients (mean age: 14.3; SD: 4.4; range: 4–27 years). The results revealed an overall symptomatic improvement resulting from the risperidone therapy: 92% of parents and 100% of the prescribing clinician’s ratings indicated a net benefit of treatment (on a visual analogue rating scale); a good adherence rate (81%); low rates of significant adverse effects (8%); and a reduction of reported offending rates (overall 93% reduction comparing rates before and during risperidone therapy in 30 patients). Furthermore, most parents feared that their offspring would become ‘uncontrollably aggressive’ (84%) and ‘un-manageable’ (74%) should the risperidone therapy be stopped abruptly. It is concluded that risperidone augmentation appears to represent a well-tolerated and effective means of helping children and young adults with complex and severe forms of ADHD.

A study by Rhodes, Coghill and Matthews, 2006 was designed to investigate the acute effects of the psychostimulant drug, methylphenidate (MPH), on neuropsychological performance in stimulant naïve boys with
ADHD. Seventy-three drug-naïve boys (age 7–15) with ADHD (combined type) completed neuropsychological tasks from the CANTAB battery under randomized, placebo controlled, double-blind conditions following an acute challenge with either placebo \((n = 24)\), .3 \((n = 25)\) or .6 \((n = 24)\) mg/kg oral MPH. MPH did not impair performance on any task. MPH (.6 mg/kg) lengthened response latencies on a task of Spatial Recognition, shortened response times on a Reaction Time task and restored performance on a Delayed Matching to Sample visual, non-working memory task. Contrary to predictions, MPH did not enhance performance on tasks with a prominent executive component, including Go/NoGo, Spatial Working Memory, Stockings of Cambridge and Attentional Set shifting tasks. Acute administration of MPH to drug-naïve boys with ADHD did not impair neuropsychological performance. Acute MPH enhanced performance on some aspects of non-executive functioning. MPH-induced slowing of responding on a relatively complex Spatial Recognition memory task and quickened responding on a reaction time task requiring less cognitive resources suggested that MPH may act by improving self-regulatory ability. Results suggested that MPH may not exert its effects on neuropsychological functioning by enhancing executive processes.

2.1.2 Limitations of Medicinal Interventions

Although psycho-stimulant medication has been widely used for many years, findings have suggested that as the sole treatment for ADHD, it is an inadequate form of intervention (Trout, Lienemann, Reid & Epstein, 2007). Problems surrounding the use of high doses include adverse physiologic, cognitive, and social effects. In a study by Mattes and Gittelman (1983), the growth in height and weight of 86 hyperactive children receiving methylphenidate hydrochloride (average, 40 mg/day for up to four years) was compared with general population norms on recently updated growth charts. A significant decrease in height percentile was apparent after 2, 3, and 4 years of treatment but not after one year. A significant loss in weight percentile occurred onward from the first year of treatment. Dosage was significantly associated
with the decrease in height and weight percentile. Greater initial height and weight were associated with greater growth decrements. The use of adjunctive thioridazine hydrochloride (mean, 87 mg/day) did not influence the growth of children receiving methylphenidate. Although the magnitude of the growth suppressant effect in groups was small (dosage accounted for only 2% of the variance in final height), the results suggested that clinicians should monitor the growth of hyperactive children receiving stimulants and consider dosage reduction in individual cases should evidence of growth suppression occur.

Rhodes, Coghill and Matthews (2006) observed the self-regulatory effect of stimulant medication but noted that when low doses are administered, most of the children treated fail to improve to the point at which no further intervention is needed.

In a study by Handen, Feldman, Gosling, Breaux and McAuliffe (1991) the adverse side effects of methylphenidate were evaluated in 27 children with attention deficit hyperactivity disorder and IQs of 48 to 74 who participated in a double-blind study of two doses of methylphenidate and placebo. A checklist of 13 side effects, generated from the Physician's Desk Reference, was completed by teachers. Rates of irritability, anxiety, moodiness, and activity level decreased significantly when comparing the placebo with drug conditions. However, medication for six (22%) of the children was discontinued because of the appearance of motor tics (three children) and severe social withdrawal (two children), suggesting that mentally retarded children with attention deficit hyperactivity disorder may be at a greater risk for developing these side effects than the non-retarded population.

In a wider study by Cascade, Kalai and Wigal (2010), data on side effects were tabulated for patients taking one of the following attention deficit hyperactivity disorder medications: amphetamine and dextroamphetamine; atomoxetine; dexamphetamine; isdexamfetamine; and methylphenidate. Forty-eight percent of the approximately 325 patients surveyed reported having
experienced a side effect as a result of taking an attention deficit hyperactivity disorder medication. Most common side effects mentioned included loss of appetite, sleep problems, and mood disturbances. Only 21 percent of side effects were considered very bothersome or extremely bothersome. Regardless of how bothersome the side effects were, only 20 percent of patients mentioned the side effects to their prescribing physicians.

Another study by Kim et al. (2010) investigated the effect of the clinical and demographic variables such as body weight, dosage, family history of attention-deficit hyperactivity disorder (ADHD), and psychiatric co-morbidity on the side-effects of OROS-Methylphenidate (OROS-MPH), and to evaluate the relationship between drug response and side effect severity. A total of 144 children (ages 6-18) with diagnosed ADHD were treated with OROS-MPH. Children were examined at baseline and after 1, 3, 6, 9, and 12 weeks of each treatment condition. The stimulant drug side effect rating scale (SERS), pulse rate, systolic blood pressure, diastolic blood pressure, and electrocardiogram (ECG) were evaluated to assess side effect profiles. Changes in these parameters from baseline were examined and analyzed. Anorexia (30.95%) and insomnia (13.10%) were found to be the most commonly reported side effects during this study. Insomnia and loss of appetite score increased at one week follow-up, but was sustained or decreased as treatment progressed. Small but significant increases in pulse rate and diastolic blood pressure were observed during treatment; however, no clinically meaningful changes in ECG parameters were noted during the study. Low body weight, high dosage of OROS-MPH, and family history of ADHD were associated with cardiovascular side effect.

The issue of community concern relating to the escalating use of stimulants in the management of ADHD symptoms, treatment acceptability, side effects, potential long term effects, danger and drug abuse dependency, and consumer and parental preference of non pharmacological
treatment, compels researchers to explore other treatment options (Saxena & Schwanz, 2011).

2.2.0 ALTERNATIVE INTERVENTIONS

2.2.1 Meditation and Yoga

Arnold’s (2001) review of alternative approaches to the management of ADHD noted that meditation and yoga was one of a number of promising strategies and warranted further systematic assessment. According to results of the study undertaken by Harrison, Manocha and Rubia (2004); where parents and children took part in 6 week program of twice a week, clinical sessions and regular meditation at home; there were significant improvements in children’s ADHD behavior, self-esteem and relationship quality. Children described benefits at home (better sleep patterns, less anxiety) and at school (more able to concentrate, less conflicts). Parents reported feeling happier, less stressed and more able to manage their child’s behavior. Indications from their preliminary study were that Sehaj Yoga Meditation may offer families an effective management tool for family oriented treatment for childhood ADHD.

2.2.2 Music Therapy

Research has found that instrumental musical arrangements have therapeutic effects on children with ADHD. Study by Rickson (2006) compared the impact of instructional and improvisational music therapy approaches on the level of motor impulsivity displayed by adolescent boys who have Attention Deficit Hyperactivity Disorder (ADHD). Measures included numbers of errors made on a Synchronised Tapping Task (STT); and Conners’ Rating Scales (Conners, 1997). Participants (n=13), aged 11 - 16 years, were enrolled in a special residential school. A combination of a multiple contrasting treatment and an experimental control group design was used. Students were randomised to three groups; control (Group A) and two treatment groups. Students in Group B received eight sessions of improvisational music therapy followed by eight sessions of instructional music therapy, while the order was
reversed for Group C. There was no statistical difference between the impacts of the contrasting music therapy approaches on the level of motor impulsivity displayed by the students as measured by the STT and the Restless-Impulsive and Hyperactive-Impulsive Conners' subscales. However all students significantly improved on the STT across each phase of treatment and improvement was slightly greater during the instructional treatment periods for both groups. During these same periods teachers reported a small decrease in restless and impulsive behaviours. The results therefore cautiously imply that the instructional approach might contribute to a reduction in motor impulsivity in the classroom. Significant improvement on STT without the corresponding improvement in motor impulsivity suggested that increased accuracy on the STT might be attributable to progress in other developmental domains. Teacher report of significant improvement for treatment groups on the DSM-IV Total Subscale adds weight to this suggestion, and implies that combined music therapy approaches might have contributed to a reduction in DSM-IV symptomology in the classroom.

2.2.3 Complementary Medicines

Using a meta-analytical approach, Sarris, Kean, Schwitzer and Lake (2011) attempted to assess the evidence of herbal and nutritional interventions for ADHD using a systematic search of clinical trials meeting an acceptable standard of evidence. PubMed, PsycINFO, Cochrane Library and CINAHL were searched up to May 26th, 2011 for randomized, controlled clinical trials using CAM products as interventions to treat ADHD. A quality analysis using a purpose-designed scale, and an estimation of effect sizes (Cohen's d) where data were available, were also calculated. The review revealed that 16 studies met inclusion criteria, with predominant evidentiary support found for zinc, iron, Pinus marinus (French maritime pine bark), and a Chinese herbal formula (Ningdong); and mixed (mainly inconclusive) evidence for omega-3, and l-acetyl carnitine. Study suggested that Ginkgo biloba (ginkgo), and Hypericum perforatum (St. John's wort) are ineffective in
treated ADHD. The research suggests only some CAMs may be beneficial in ADHD, thus clinicians need to be aware of the current evidence. Promising candidates for future research include Bacopa monniera (brahmi) and Piper methysticum (kava), providing potential efficacy in improving attentional and hyperkinetic disorders via a combination of cognitive enhancing and sedative effects.

2.2.4 Occupational Therapy

Slaich (2002) describes the role of Occupational Therapy in the treatment of ADHD. Using the case study method with one 7 year old child with ADHD, and working for total of 60 hours in 3 months of span, Slaich concluded that attention span can be increased by vision therapy – which includes skills such as visual tracking, fixation, focus change, binocular fusion and visualization. According to Slaich (2002) when all of these skills are well developed, children and adults can sustain attention, read and write without careless errors, give meaning to what they hear and see and rely less on movement to stay alert.

Hahn-Markowitz, Manor and Maeir (2011) proposed an intervention that deals directly with Executive Functions in the children with ADHD in daily tasks. Fourteen children and their parents participated in the Cognitive-Functional (Cog-Fun) program in occupational therapy, which is tailored to the executive dysfunction of ADHD and focuses on enabling cognitive strategies for occupational performance. The study included initial assessment of EFs (Behavior Rating Inventory of Executive Functions; Tower of London(DX)), occupational performance (Canadian Occupational Performance Measure), 10 sessions of Cog-Fun intervention with each child-parent dyad, and post-intervention and 3-month follow-up assessments. They found significant improvements with medium to large effects on outcome measures after intervention, and most effects were maintained at follow-up. The findings warrant controlled studies examining the effectiveness of this intervention for children with ADHD.
2.2.5 Chiropractic Care

Karpouzis, Bonello and Pollard (2010) studied whether chiropractic care can reduce symptoms of inattention, impulsivity and hyperactivity for pediatric and adolescent ADHD. Electronic databases (Cochrane CENTRAL register of Controlled Trials, Cochrane Database of Systematic reviews, MEDLINE, PsycINFO, CINAHL, Scopus, ISI Web of Science, Index to Chiropractic Literature) were searched from inception until July 2009 for English language studies for chiropractic care and ADHD. All randomized controlled trials were evaluated using the Jadad score and a checklist developed from the CONSORT (Consolidated Standards of Reporting Trials) guidelines. The search yielded 58 citations of which 22 were intervention studies. Of these, only three studies were identified for pediatric and adolescent AD/HD cohorts. The methodological quality was poor and none of the studies qualified using inclusion criteria. They concluded that there was insufficient evidence to evaluate the efficacy of chiropractic care for pediatric and adolescent AD/HD. The claim that chiropractic care improves pediatric and adolescent ADHD, is only supported by low levels of scientific evidence. In the interest of pediatric and adolescent health, if chiropractic care for ADHD is to continue, more rigorous scientific research needs to be undertaken to examine the efficacy and effectiveness of chiropractic treatment. Adequately-sized clinical trials using clinically relevant outcomes and standardized measures to examine the effectiveness of chiropractic care verses no-treatment/placebo control or standard care (pharmacological and psychosocial care) are needed to determine whether chiropractic care is an effective alternative intervention for pediatric and adolescent ADHD.

2.3.0 PSYCH-EDUCATIONAL UNI-MODAL INTERVENTIONS

2.3.1. Behavioural Treatment

Behaviour Treatment (BT) including multiple behaviour interventions and behaviour therapies, especially classroom contingency management and parent training, is the other major modality used with hyperactive children. A
wide range of behavioral approaches are used to treat both the core problems (i.e., inattention, impulsivity and hyperactivity) and associated problems (i.e., aggression, academic underachievement, poor peer interaction) of children suffering from (ADHD). A behavior "management" approach in the management of ADHD children connotes the ability to plan ahead and prevent the need for responsive discipline. It does not suggest an ability to erase a difficult situation. The foundational concepts of behavior management are structure, routine, consistency, communication, clarity, and constructive consequences (Gupta, 2002).

2.3.1 i. Controlling Motor Excess/ Hyperactive Behaviours

Motor excess behaviors have been clearly linked to externalizing disorders, which are often comorbid with ADHD. Tryon, Tryon, Kaslausky, Grueu and Swanson (2006) reported the preliminary results of a study, using a device that combines a modern beeper and actigraphy technology for the purpose of measuring, monitoring and modifying motor excess in children with confirmed diagnosis of ADHD. Nine boys ranging in age from eight to nine years with ADHD wore a particular type of feedback actigraphs (shorter and modern version of bio-feedback) during school periods and were reinforced for activity level reductions in the context of the simple pre/ post research design. The finding indicated that seven of the nine boys reduced their activity level from 20 – 47 % of baseline levels while the activity levels of two remaining boys increased from 2- 7% of baseline levels. The findings were statistically significant and constitute a large effect.

Azrin, Ehle and Beaumont (2006) observed that motor behaviors can be reduced significantly if physical exercise is used as a reference to promote calmness. Using case study- single subject design, they worked with a 4-year-old ADHD boy and found attentive calmness was substantially increased from a mean of about 3 seconds per trial to the maximum scheduled duration of 60 seconds by using a scheduled period of physical activity as the reinforcer for the attentive-calmness. Results suggested the possible use of this type of
reinforcer as an addition or substitution for the usual reinforcers in contingency management with ADHD children.

Schulman, Suran, Stevens and Kupst (1979) demonstrated that classroom activity level can be reduced in hyperactive boys using activity feedback and positive reinforcement. The biomotometer, an electronic device which simultaneously measures motor activity and provides auditory feedback, was used in combination with material reinforcers in an experiment to reduce children's activity level in a classroom setting. Subjects were nine boys and two girls, aged 9--13, from a day hospital program for emotionally disturbed children. After five baseline trials, each child had five contingent reinforcement trials in which he/she received feedback "beeps" from the biomotometer and was given toy or candy rewards after each trial in which activity fell at least 20% below mean baseline level. Then five noncontingent reinforcement trials were run in which children received rewards for wearing the apparatus without the feedback attachment. Results indicated that the intervention "package," including instructions, feedback, and contingent reinforcement, was successful in all five trials for 8 of 11 children. Activity levels increased during the final non-contingent phase.

In Taiwan, Li, Lin, Chang and Hung (2004) explored the temporal mechanism of attention deficit in children with ADHD and concluded that a training to control blinking (magnitude and time incidents) and thus closing gates of attention can reduce the various academic and attention related impairments in children with ADHD. In rapid serial visual presentation tasks in which two targets (T₁ and T₂) were presented in close temporal proximity among distractors, participants tried to identify T₁ and detect T₂ in one (dual-task) experiment and only to detect T₂ in a second control (single-task) experiment. The sensitivity of T₂ detection was analyzed using signal detection theory. The attentional blink--the impairment in T₂ detection following the identification of T₁--was increased in magnitude and protracted in the patients. Moreover, some children with ADHD appeared to have a blink largely normal
in magnitude but temporally displaced toward a later time. The authors hypothesize that a slower closing of the attention gate may mediate this specific attention impairment in children with ADHD.

2.3.1 ii. Developing Inhibitory Control

Vloet, Konrad, Herpertz-Dahlmann and Kohls (2011) investigated the effects of social and monetary reward on response inhibition in boys with ADHD + CD/ODD compared to healthy controls. An incentive go/no-go task was applied. They hypothesized that the control group (n = 17) would show greater improvements in inhibitory control in response to social reward than the ADHD + CD/ODD group (n = 17), but that both groups would respond equally to monetary reward. Both groups showed improved inhibition accuracy in the social condition and even greater improvement in the monetary condition. Interestingly, the control group altered their response strategy when money was at stake, i.e., they slowed down more dramatically in favour of stronger inhibitory control and, thus, a potentially greater financial gain. Findings suggested that both social and nonsocial reward procedures can be effective in behavioral interventions, but that monetary reinforcers may be more effective.

2.3.1 iii. Controlling Off Task Behaviours

Stahr, Cushing, Lane and Fox (2006) examined the effects of a function-based intervention implemented with one student, who had attention-deficit/hyperactivity disorder, internalizing behavioral problems, and a speech and language impairment; single subject case-study design. Student attended a fourth-grade classroom in a self-contained school that served students with emotional and behavioral disorders. During language and math classes, he exhibited high rates of off-task behavior. His teacher viewed these behaviors as disruptive, creating lost instructional time for all students. Functional assessment data indicated that his off-task behavior was maintained by attention (positive reinforcement) and escape from tasks (negative
reinforcement). A function-based intervention including a communication system, a self-monitoring component, and extinction resulted in improvements in his behavior. The classroom teachers and student rated the intervention favorably.

2.3.1 iv. Classroom Based Behaviour Modifications

Case study by Fabiano and Pelham (2003) reported impact of modifications to an existing behavior management plan in improving the behavioral intervention of a third-grade boy diagnosed with ADHD. A multiple baseline design across settings was used to demonstrate the effectiveness of the modified intervention. Behavioral observations indicated improvement in on-task behavior and reductions in disruptive behavior. The treatment was judged to be socially valid as the teachers overwhelmingly accepted it and modified the participant's behavior to normative classroom behavior limits. The study illustrated the importance of evaluating and modifying existing behavioral treatments for ADHD in the classroom to increase treatment effectiveness.

Coles et al. (2005) examined the individual treatment response to behavior modification in the context of a summer treatment program. Four children ages 11 to 12 diagnosed with ADHD were examined in a BABAB design in which a comprehensive behavioral program was utilized and withdrawn across an 8-week period. Dependent measures included frequency counts of negative behaviors, rule violations in recreational and classroom settings, and academic seatwork completion and accuracy. Results documented the effectiveness of the behavioral intervention with all 4 children. Some children showed consistent responses regardless of setting, while others showed differential responses in classroom and recreational settings. In general, behavior worsened progressively over days during the withdrawal weeks. The second withdrawal of treatment produced deleterious effects for several children that persisted for a time even when behavior modification was reinstated.
2.3.1 v. Limitations of Behaviour Interventions

Data suggest that while behavioral therapy can reduce one of the main symptoms of ADHD-impulsivity; Kendall and Braswell (1990) noted that it has not been successful in treating other symptoms of ADHD i.e. inattention and hyperactivity, and academic achievement. Treatment outcomes are, at best, inconsistent (Corkum, McGonnell & Schachar, 2010). The study by Wolraich, et al. (1990) noted that it is not known how frequently behavior-modification approaches are implemented, however, and there were indications that practitioners report using behavior therapy much more frequently than parents report receiving it.

According to MTA, after a decade of careful investigation, behavioral therapies have not been shown to be helpful, either alone or as an enhancer of the effects of medication. Several studies use case-study, single-subject design and findings are difficult to generalize as well as cumbersome to be used in a school based setting (MTA, 1999).

2.3.2 Cognitive–Behavior Interventions

Cognitive Behavior Treatments (CBT) were launched as therapists started giving lesser importance to behavior therapies and started looking for something more than simply studying behaviors but lesser than the study of influence of ‘thinking’ mind (Saxena and Schwanz, 2008)

2.3.2.i Cognitive Behaviour Interventions: Process and Utility

Young (2002) and Young, Brahnam, Gray and Rose (2008) found CBT a very useful intervention technique for young adolescents and adults with ADHD. Though the study doesn’t deal particularly with children, still provides an important insight about the cognitive processes. They attempted to evaluate the psychological impact of receiving a diagnosis of ADHD in adulthood and treatment with medication and to examine how diagnosis and treatment with medication changes an individual’s self-perception and view of the future. Participants were eight individuals diagnosed with ADHD at a tertiary service.
Semi-structured interviews were conducted and the data were analyzed according to the principles of Interpretative Phenomenological Analysis. Three master themes emerged from the analysis: Participants engage in (a) a review of the past, particularly how they feel different from others, (b) the emotional impact of the diagnosis, and (c) consideration of the future. These themes suggested a six-stage model of psychological acceptance of a diagnosis of ADHD: (a) relief and elation, (b) confusion and emotional turmoil, (c) anger, (d) sadness and grief, (e) anxiety, and (f) accommodation and acceptance. Conclusion: The model indicated an important role for psychological treatment, which should begin at the point of diagnosis. Cognitive behavioral techniques will help clients diagnosed with ADHD in adulthood cope with the adjustment process. Persons with ADHD should be taught skills to anticipate future hurdles and challenges and apply appropriate coping strategies.

2.3.2.ii Limitations of Cognitive Behaviour Interventions

At present, CBT is neither as pervasive nor as scientifically justified as either stimulant or behavioral treatments for ADHD in children (Stein, Zinter & Jensen, 2006). CBT approaches have, however, produced solid and growing enthusiasm for their use as adjuncts or even alternatives to more traditional pharmacologic and behavioral strategies. (Whalen & Henker, 1991; Dunn, Dalgleish, Lawrence & Ogilvie, 2007). CBT yielded significant improvement when given with as well as without medication to adolescents and adults with ADHD. However not much of evidence of effectiveness has been found for CBT as a treatment modality for children with ADHD (DuPaul & Weyandt, 2006).

2.3.3 Self-Management Techniques

Moore, Du Paul and White (2006) implemented self-management-procedures in school setting with students with ADHD in secondary school and found consistent results across the participants in enhancing attention span,
better classroom behavior and improved academic performance. They applied multiple-baseline across participants design in their study to evaluate the effects of ‘self-management procedure’ to enhance the classroom preparation skills of secondary school students with ADHD. Three male students enrolled in a public secondary school were selected because teacher reports suggested that these students were insufficiently prepared for class and inconsistently completed assignments. The intervention involved training in self-management procedures focusing on the improvement of classroom preparation skills. Following the intervention, the training process was systematically faded. Results were consistent across the 3 participants in enhancing classroom preparation behaviors.

2.3.4 Parent Centered Interventions

2.3.4 i. Parent Training

Numerous studies have reviewed the etiology of ADHD in parents and have tried to work with parent counseling and parent training. Nigg, Blaskey, Stawicki and Sachek (2004) assessed 307 parents and 79 siblings of children with ADHD and concluded that they had clearly different neuropsychological patterns in comparison to the control group of parents and siblings although they suggested more examination for their proposed ‘neuro-genetic model of ADHD etiology’. It was observed that the children with ADHD tend to remain ADHD despite regular treatment (medicinal, therapeutic or both), partially because of the parental inefficiency on executive functions and inconsistency in their approach toward the management of behavior of children.

Hook and DuPaul (1999) examined if parent tutoring for reading problems is helpful for children with ADHD. The researchers trained the parents of 4 children (three 7 year – old boys in Grade -2 and one 8 – year- old girl in Grade 3) in the use of a home curriculum based reading tutoring program. The tutoring sessions were carried out 2 to 3 times per week for 4 to 8 weeks, depending on the family. Data collected included the number of words
read correctly per minute in home tutoring sessions and in grade appropriate reading passages at school. Comparison data of the number of correct words read per minute were also collected at various points in the intervention on comparison peers. Additionally, information about parent, child and teacher satisfaction with the intervention, and treatment integrity were collected. Results were collected in the form of number of words read per minute at home and passages read at school according to grade appropriateness.

2.3.4 ii. Parenting Skills Interventions

Family therapy is frequently recommended for children and adolescents with ADHD (Robin, 1998). Murray and Johnston (2006) examined the impact of maternal ADHD on the behavior of the children. Examining mothers with and without ADHD (n=30+30), they found that mothers with ADHD were poorer at monitoring child behavior problems, less consistent and less effective at problem solving about child rearing issues than controlled mothers. They finally concluded that parenting is an area of functioning that requires more attention in ADHD research.

Ristow et al. (2009) carried out a pilot study in cooperation with the Mannheim police department investigating the effectiveness of a home-based prevention program for first-time delinquent children with ADHD and CD and their families. 24 children aged 8-13 years and their parents participated over a four-month period in the prevention program, which included 18 sessions of home treatment based on a cognitive behavioural concept. Core symptoms of ADHD and CD were assessed by means of the DISYPS-KJ scales (Diagnostik-System für psychische Störungen im Kindes- und Jugendalter nach ICD-10 und DSM-IV, German Scale for ADHD) before and after treatment. The training program significantly reduced both hyperactive and aggressive-antisocial behaviour on the parent rating scales. 88% of the parents reported an improvement of primary problems of their children. They concluded that the described home-based family prevention program is well effective in reducing problem behaviour in children with ADHD and CD.
2.3.4 iii. Parental Perspective on Interventions

Davis, Claudius, Palinkas, Wonk and Leslie (2011) examined components of family-centered care in families' stories about treatment decision making for their child with ADHD. Twenty-eight families participated in qualitative interviews that addressed families' perspectives on (a) the treatment decision-making process, (b) the cause and impact of their child's symptoms, and (c) treatment goals and preferences. It was found that the majority of families preferred to be primary or shared decision makers regarding treatment decisions. Families' perspectives on the cause of the child's symptoms varied and often were not consistent with a biomedical framework. Families described multiple areas of impairment on child, family relationships, and family functioning. Perspectives toward evidence-based treatments were mixed, with families also expressing interest in and pursuing interventions not delineated in current treatment guidelines. Findings reinforced the importance of eliciting families' perspectives and involving these important stakeholders in shared decision making as critical components of family-centered care for children with ADHD.

2.3.4 iv. Limitations of Parent Training

Hook and DuPaul (1999) examined if parent tutoring for reading problems is helpful for children with ADHD. The researchers trained the parents of 4 children (three 7 year– old boys in Grade -2 and one 8– year- old girl in Grade 3) in the use of a home curriculum based reading tutoring program. The tutoring sessions were carried out 2 to 3 times per week for 4 to 8 weeks, depending on the family. Data collected included the number of words read correctly per minute in home tutoring sessions and in grade appropriate reading passages at school. Comparison data of the number of correct words read per minute were also collected at various points in the intervention on comparison peers. Additionally, information about parent, child and teacher satisfaction with the intervention, and treatment integrity were collected. Results were collected in the form of number of words read per minute at home.
and passages read at school according to grade appropriateness. Finally they pointed out this intervention may not be possible for parents to implement easily with children with behavior problems as the process was cumbersome and too technical for parents to learn and implement. Parents had their own schedules and were neither motivated nor able to include this intervention in their day to day routine.

2.3.5 Teacher Centered Interventions

When students manifest inattentive or hyperactive behaviour in classroom setting, teachers usually are the first ones to recognize and recommend interventions (Vereb & DiPerna, 2004). They also play an important part in finalizing diagnostic and treatment related decisions by reporting their observations to the clinicians, and finally, when educational interventions are suggested, it’s the task and the responsibility of the teacher to implement them (Snider, Busch & Arrowood, 2003). Several studies noted that when teachers disagree with a recommended treatment, they may refuse to implement the intervention, may implement it improperly, or may fail to complete treatment (Eckert & Hintze, 2000; Wilson & Jennings, 1996). Treatment acceptability researchers have attempted to identify factors that affect acceptability ratings for treatments (Fairbanks & Stinnett, 1997). As further elaborated, treatments that are less intrusive in the classroom, take less time to implement, and use positive rather than negative consequences often are rated as more acceptable than treatments without these characteristics. Also, rater and child characteristics can affect acceptability ratings. Specifically, the amount of knowledge the rater has regarding the given treatment is positively related to the ratings of acceptability. That is, the more individuals know about a specific treatment, the higher they tend to rate the acceptability of that treatment (Elliott, 1988). Power, Hess and Bennet (1995) also hypothesized that willingness to accept and use a treatment is dependent on two factors: amount of knowledge about ADHD and number of years of teaching experience. Neither of these factors correlated strongly with acceptability
ratings. Following the lead, Vereb and DiPerna (2004) explored the relationship among teachers' knowledge of ADHD, knowledge of common treatments for ADHD, and acceptability of different approaches to treatment for ADHD (medication and behavior management). Relationships also were explored between these variables and teachers' training and experience in working with children with ADHD. Results indicated that teachers' knowledge of ADHD, years of teaching experience with students with ADHD, and training demonstrated positive relationships with ratings of treatment acceptability and thus overall efficacy.

A study, by Girio and Owens (2008), examined teachers’ acceptability of evidence-based and promising treatments for children with ADHD. Teachers (N = 156) from 11 elementary schools read a vignette describing a boy with symptoms typical of combined type ADHD. Using the Intervention Rating Profile-10, teachers rated the acceptability of three promising treatments (peer-tutoring, self-reinforcement, and social skills) and three evidence-based treatments, both psychosocial (daily report card and time-out) and pharmacological (stimulant medication). Teacher factors, including teacher self-efficacy, were evaluated as predictors of treatment acceptability. The daily report card (DRC) received the highest mean, acceptability rating among the treatments, and was rated significantly higher than 4 of 5 other treatments; the DRC was not rated significantly higher than the self-reinforcement strategy. Years of experience was predictive of acceptability in that more experienced teachers rated timeout as more acceptable than peer tutoring. Results replicated previous findings and uniquely indicate that promising treatments are considered as acceptable, and in some cases, more acceptable than evidence-based treatments for children with ADHD.

Snider, Busch and Arrowood (2003) assessed general and special education teachers' knowledge, opinions, and experience related to the diagnosis of ADHD and its treatment with stimulant medication. A random sample of 200 general educators and 200 special educators from Wisconsin
were surveyed. Results revealed that teachers had limited knowledge about ADHD and the use of psycho-stimulant medication. Teachers' opinions about the effect of stimulant medication on school-related behaviors were generally positive, although special education teachers were more positive than general educators. The survey confirmed that teachers were the school personnel who most frequently recommended an assessment for ADHD. The results also indicated the significance and implications of teacher preparation and continuing education about the nature and treatment modalities for ADHD.

2.3.6 Social Skills Training

It has been estimated that as many as 50% of children diagnosed with ADHD experience poor social relationships (Milich & Landon, 1982). Many of these children with ADHD display inappropriate social behaviors and perhaps consequently are rated unfavorable by their peers (Frankel, Cantell & Myatt, 1996; Gerdes & Hoza, 2006). However, significant social skill improvements were realized in a study by Frankel, Myatt, Cantwell and Feinberg (1997), where they employed a comprehensive treatment approach that included social skills training for children, collateral training for their parents. Thirty-five children with ADHD and 14 children without ADHD were given 12 sessions of treatment (treatment group). Outcome was compared with 12 children with ADHD and 12 children without ADHD who were on a waitlist for treatment (waitlist group). Stimulant medication was prescribed for all children with ADHD. Subjects with ADHD showed improvement comparable with that of subjects without ADHD on all teacher-and parent-reported measures of peer adjustment and social skills, except teacher-reported withdrawal. Effect sizes ranged from 0.93 to 1.34, indicating that the average treatment group subject was better off than 83.4% of waitlist subjects on outcome measures. Results suggested that children with ADHD are best helped by a combination of social skills training for themselves, collateral training for their parents, and stimulant medication.
2.3.7 Peer Tutoring

A study by Du Paul et. al. (1998) describes the use of a peer tutoring program in which two students work together on an academic activity, with one student providing assistance, instruction and feedback to the other. Subjects were 19 children with ADHD (16boys, 3girls) and 10 peer comparison children, ranging in age from 6 to 19 years. During peer tutoring, tutoring pairs worked with each other for 15 to 20 minutes per day, 3 to 4 days per week, on a specific academic skill. Both, the children with ADHD, as well as the peer comparison children displayed increase in on task behavior, and improved academic performance. Children and teachers alike reported satisfaction with the program, and teachers were able to implement procedures with a high level of fidelity with minimal training. The authors concluded that peer tutoring may be an important addition to other treatments for ADHD.

Plumer and Stoner (2005) investigated the effects of Classwide Peer Tutoring (CWPT) and peer coaching on the peer social behaviors of children with ADHD. A single-subject, multiple-baseline design was used with three elementary-school students in Grades 3 and 4. Following a baseline period, CWPT was implemented in each student’s classroom. During the second intervention phase, CWPT was continued and peer coaching was added. Peer social behaviors were observed in both academic and social settings, with a primary focus on intervention effects on the latter setting. Results suggested that students participating in CWPT were actively and positively engaged with their peers while carrying out the CWPT program in the academic setting. However, when only CWPT was implemented, increases in positive peer social behaviors were not observed in social settings. The addition of peer coaching resulted in enhanced social behaviors during recess and lunch.

2.3.8 Attention Training Interventions

Miranda, Presentación, Siegenthaler and Jara (2011) analyzed the effects of an intensive psychosocial intervention on the executive functioning (EF) in
children with ADHD. The treatment was carried out in a coordinated manner over a period of 10 weeks with 27 children with ADHD aged 7-10, their parents, and their teachers. A battery of neuropsychological tasks was applied to evaluate attention, interference control, verbal and visuo-spatial working memory, planning ability, and flexibility. The comparative analysis of the treated group of ADHD children and an untreated ADHD group showed significant differences that were especially important in visuo-spatial memory and planning in favor of the treated children, even when the scores in the pretreatment phase were included as covariables. Likewise, improvements were observed in the parents' and teachers' behavioral ratings of hyperactivity or impulsivity and inattention. The conclusion was drawn that psychosocial interventions with children with ADHD can have a positive effect on some executive functions.

Steiner, Sheldrick, Gotthelf and Perrin (2011) examined the efficacy of 2 computer-based training systems to teach children with ADHD to attend more effectively. A total of 41 children with ADHD from 2 middle schools were randomly assigned to receive 2 sessions a week at school of either neurofeedback (NF) or attention training through a standard computer format (SCF), either immediately or after a 6-month wait (waitlist control group). Parents, children, and teachers completed questionnaires pre- and post-intervention. Primary parents in the NF condition reported significant (P < .05) change on Conners' Rating Scales-Revised (CRS-R) and Behavior Assessment Scales for Children (BASC) subscales; and in the SCF condition, they reported significant (P < .05) change on the CRS-R Inattention scale and ADHD index, the BASC Attention Problems Scale, and on the Behavioral Rating Inventory of Executive Functioning (BRIEF). This randomized control trial provides preliminary evidence of the effectiveness of computer-based interventions for ADHD and supports the feasibility of offering them in a school setting.
Study by Tucha et al. (2011) was based on a neuropsychological model of attention and assessed the effect of an attention training program on attentional functioning of children with ADHD. Thirty-two children with ADHD and 16 healthy children participated in the study. Children with ADHD were randomly assigned to one of the two conditions, i.e., an attention training program which trained aspects of vigilance, selective attention and divided attention, or a visual perception training which trained perceptual skills, such as perception of figure and ground, form constancy and position in space. The training programs were applied in individual sessions, twice a week, for a period of four consecutive weeks. Healthy children did not receive any training. Alertness, vigilance, selective attention, divided attention, and flexibility were examined prior to and following the interventions. Children with ADHD were assessed and trained while on ADHD medications. Data analysis revealed that the attention training used in the present study led to significant improvements of various aspects of attention, including vigilance, divided attention, and flexibility, while the visual perception training had no specific effects. The findings indicate that attention training programs have the potential to facilitate attentional functioning in children with ADHD treated with ADHD drugs.

Kotwal, Burns and Montegomery (1996) used computer-assisted cognitive training program to treat a 13-year-old Caucasian male with attention deficit hyperactivity disorder. The subject was administered a cognitive training computer program, Captain's Log, for 35 sessions. Pre/post differences on the Conners’ Parent Rating Scale revealed a decrease on all subscales. The scores on the Conners’ Teacher Rating Scale were less conclusive. Electrophysiological testing on the A620 EEG/Neurofeedback revealed a reduction in EMG, theta, and beta wave amplitudes. However, the theta/beta ratio increased. A 7-month follow-up revealed that most of the acquired gains were maintained, but at a slightly lower level. Study concluded that long term
use of computer-assisted cognitive training program might help in developing attention and reducing hyperactive/impulsive behaviours in various settings.

2.3.9 Academic School Based Interventions

Study by Ervin, DuPaul, Kern and Freidman, (1998) investigated school-based intervention for adolescents with ADHD and involved the use of a functional assessment of the off-task behavior of two middle-school-aged youth, followed by classroom-based behavioral interventions. Following the assessment procedure, functional hypotheses were developed and recommendations were offered to the teachers. The classroom teachers selected the strategies to be used on the basis of practicality and perceived effectiveness. Following the implementation of these interventions, the investigators found large improvements in the on-task behavior of both boys in the targeted classrooms. For both boys, the average percentage of on-task intervals at baseline averaged between 54% and 78%. Following these interventions, the classroom averages ranged from 88% to 95%. Although based on data from only 2 participants, this study supports the use of classroom-based behavioral interventions with adolescents.

DuPaul et al. (2006) evaluated the relative efficacy of two consultation-based models for designing academic interventions to enhance the educational functioning of children with ADHD. Children (N=167) meeting DSM-IV criteria for ADHD were randomly assigned to one of two consultation groups: Individualized Academic Intervention (IAI; interventions designed using a data-based decision-making model that involved ongoing feedback to teachers) and Generic Academic Intervention (GAI; interventions designed based on consultant-teacher collaboration, representing “consultation as usual”). Teachers implemented academic interventions over 15 months. Academic outcomes (e.g., standardized achievement test, and teacher ratings of academic skills) were assessed on four occasions (baseline, 3 months, 12 months, 15 months). Hierarchical linear modeling analyses indicated significant positive growth for 8 of the 14 dependent variables; however, trajectories did not differ
significantly across consultation groups. Interventions in the IAI group were delivered with significantly greater integrity; however, groups did not differ with respect to teacher ratings of treatment acceptability. The results of this study provide partial support for the effectiveness of consultation-based academic interventions in enhancing educational functioning in children with ADHD; however, the relative advantages of an individualized model over consultation model have yet to be established.

DuPaul, Guevremont and Barkley (1992) investigated the efficacy of response-cost contingencies alone and in combination with directed-rehearsal procedures for managing the classroom behavior and academic productivity of two boys with ADHD. A within-subject reversal design with multiple-baseline components across academic work periods (i.e., reading and language) was employed to evaluate each child’s behavior and academic performance. Response-cost contingencies led to marked improvements in each student's task-related attention and a reduction in other ADHD symptoms. Response-cost effects on academic productivity and differential effects associated with directed-rehearsal contingencies were equivocal. In addition to promoting greater attention to independent seat-work, response-cost procedures have the potential to affect other important areas of classroom functioning such as behavioral control during teacher lectures.

Fiorello, Hale and Snyder (2006) presented the Cognitive Hypothesis Testing (CHT) model for integrating RTI (Response to Intervention) and comprehensive evaluation practices in the identification of children with reading disabilities. The CHT model utilizes a scientific method approach for interpreting cognitive and neuropsychological processes together with evaluation of ecological and treatment validity data to develop targeted interventions for students who do not respond to standard academic interventions. A case study highlights how CHT practices can lead to effective interventions for a child who did not respond to a phonologically based reading intervention. In addition, discriminant analyses of 128 children with reading
disabilities revealed the presence of Global, Phonemic, Fluency-Comprehension, and Orthographic subtypes. Results suggested that subtypes show disparate cognitive profiles that differentially impact their reading achievement, supporting our contention that individual assessment of cognitive processing strengths and weaknesses is not only necessary for identifying children with reading disabilities but also can lead to individualized interventions designed to meet their unique learning needs.

2.4.0 BIMODAL INTERVENTIONS

Several studies combine two types of interventions together to address the behavioural and academic needs of students with ADHD. Using such bimodal approach, Rapport, DuPaul, Stoner and Jones (1996) studied the effect of stimulants and attentional training on behaviour and neuro-cognitive performance. The effectiveness of four doses (5-mg, 10-mg, 15-mg, 20-mg) of methylphenidate (MPH) and attentional training (AT) were evaluated using neurocognitive instruments (Continuous Performance Test; Matching Unfamiliar Figures Test), narrow-and broad-band rating scales in the context of a double-blind, placebo-control, within-subject reversal design for dizygotic twin girls with Attention-Deficit/Hyperactivity Disorder (ADHD). Both interventions proved effective for improving neurocognitive test performance and behavior, although broad-band ratings revealed dose-response curves different from those obtained from the from the neurocognitive tests.

Abramowitz, Eckstrand, O’leary and Duncan (1992) used bimodal interventions involving pharmacotherapy and behavior therapy as the treatment of choice for Attention-Deficit Hyperactivity Disorder (ADHD). Their study examined the effects of a relatively simple behavioral intervention alone and in combination with stimulant medication. Subjects were three boys, ages 10 and 11, attending a summer day treatment program. Rates of off-task behavior in the classroom were examined in relation to all six possible combinations of two doses of methylphenidate plus placebo and two "intensities" of teacher reprimands, immediate and delayed. Results suggested that for some children
with ADHD, a simple behavioral intervention implemented in its most intense form can achieve results comparable to those achieved with medication. Additionally, for some children medication can obviate the need for the most intense form of a behavioral intervention. A case-by-case assessment is necessary and feasible.

Powers, Marks, Miller, Newcorn and Halperin (2008) examined the possible relationship of childhood stimulant treatment to academic functioning during adolescence. Children (n = 169) were initially recruited and diagnosed with ADHD when they were 7–11 years old. A subsample of those with childhood ADHD (n=90) was reevaluated on average 9.13 (SD = 1.5) years later. Proband who did and did not receive treatment with stimulant medication were compared to each other and to a never-ADHD comparison group (n = 80) on three subtests from the Wechsler Individual Achievement Test-II (WIAT-II), as well as high school grade point average (GPA) and number of retentions in school as derived from school records. Analyses of covariance controlling for severity of childhood ADHD symptoms indicated that probands treated with psycho-stimulant medication achieved better academic outcomes, as measured by WIAT-II subtests and high school GPA, than those not treated with psycho-stimulants (p < .05). However, treated probands did not fare as well as the never-ADHD comparison group. Study concluded that psycho-stimulant treatment for children with ADHD may benefit long-term adolescent academic performance, although the extent of improvement is likely to vary as a function of multiple factors.

Involving the parents and teachers together, a study by Murray, Rabiner, Schulte and Newitt (2008) examined the feasibility and integrity of a daily report card (DRC) intervention in a small sample of randomly assigned elementary students with previously diagnosed ADHD and classroom impairment. In order to enhance implementation, a conjoint behavioral consultation approach was used in which parents were engaged as active participants in the treatment. Intervention parents and teachers maintained
moderately high levels of adherence over 4 months based on multiple methods of implementation assessment, and acceptability ratings were all very favorable. Intervention participants demonstrated significant improvement in academic skills and productivity at post-test as compared to control participants, with moderately large effect sizes. Results suggest that a DRC intervention implemented within conjoint parent–teacher consultation may help to reduce the research to practice gap in evidence-based school interventions.

2.5.0 COMPARISON AMONG VARIOUS MAJOR TREATMENT MODALITIES: METHODOLOGICAL HURDLES AND BARRIERS

In studies of ADHD therapies, major methodological hurdles or barriers are encountered, some of which are generic to studies of treatment for this clinical population and others that are specific to a particular type of therapy or to specific comparisons between therapies.

2.5.1 Heterogeneity of Population and Sample

A prime example of the first subclass is the heterogeneity of youngsters with ADHD (Antshel et al. 2007). Considering the academic difficulties of children who meet the diagnostic criteria for ADHD, within the social realm, one child with ADHD may have difficulties because of the immature acts, another because of noncompliance and oppositionality, and a third because of lack of the subtle social skills needed to enter a group, de-escalate a conflict, or maintain a friendship. When the diversity of problems within each domain is considered along with the possible permutations and combinations, the tasks of assessment and treatment are daunting indeed (Trout, Lienemann, Reid & Epstein, 2007). The delineation of reliable subgroups within the vast ADHD rubric will facilitate the discovery of person-by-therapy interactions that may, eventually, optimize the match between child and treatment (Tryon, Tryon, Kazlausky, Gruen & Swanson, 2006).
2.5.2 Subject Sources and Selection Bias

Another methodological pitfall concerns subject sources and selection biases. Many Behavior Therapy and Cognitive Behavior Therapy studies are conducted in school settings, using children selected because they received extreme scores on teacher rating scales rather than because they were clinically diagnosed as showing ADHD. In contrast, more stringent selection criteria are usually applied in Stimulant Therapy studies, including clinical referral and adherence to professional diagnostic standards. School referrals show more difficulties in concentration, whereas clinic caseloads contain a higher percentage of disruptive behaviors. These sampling differences impair the validity of efficacy tests across clinics and studies and may be prime contributors to the contradictions in the published literature (Tryon, Tryon, Kazlausky, Gruen & Swanson, 2006).

2.5.3 Problem Domain and Time Course

There are also interactions between problem domain and time course. When stimulant medication is effective, for example, concentration and compliance problems tend to ease immediately. Improvements in academic achievement and interpersonal relationships may take longer and, in fact, long-term gains in these two realms have, for the most part, eluded empirical verification (Bental & Tirosh, 2007).

2.5.4 Heterogeneity in Treatment Responsiveness

Heterogeneity in treatment responsiveness is found not only across children and instruments, but also across performance domains for the individual child (Douglas, Barr, Amin, O’Neill, & Britton, 1988; Rapport, DuPaul, Stoner & Jones, 1986). Stratton, Reid and Hammond (2001) observed that children with only hyperactivity are better tolerated and managed by parents and teachers in comparison to children with hyperactivity as well as with aggressive nature. It was also observed that children with only hyperactivity responded better on all intervention (modalities medicinal,
behavioral and combination of two) (Freeman, 2004). Perhaps the most enigmatic aspect of these many faces of heterogeneity is the general inability to predict who will respond, when, under what conditions, and in what manner or domain (Freeman, 2004).

2.5.5 Adequacy and Comparability of Assessment Procedure

Another issue concerns adequacy and comparability of assessments. Multiple measures are available for each domain of functioning, including direct observations, standardized tests, rating scales, interviews, and self-report instruments. Given the pervasiveness of the ADHD child's problems and the potency of situational influences, it is also important to examine several settings and to collect information from multiple informants (American Academy of Pediatrics, 2001). The problem is that there is only limited agreement among sources and instruments, with inter-correlations among even the most reliable measures often hovering in the .20–.40 range (Achenbach, McConaughy, & Howell, 1987).

2.5.6 Difference in Nature of Treatments, and Procedural Variations

There are other realms and dimensions of efficacy where the treatments are different, by their very nature, and comparative questions become mute. A clear example would be the problems of calibration in a comparative efficacy study. What types and amounts of behavioral or cognitive treatment are comparable to a 20 mg, twice-daily dose of methylphenidate? What is a minimally effective or a standard dose of cognitive–behavioral training? What duration of behavioral intervention is comparable to 6 months of stimulant treatment? How can therapist contact be equated or its effects controlled across treatments when CBT requires far more frequent and intense sessions than does either ST or BT and when the target of change in BT may be the parent or teacher rather than the ADHD child? (Whalen & Henker, 1991).

In many cases, it is impossible to know whether poor outcomes should be attributed to ineffective treatments or to failure to follow or complete a
therapeutic regimen. Clearly, adherence is a major issue in the treatment of children with ADHD (Faraone, Biederman & Zimmerman, 2007).

### 2.5.7 Difference in the Treatment Goals

Differential treatment goals must also be considered in comparative analyses. Although the therapeutic objectives for ST, BT, and CBT are not inherently different, practitioners of the three approaches may target different domains. Cognitive–behavioral therapists tend to focus on fundamental changes in the ways children with ADHD think and act, whereas those engaged in behavioral parent training may be directed more toward the parent than the child, seeking to improve parental coping skills for managing difficult children rather than to ameliorate the child's problems per se. It is also true, however, that CBT can be aimed at developing parenting competence, and behavioral parent training programs can be designed to change specific aspects of children's behavior.

### 2.5.8 Long-term vs. Short Term Studies

An overarching problem is that researchers have been attempting to answer long-term questions with short-term studies (Kallivayalil, Bhave, Chadda, Vaishav & Punnosse 2007). Short-term findings may best serve a heuristic function, providing procedural probes and hints about promising therapeutic directions. From a clinical perspective, a 30% increase in task attention or a 30% improvement in behavior ratings during a 6-week treatment program is encouraging and may improve the immediate social ecology. But such changes are of limited significance unless they are linked to later adjustment and accomplishment. In most cases, however, long-term studies cannot address questions about comparative efficacy, because adolescents and adults cannot usually be differentiated in terms of intervention histories.

### 2.5.9 Developmental Course of ADHD

ADHD is a chronic disorder, with some of the associated problems often evident by the age of 2 or 3 years. The impulsivity and inattentiveness seen in
the school years may change form yet continue through adolescence and even adulthood (Adler et al., 2005, Sayal, Letch & ElAbd, 2008). This means that treatment is inevitably a long-term endeavor rather than a “quick fix” and that therapeutic strategies that are appropriate across a wide developmental range will prove most useful (Wolraich, 2005)

2.5.10 Summary

Despite the impressive track record established by stimulant therapies over the past two decades, this treatment has serious limitations. Not all children can be given these medications, nor do all who take them improve. As observed by Rhodes, Coghill and Matthews (2006), in the majority who appear to benefit, the changes may be short-lived or may persist only as long as the drug regimen continues. It is not always evident that non-pharmacological alternatives come with a similar set of constraints, including dysfunctional messages, ethical dilemmas, and the problems of ineffectiveness with some children or some problem domains and circumscribed or short-term impact with others. As a lifetime rather than an acute disorder, ADHD has a salient impact on key members of the child's social network, a network that, in turn, plays a pivotal role in shaping all future outcomes. The non-pharmacological treatments considered here teach problem-solving and coping skills not only to children with ADHD but also to those who interact with the children on a regular basis. The juxtaposition of successes and limitations that characterizes all therapeutic modalities for ADHD would seem to mandate further exploration of multimodal approaches (Saxena and Schwanz, 2011).

2.6.0 MULTIMODAL APPROACH OF INTERVENTIONS

Review of research indicates that a multimodal intervention approach is more effective than unimodal intervention approach in addressing the multiplicity of difficulties associated with ADHD. Multimodal treatment typically is defined as the combination of medication, behavioral strategies, and educational accommodations.
Investigations systematically comparing the combination of stimulant medication, behavioral interventions and their combination (i.e., multimodal treatment) have found medication to be superior to behavioral treatments in reducing ADHD symptoms (Abikoff et al., 2004; MTA Cooperative Group, 1999). The largest scale and most comprehensive investigation of these two treatments was the Multimodal Treatment of ADHD (MTA) study completed at multiple sites in North America (MTA Cooperative Group, 1999). A sample of 579, 7 to 10 year old children diagnosed with ADHD was randomly assigned to one of four treatment groups. One group received stimulant medication (e.g., methylphenidate) that was titrated using state-of-the-art, multi-method, controlled trials, while a second group received multiple behavioral interventions across home, school, and summer camp settings. The school component of the latter protocol included: (a) ongoing consultation with classroom teachers regarding behavioral interventions and (b) a paraprofessional working with the student with ADHD for half the school day on a daily basis for 12 weeks in the fall of the school year. The paraprofessional implemented behavioral interventions such as token reinforcement for appropriate classroom behavior. A third group received both carefully titrated stimulant medication and comprehensive behavioral intervention. Finally, a control/comparison group was comprised of participants who received treatment as delivered in the community (community care control group). Approximately 67% of control group participants were receiving stimulant medication that was titrated using less controlled and more typical procedures than was the MTA medication group. Dependent measures across multiple areas of functioning were collected at three time points during and immediately following the 14-month treatment protocol for all four groups.

Participants in all four groups showed significant reductions in ADHD symptomatology during and following treatment. Significantly greater reductions in symptoms were obtained for the medication management and combined intervention groups relative to the behavioral only and community
care control groups. Although carefully titrated stimulant medication clearly was the superior unimodal treatment, additional analyses shed light on the contribution of behavioral interventions. Specifically, the greatest improvement, particularly for problems associated with ADHD (e.g., oppositional behavior, and social performance difficulties), was evidenced by children who received the multimodal treatment protocol (Conners et al., 2001; Swanson et al., 2001). Children in the combined intervention group required a lower mean dosage of medication than did the medication only group. Using a relatively conservative definition of treatment "success", Swanson et al. found that 68% of combined intervention children were successfully treated relative to 56%, 34%, and 25% of the medication only, behavioral intervention only, and community care control group children. Although, the effect size separating the behavioral intervention and community care control group was small (Conners et al., 2001), it is important to note that most of the control group participants received stimulant medication as typically prescribed in the community. Thus, intensive behavioral programming (including school-based strategies) aimed specifically at reducing disruptive behavior appears equivalent to the medication-as-usual protocol that typically is used in the community.

Several other researchers studied the combination of approaches and intervention strategies. Strong believers in stimulants for ADHD, Murray and Patel (2001) also advocated that a number of behavioral and psychosocial interventions can be used effectively as part of multimodal approach to address many ADHD & related problems. Reports suggest that a multimodal treatment approach is preferable to address many symptoms of ADHD and its associated problems for the children, the family, and the school (Young and Amarasinghe, 2009).

Swanson (1992), views that the multimodal intervention is based primarily on two issues: to rely on medication for the children with ADHD and second is not to consider ADHD as a handicapping condition. The intervention
model described by him, has 4 components: a classroom behavior modification program, a small group training program, a medication assessment program and a parent training program.

University of California, Irvine, Child Development Center, developed a professional model program for the Irvine Unified School District (IUSD) to implement ADHD interventions on a school vide basis (Swanson, 1992). As per their assessment, one school had approximately 2% students with mild impairment due to ADHD, 2% with moderate impairment and 1% with severe impairment. To provide the paraprofessional intervention for 10 to 12 students with ADHD, it was estimated that two full and one half time behavioral specialists would be required. Twice a week, these students with moderate impairment due to ADHD (in groups of four), attended a 30 to 45 min. skill-training group in which continuous reinforcement was used to shape new social and cognitive skills, which children with ADHD often lack. Over a 6 to 12 week period, these groups were used to cover a curriculum designed to develop and practice specific skills (eg. cooperation, communication, participation, validation, assertion without aggression etc.) and rules (raising hand to talk, staying seated, following directions etc.). The paraprofessional who conducted the skill-training group also returned to the classroom with the students with ADHD to serve as a classroom aide. Instantly the extra classroom aide time may amount to 15 hours per week for each classroom containing one of more of the students with ADHD who were concurrently in the twice-a-week skill-training group (Swanson, 1992).

Group skill training alone does not have a significant impact of the academic performance or behavior of students with ADHD in the regular classroom. Classroom effects are dependent upon the paraprofessional acting as a classroom aide to provide “reinforced practice” in the regular classroom. This practice seems to be essential to achieve generalization of targeted behavior of students with ADHD. Based on experience in IUSD, the assignment of an extra aide to work with the targeted student with ADHD (as well as other students in
the class room) was found to be a very cost efficient way of delivering effective educational intervention for students with ADHD who require extra help in the school setting (Swanson, 1992).

According to Smith, Waschbuoch, Willoughby and Evans (2000), four types of psychosocial interventions have demonstrated promising initial results with children and adolescents with ADHD: (a) note-taking, (b) self-monitoring training, (c) functional assessment with behavioral interventions, and (d) family-based intervention.

The Summer Treatment Program (STP) (Pelham & Hoza, 1996) is also a multimodal treatment program, following ‘with-in school based mental health model’, for children with ADHD. The STP operates as a summer camp for children with ADHD that provides intensive behavioral and pharmacological interventions. The STP was included as part of the interventions evaluated in the MTA. The first author developed the adolescent version of the STP with William Pelham (director of the STP) in the early 1990s to extend the age range of the successful STP model.

A study by Evans, Axelrod and Langberg (2004) provides pilot data from the first year of implementation of the Challenging Horizons Program (CHP). The interventions included in the CHP are based on many of those used in the adolescent version of the STP, experience with school based mental health, and the psychosocial treatment of literature for this population. The procedures from the literature and STP were modified to include techniques targeting generalization and to take advantage of the resources available in a school setting. Evans, Axelrod and Langberg (2004), selected a school-based model to improve access to services. In the study, the effects of a set of behavioral and educational interventions provided in a middle-school based mental health program on the behavior and academic performance of 7 students diagnosed with ADHD were studied. The treatments included educational, social skills and family interventions designed to target school functioning,
Dependent measures included parent and teacher ratings of ADHD symptoms, daily functioning, and academic grades. Large effect were found on measures of inattention and school functioning. Grades and measures of family functioning and peer relations yielded small to moderate effect. Description of the procedures is provided and implications for advancing school-based mental health care for adolescents with a diagnosis of ADHD are discussed.

Studies by Adelman, Barker and Nelson (1993) and Evans (1999) have reported that youth and their parents experience fewer and different obstacles to care when engaging in school-based services as opposed to clinic-based care. For example, many transportation and fiscal obstacles are encountered less frequently in school-based care than clinic-based care. On the other hand, there is a perception reported by some parents that the quality of care and adherence to standards of confidentiality are lower in a school than in a clinic (Evans, 1999). Consistent with reports describing that most children with mental health disorders who need treatment do not receive care, MTA (1999) reported that this appears to be true also for children with ADHD. Given the likely advantages of school-based services and the school-related problems experienced by middle school youth with ADHD, the development of school based mental health services for youth with ADHD is a logical advancement.

Although psychotropic medication is often effective in increasing attention and reducing disruptive behavior, it is not always associated with significant enhancement of academic and social functioning in children and adolescents with AD/HD. In fact, the literature indicates that treatment efforts must focus on multiple targets (behavioral, academic, and social functioning), and should include several treatment agents (parents, teachers, peers, and students themselves) implementing behavioral, medical, and educational interventions across school years (Barkley, 2006; DuPaul & Stoner, 2003). Therefore, a school-based intervention plan involving parents, teachers, and
students is a critical component within a multimodal treatment protocol (DuPaul & Weyandt, 2006).

2.6.1 Limitations of Multimodal Approach

The need for integrating treatment outcome research and school-based mental health model was pointed out in a review article by Rones and Hoagwood (2000). Although much has been written about the potential advantages of school-based mental health treatment programs (Evans, 1999; Evans, Axelrod, & Sapia, 2006; Weist, 1997), research findings on them are limited. Rones and Hoagwood (2000) noted that those school-based treatment programs that have been studied have focused primarily on youth in the primary grades (K-2) or youth diagnosed with mood disorders in high school. Treatments programs for youth in middle school with disruptive behavior disorders have not been reported (Rones & Hoagwood, 2000) or have produced minimal effects (Dupper & Krishef, 1993). School-based mental health models are specially suited to children with ADHD because of the levels of school dysfunction they exhibit. In addition there are many advantages believed to be inherent in this model of care related to effectiveness and generalization (Evans, 1999).

2.7.0 CONCLUSION

Although much progress has been made in our understanding of the diagnosis and treatment of ADHD, much has yet to be researched about treatment modalities and delivery procedures for children, and for adolescents and adults. It is clear that the current intervention practices, although valid for children, may need to be modified for particular subgroups within the diagnostic category, to address the individual need of the child. Additional studies are required to clarify how and what non medical interventions, unimodal or multimodal can be helpful for children with ADHD along with their family members and caretakers including teachers. Better research is needed to examine the efficacy of non medical treatment modalities in various
settings and across the different age groups. Research is also needed to determine the long-term efficacy and cost efficiency of multimodal and other modalities of treatment, specially, BT, CBT and skill training procedures. Researchers must see that the non medical interventions do not become too cumbersome, technical, time consuming and expensive for the family of children and adults with ADHD. Lastly, longitudinal studies examining the outcomes for adolescents and adults are required to identify more clearly the course of the disorder and the impact of treatment.

With all this review of existing studies, current study evolved with a basic question to be investigated; what kind of multimodal intervention can be successful, what different modalities can be combined together (using non medicinal interventions) and how feasible and effective they can be. The current study proposes a model inclusive of direct interventions (academic and behavioural) with students with ADHD and parent and teacher training, and has tried to investigate its efficacy and efficiency in helping children with ADHD to improve behaviours, academic performance, and peer relations.